STANDARDS ON UNDER SECTION 18 OF THE OCCUPATIONAL SAFETY, HEALTH AND WORKING CONDITIONS CODE, 2020

1. **Short title, extent, and commencement.** -These Standards may be called the Occupational Safety and Health (Factories) Standards, 2022.

2. **Date of Notification -** They shall come into force on the date of their publication in the Official Gazette.

CHAPTER I – DEFINITIONS

3. Definitions

(1) "A-weighting" means making graded adjustments in the intensities of sound of various frequencies for the purpose of noise measurement, so that the sound pressure level measured by an instrument reflects the actual response of the human ear to the sound measured.

(2) "abrasive wheel" means a wheel manufactured of bonded emery or similar abrasive.

(3) "accident" unplanned/undesired event giving rise to death, ill health, injury, damage or other losses to personnel or property.

(4) "adjacent spaces" means the area in and around the place where recycling activity is carried out

(5) "artificial humidification" means the introduction of moisture into the air of a room by any artificial means whatsoever, except the unavoidable escape of steam or water vapour into the atmosphere directly due to a manufacturing process.

Provided that the introduction of air directly from outside through moistened mats or screens placed in openings at times when the temperature of the room is 26.5 degrees centigrade or more, shall not be deemed to be artificial humidification.

(6) "anchor" means a device to hold in position and resist the sudden high forces imposed on the device due to a pull or other shock force from a fall.

(7) "anchor point" means the supporting medium for the pfas anchor, usually a beam or column, or an embedment or other fixity into the support structure; the anchor point shall have adequate strength to resist the impact force, with deformation within prescribed limits.

(8) "appropriate personal protective equipment" means that when the protective equipment is used by the worker, he shall have no risk to his life or health or body.

(9) "airborne asbestos dust" means, for the purposes of measurement, dust particles measured by gravimetric assessment or other equivalent method

(10) "annealing lehr" area where annealing and cooling of the glass takes place.

(11) "asbestos" means any fibrous silicate mineral and any admixture containing actionlite, amosite, anthophyllite, chrysotile, crocidolite, tremolite or any mixture thereof, whether crude, crushed or opened.

(12) "asbestos textiles" means yarn or clothes composed of asbestos or asbestos mixed with any other materials.

(13) "asbestos dust" means airborne particles of asbestos or settled particles of asbestos which are liable to become airborne in the factory.

(14) "authorized ship recycling facility" means a ship recycling plot or plots in cluster developed to cater to safe and environmentally sound ship breaking

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(15) “band saw” means a band saw, the cutting portion of which runs in a vertical direction but does not include a log saw or band resawing machine.

(16) “bath” means any vessel used for an electrolytic process or for any subsequent process;

(17) “battery cycler” is an instrument testing and assessing health of rechargeable batteries

(18) “batch plant” area where the raw materials are received, mixed and delivered to the furnace

(19) “boom hoist” means a vehicle on wheels with a telescoping and articulated boom mounted on it with capabilities to reach points around it up to a certain maximum safe height.

(20) “belt” includes any driving strap or rope.

(21) “blasting” means cleaning, smoothing, roughening, or removing of any part of the surface of any article by the use of an abrasive of a jet of sand, metal shot, or grit or other material, propelled by a blast of compressed air or steam.

(22) “blasting enclosure” means a chamber, barrel, cabinet or any other enclosure designed for the performance of blasting therein.

(23) “blasting chamber” means a blasting enclosure in which any person may enter at any time in connection with any work or otherwise.

(24) “black liquor” spent liquor from the pulping process containing organic (lignin) and inorganic salts predominantly containing sodium carbonate salts

(25) “bleaching powder” means the bleaching powder commonly called chloride of lime.

(26) “bleaching”: bleaching improves whiteness by removing natural coloration and remaining trace impurities from the cotton; the degree of bleaching necessary is determined by the required whiteness and absorbency

(27) “blister copper” is partly purified copper with a blistered surface formed during smelting

(28) “breathing apparatus” means a helmet or face piece with necessary connection by means of which a person using it breathes air free from dust, or any other approved apparatus.

(29) “breaking company” means the owner of the ship breaking facility or any other organization or person who has assumed the responsibility for operation of the ship breaking activity from the owner of the ship breaking facility and who on assuming such responsibility has agreed to take over all duties and responsibilities

(30) "bulk storage" means bullet or Horton sphere or mounded vessel used for storage of flammable liquefied or compressed gases or highly flammable liquids, which are having capacity exceeding one thousand liters of water capacity

(31) "bullet" means a horizontal cylindrical pressure vessel with hemispherical or dished ends used for storage of flammable liquefied or compressed gas

(32) “by-products” the coke oven gas from the coke ovens contains various useful chemicals like tar, ammonium sulphate and sulphuric acid which are extracted or separated by various process

(33) “calendar” means a set of heavy rollers mounted on vertical side frames and arranged to pass cloth between them. calendars may have two to ten rollers, or bowls, some of which can be heated.

(34) “card” means a machine consisting of cylinders of various sizes - and in certain cases flats -covered with card clothing and set in relation to each so that fibres in staple form may be separated into individual relationship. the speed of the cylinders and their direction of rotation varies. the finished product is delivered as a silver. cards of different types are: the revolving flat card, the roller and clearer card, etc.

(35) "card clothing" means the material with which the surfaces of the cylinder, deffer, flats, etc. of a card are covered and consists of a thick foundation material made of, either textile fabrics through which are pressed many fine closely spaced specially bent wires, or mounted saw toothed wire.

(36) "carbon black" is a group of intensely black, finely divided forms of amorphous carbon, usually obtained as soot from partial combustion of hydrocarbons, used principally as reinforcing agents in automobile tires and other rubber products but also as extremely black pigments of high hiding power in printing ink, paint, and carbon paper.

(37) "catastrophic" means incidents that have major consequences with unacceptable lasting effects, usually involving loss of human life, severe off site impacts, and/or loss of community trust with possible loss of facility to operate

(38) "caustic" means hydroxide of potassium or sodium;

(39) "camber" camber or cant is the cross slope provided to raise the middle of the road surface in the transverse direction to drain off rainwater from the road surface

(40) "centrifugal machines" include centrifugal extractors separators and driers.

(41) "chemical works" means any factory or such parts of any factory as are listed in appendix `a' to this schedule

(42) "chlorate" means chlorate or perchlorate;

(43) "chrome process" means the manufacture of chromate or bichromate of potassium or sodium, or the manipulation, movement or other treatment of these substances.

(44) "churn" means the vessel in which alkali cellulose pulp is treated with carbon disulphide;

(45) "circular saw" means a circular saw working in a bench (including a rack bench), but does not include a pendulum or similar saw which is moved towards the wood for the purpose of cutting operation.

(46) "cleaning of castings" where done as an incidental or supplemental process in connection with the making of metal castings, means the freeing of the casting from adherent sand or other substance and includes the removal of cores and the general smoothening of a casting, but does not include the free treatment.

(47) "clean-up operation" means an operation where hazardous wastes are removed, contained incinerated, neutralized, stabilized, cleared-up, or in any other manner processed or handled with the ultimate goal of ensuring safety and health of the workers

(48) "code" means the occupational safety health and working conditions code, 2020.

(49) "cold end" where glasses are being cut as per the sizes required and packed and send it to warehouse for dispatch

(50) "comber" means a machine for combing fibres of cotton wool, etc. the essential parts are device for feeding forward a fringe of fibres at regular intervals and an arrangement of combs or pins, which, at the right time, pass through the fringe. all tangled fibres, short fibres, and nips are removed and the long fibres are laid parallel.

(51) "combing machinery" means a general classification of machinery including combers, silver lap machines, ribbon lap machines, and gill boxes, but excluding cards.

(52) "consequence modelling" the estimation of the credible and worst case scenario, physical outcomes of loss of containment scenarios involving flammable, explosive and toxic materials with respect to their potential impact on people, assets, or safety functions.

(53) "confined space" means any space by reason of its construction as well as in relation to the nature of the work carried therein and where hazards to the persons entering into or working inside exist or are likely to develop during working.

(54) "continuous bleaching range" means a machine for bleaching of cloth in rope or open-width form with the following arrangement. the cloth, after wetting out, pass through a squeeze roll into a saturator containing a solution of caustic soda and then to an enclosed j-box. a v- shaped arrangement is attached to the front part of the j.box for uniform and rapid saturation of the cloth with steam before it is packed down in the j.box. the cloth, in a single strand rope form, passes over a guide roll down the first arm of the "v" and up the second. steam is injected into the "v" at the upper end of the second arm so that the cloth is rapidly saturated with steam at this point. the j-box capacity is such that cloth will remain hot for a sufficient time to complete the securing action. it then passes a series of washers with a squeeze roll in between. the cloth then passes through a second set of saturator, j-box and washer, where it is treated with the peroxide solution. by slight modification of the form of the unit, the same process can be applied to open-width cloth.

(55) "control" means safeguards prescribed to eliminate or otherwise manage the risks at the workplace; also known as 'treatment' and 'response'. generic term for "risk control", in context.

(56) "controlled substances" means chemical substances mentioned in appendix b

(57) "cupola of furnace" includes a receiver associated therewith

(58) "corrosive operation" means an operation of manufacturing, storing, handling processing, packing, or using any corrosive substance in a factory.

(59) "corrosive substance" includes sulphuric acid, nitric acid, hydrochloric acid, hydrofluoric acid, carbolic acid, phosphoric acid, liquid chlorine, liquid bromine, ammonia, sodium hydroxide and potassium hydroxide and a mixture thereof, and any other substance which the state government by notification in the official gazette specify to be corrosive substance.

(60) "coke ovens" an oven made usually of refractory brick and blocks and used for carbonization of coal by pyrolisis. the main function of coke ovens is to convert coal into coke which is used as a fuel and reducing agent in the blast furnace. its secondary function is to recover volatile matter and co (coke oven) gas from coal and extract chemicals known as coal chemicals. co gas produced is used for heating purposes in the plant

(61) "coal tar distillation products" coal tar is distilled to manufacture a broad range of high-quality products that cater to key industries such as aluminium, graphite, carbon black and specialty chemicals. the key product of the distillation of coal tar is coal tar pitch. this is further processed into desired chemical and physical properties to form binder pitch, impregnated pitch,light oil, naphthalene etc

(62) "crawling board" means a plank with cleats spaced and secured at equal intervals, for use by a worker to move up and down sloping roofs.

(63) "critical temperature" the temperature beyond which runaway reaction will result in

(64) "cryogenic vent" a cryogenic vent keeps liquid flowing in a vacuum-jacketed pipe system by allowing the boil-off of gases to escape, but not the liquid

(65) "cylinders" as defined under rule 2(xxiii) of Gas Cylinder Rules 2016

(66) "dangerous occurrence" any undesired event, which may be infrequent but has a high potential for severe injury and/or death

(67) "dangerous chemical reactions" means high speed reactions, runaway reactions, delayed reactions, etc. and are characterised by evolution of large quantities of heat, intense release of toxic or flammable gases or vapours, sudden pressure build-up etc

(68) "daily exposure of vibration" means the quantity of mechanical vibration to which a worker is exposed during a working day, which takes account of the magnitude and duration of the vibration.

(69) "delineator" raised reflective markers include a lens or sheeting that enhances their visibility by reflecting automotive headlights

(70) "degrees (of temperature)" means degrees on the centigrade scale.

(71) "dewars" means double wall insulated vessel for storage of liquid cryogens

(72) "dangerous pesticides" means any product proposed or used for controlling, destroying or repelling any pest or for preventing growth or mitigating effects of such growth including any of its formulations which is considered toxic under and is covered by the insecticides act, 1968 and the rules made thereunder and any other product, as may be notified from time to time by the state government.

(73) "decibel" means one-tenth of "bel" which is the fundamental division of a logarithmic scale used to express the ratio of two specified or implied quantities, the number of "bels" denoting such a ratio being the logarithm to the base the of 10 of this ratio. the noise level (or the sound pressure level) 6 corresponds to a reference pressure of 20 x 10 Newton per square meter or 0.0002 dynes per square centimetre which is the threshold of hearing, that is, the lowest sound pressure level necessary to produce the sensation of hearing in average healthy listeners. The decibel in abbreviated form is dB.

(74) "decontamination" means the removal of hazardous waste from workers and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects.

(75) "dB A" refers to sound level in decibels as measured on a sound level meter operating on the a-weighting net work with slow meter response

(76) "design pressure" means the maximum pressure that a pressure vessel or plant is designed to withstand safely when operating normally.

(77) "desizing" depending on the size that has been used, the cloth may be steeped in a dilute acid and then rinsed, or enzymes may be used to break down the size.

(78) "district magistrate" includes such other official as may be appointed by the state government in that behalf.

(79) "distributed control system" a distributed control system (DCS) is a computerised control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system, but there is no central operator supervisory control

(80) "dielectric" dielectric, insulating material or a very poor conductor of electric current

(81) "doctor blade" it is a mechanical device used for removing water, cleaning contaminants of the rolls and conditioning of the roll surface

(82) "dressing or fettling operations" includes stripping and other removal of adherent sand, cores, runners, risers, flash and other surplus metal from a casting and the production of reasonably clean and smooth surface, but does not include (a) the removal of metal from a casting when performed incidentally in connection with the machining or assembling of castings after they have been dressed or fettled, or (b) any operation which is knock-out operation.

(83) "draw texturizing" polyester filament yarn is drawn, false twisted and heat set to produce draw texturized yarn bobbin

(84) "dumping" means transfer of cellulose xanthate from a dry churn to a dissolver.

(85) "dyeing" for instance, is commonly carried out with an anionic direct dye by completely immersing the fabric (or yarn) in an aqueous dye bath according to a prescribed procedure. for improved fastness to washing, rubbing and light, other dyes such as vats and reactives are commonly used.

(86) "efficient exhaust draught/ventilation" means localised ventilation effected by mechanical means for the removal of dust or fume or at its source of origin so as to prevent it from escaping into the atmosphere of any place where any work is carried on. no draught shall be deemed to be efficient which fails to remove the dust or fume or mist at the point where it is generated and fails to prevent it from escaping into and spreading into the atmosphere of a work place

(87) "edge-protection" means a physical barrier such as guard-rails that would prevent an individual from straying beyond the edge of a working platform or access way or stairs, causing him to fall and get injured

(88) "electrolytic process" means the electrolytic plating or oxidation of metal articles by the use of an electrolyte containing acids ,bases or salts of metals such as chromium, nickel, cadmium, zinc, copper, silver, gold, etc.:

(89) "electro winning- process" to recover metals, from a solution by means of electrolytic chemical reaction

(90) "embossing calendar" means a calendar with two or more rolls, one of which is engraved for producing figure effects of variobleaus kinds on a fabric.

(91) "emergency" means a situation or condition leading to a circumstance or set of circumstances in which there is danger to the life or health of persons or which could result in big fire or explosion or pollution to the work and outside environment, affecting the workers or neighbourhood in a serious manner, demanding immediate action.

(92) "employed " means employed in any process involving contact with liquid from a bath.

(93) "enclosed system" means a system which will not allow escape of benzene vapours to the workers atmosphere; and

(94) "ergonomics" – the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory principles, data, and methods to design in order to optimize human well-being and overall system performance

(95) "esterification" the esterification is a reaction betwe/en acid and alcohol resulting in ester and water. the esterification reaction converts pure terephthalic acid (pta) with ethylene glycol (eg) to monomer

(96) "e-waste" means electrical and electronic equipment, whole or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing refurbishment and repair processes

(97) "exposure to asbestos" means exposure to airborne repairable asbestos fibres or asbestos dust; whether originating from asbestos or from minerals, materials or products containing asbestos in the factory.

(98) "exposure action value" means the level of daily exposure set out in clause-3 for any worker which, if reached or exceeded, requires specified action to be taken to reduce risk;

(99) "exposure limit value" means the level of daily exposure for any worker which must not be exceeded, as specified in sub clause-3.

(100) "explosives" as defined under section 4(d) of the Explosives Act, 1884

(101) "explosive mixture" means a mixture of combustion agent (oxidizing substance in gaseous, liquid or solid state) and a fuel (oxidisable substance in gaseous, liquid or solid state) in such proportions that it could give rise to a very rapid and violent oxidation reaction, liberating more

kinetic energy than is dissipated through conduction and convection, ultimately causing practical effect of explosion

(102) "factory medical officer"(FMO) means a qualified medical practitioner appointed by the employer for the purposes of the code.

(103) "facility"means the buildings, containers or equipment which contain a process or operate based on a technology

(104) "facility siting" is an assessment of occupied buildings given potential exposure to explosion fire and toxic hazards

(105) "fall arrest" means stopping a falling person from impacting the ground or other base which would injure him

(106) "fall prevention" means complete elimination of the likelihood of a fall, by safeguards with or without ppe

(107) "fall protection" means the mitigation of adverse consequences to the worker after a fall is initiated, by safeguards with or without ppe

(108) "fall restraint" means a device and technique to prevent an individual from falling off of an unprotected edge with a cable attached to an anchor so as to restrain his movement beyond the edge

(109) "full body harness (FBH)" – means a body support device consisting of connected straps designed to distribute a fall arresting force over at least the thigh, shallers and pelvis, with provision for attaching a shock absorber, lanyard, lifeline or other components

(110) "ferrous metals" the ferrous metals include integrated iron and steel, ferro alloys and special steels. special steel is a special chemical composition (alloy), using a special production process, with special microstructure and properties of steel to meet the special needs class.

(111) "fettling" includes scalloping, towing, sand papering, sand sticking, brushing or any other process of cleaning of pottery ware in which dust is given off.

(112) "fibre processing" spun yarn, in tow form is drawn, heat-set, crimped, dried, cut into small cut length fibres and packed in bale form

(113) "first employment" means employment for the first time in a hazardous process or operation so notified under section 82 of the Code, or re-employment therein after cessation of employment in such process or operation for a period exceeding three calendar months.

(114) "first aid injury" any one-time treatment and any follow up visit for the purpose of observation of minor scratches, cuts, burns, splinters, or other minor industrial injury, which does not ordinarily require medical care and hospitalization.

(115) "filament process" polyester polymer is extruded through fine capillary and solidified in form of yarn and wound as a continuous filament on paper tube in form of a bobbin.

(116) "fixed fencing" means fencing provided for the tools of a power press being fenced which has no moving part associated with or dependent upon the mechanism of a power and includes that part of a closed tool which acts as a guard.

(117) "fireproof" means a passive means of protection of a structure or equipment or vessel from exposure to direct fire or flame impingement or prolonged exposure to high intensity radiant thermal flux, by the application of a coating of certain heat-resistant substance or mixture of a specified rating

(118) "fire safe" means a provision of dual seating to control leakage to acceptable level, even after damage, due to fire, as applied to valves

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(119) “flameproof enclosure” as applied to electrical machinery or apparatus means an enclosure that will withstand, when covers or other access doors are properly secured, an internal explosion of the flammable gas or vapour which may enter or which may originate inside the enclosure without suffering damage and without communicating internal inflammation (or explosion) to the external flammable gas or vapour.

(120) “flammable compressed gas” means flammable compressed gas as defined in section 2 of the Static and Mobile Pressure Vessels (Unfired) Rules 1981 framed under the Explosive Act, 1884.

(121) “flammable liquefied gas” means a flammable gas kept in liquefied state by the application of pressure at normal ambient temperature 13% (thirteen percentage) or less of which by volume with air forms a flammable mixture or which has a flammable range with air of at least 12% (twelve percentage) points regardless of the lower flammable limits.

(122) “fluorine compound” a fluorine compound is one that contains fluorine, as an element in chemical combination, not as a free gas

(123) “float” area where the glass ribbon is formed.

(124) “foundry” means those parts of a factory in which the production of iron or steel or non-ferrous castings (not being the production of pig iron or the production of steel in the form of ingots) is carried on by casting in moulds made of sand, loam, moulding composition or other mixture of materials, or by shell moulding or by centrifugal casting in metal moulds lined with sand, or die casting including pressure die casting, together with any part of the factory in which any of the following processes are carried on as incidental processes in connection with and in course of, such production, namely, the preparation and preparation of moulds and cores, knock out operations and dressing or fettling operations

(125) “Forklift truck” means an industrial truck powered by electricity or fuel used to lift and move materials over short distances

(126) ”frequency” is the rate of pressure variations expressed in cycles per second or hertz.

(127) “fume” includes gas or vapour.

(128) “fume process” means any process in which carbon disulphide or hydrogen sulphide is produced, used or given off;

(129) “Furnace” area where the raw materials are melted.

(130) “fungicides” are biocidal chemical compounds or biological organisms used to kill parasitic fungi or their spores

(131) "gas free " means a condition when the concentration of a flammable gas in an equipment or a vessel is well below the threshold limits (lower explosive limit), so, that it is safe for a man to enter into the equipment or vessel or to conduct "hot work" there, as the case may be

(132) “garnett machine” means any of a number of types of machines for opening hard twisted waste of wool, cotton, silk, etc. essentially, such machines consist of a licker-in; one or more cylinders, each having a competent worker and stripper rolls; and a fancy roll and deffer. theaction of such machines is somewhat like that a wool card, but it is much more severe in that the various rolls are covered with garnett wire instead of card clothing.

(133) “guardrail” means a barrier to prevent workers from falling from height or into depth while carrying out the assignments at places with fall hazards

(134) “guide-rail” means a rod or bar along which a ring or clamp can slide to permit the wearer

of the waist belt at the other end of the connecting cable to slide to access work areas safely.

(135) “gill box” means a machine used in the worsted system of manufacturing yarns. its function is to arrange fibres in parallel order. essentially, it consists of a pair of feed rolls and a series of followers where the followers move at a faster surface speed and perform a combing action.

(136) “glazing” means the abrading, polishing or finishing, by aid of mechanical power, of metal, by means of any wheel, buff, mop or similar appliance to which any abrading or polishing substance is attached or applied

(137) “grinding” means the abrasion, by aid of mechanical power, of metal, by means of a grindstone or abrasive wheel;

(138) “grindstone” means a grindstone composed of natural or manufactured sandstone but does not include a metal wheel or cylinder into which blocks of natural or manufactured sandstone are fitted.

(139) “green liquor” intermediate product from the recovery boiler after incineration of the organic portion of the black liquor, which will predominantly contain sodium carbonate salts.

(140) 'ground or powdered flint or quartz' does not include natural sands

(141) “gross tonnage” means the gross tonnage (gt) calculated in accordance with the tonnage measurement regulations contained in annex i to the international convention on tonnage measurement of ships, 1969, or any successor convention

(142)

(143) “guillotine” means a machine ordinarily equipped with straight, bevel-edged blade operating vertically against a stationary resisting edge and used for cutting metallic or non-metallic substances.

(144) “hacking” means the chipping of the surface of a grindstone by a hack or similar tool.

(145) “hand-arm vibration” means mechanical vibration which is transmitted into the hands and arms during a work activity;

(146) “hand rail” means a rail or panel of sufficient height for a person to hold on to while ascending or descending stairs or steps, intended also to protect him from falling

(147) “halogenated hydrocarbons” also known as halocarbons, are hydrocarbon compounds in which at least one hydrogen atom is replaced by a halogen atom such as fluorine, chlorine, or bromine

(148) “hazardous material” means any material or substance which is liable to create hazards to human health and/or the environment

(149) “health officer” means the municipal health officer or district health officer or such other official as may be appointed by the state government in that behalf.

(150) “health hazard” means a chemical or a pathogen where acute or chronic health effects may occur in exposed workers

(151) “high vibration” means any exposure greater than the exposure limit value and action value specified in clause-3.

(152) “hierarchy” means decreasing order of effectiveness of any safeguard or other prescribed entity

(153) “hand-arm vibration” means mechanical vibration which is transmitted into the hands and arms during a work activity

(154) “herbicides” are chemicals used to manipulate or control undesirable vegetation

(155) ”high noise level” means any noise level measured on the a-weighted scale is 85 db or above.

(156) "highly flammable liquid" means any liquid including its solution, emulsion or suspension which gives off flammable vapours at a temperature less than 32 degree centigrade;

(157) “highly toxic material” means substances that may cause significant harm or even death to an individual if even very small amounts enter the body through any route of exposure.

(158) “hot work” means any work which involves (i) welding, burning, soldering, brazing, sand blasting or chipping by spark producing tools; or (ii) use of non-flameproof electrical equipment or equipment with internal combustion engines; and includes any other work which is likely top produce sufficient heat capable of igniting flammable gases or vapours;

(159) “hygrometer” means an accurate wet and dry bulb hygrometer conforming to the prescribed conditions as regards construction and maintenance.

(160) "horton sphere" means a spherical pressure vessel, supported vertically and is used for thes torage of flammable liquefied' or compressed gas;

(161) “IDLH or immediately dangerous to life or health” means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape from a dangerous atmosphere

(162) “incident” event that give rise to an accident or has the potential to lead to an accident. an incident where no ill health, injury, damage or ,other loss occurs is also referred to ‘near-miss’. the term incident’ includes ‘near-misses’

(163) “Inhibitor” inhibitor is a substance which slows down or prevents a particular chemical reaction or other process or which reduces the activity of a particular reactant, catalyst, or enzyme

(164) “in running rolls” means any paid of rolls or drums between which there is a “nip”.

(165) “industrial robots”: robots are multi-operational, reprogrammable and mechanical manipulating machines that typically employ one or more means of power namely electromechanical, hydraulic, or pneumatic. robots are programmable in three or more axes, which can be either fixed in place or fixed to a mobile platform for use in automation applications in an industrial environment. they are designed to move material, parts, tools, or specialized devices through variable programmed motions to perform a variety of tasks. an industrial robot includes not only industrial robots but also any devices and/or sensors required for the robot to perform s its tasks as well as sequencing or monitoring communication interfaces.

(166) “interlocking arrangement” means a device that prevents the setting in motion of a dangerous part of a machine or the machine itself while the guard cover or the door provided to safeguard against danger is open or unlocked, and which will also hold the guard, cover or door closed and locked while the machine or the dangerous part is in motion.

(167) “insecticides” are pesticides that are formulated to kill, harm, repel or mitigate one or more species of insect

(168) “iodine compound” a iodine compound is one that contains iodine, as an element in chemical combination, not as a free element.

(169) “kier” means a large metal vat, usually a pressure type, in which fabrics may be boiled out, bleached, etc.

(170) “knock-out operations” means all methods of removing castings from moulds and the following operations, when done in connection therewith, namely, stripping, coring-out and the removal of runners and risers.

(171) “lead material” means material containing not less than five per cent of lead

(172) “lead compound” means any compound of lead other than galena which, when treated in the manner described below, yields to an aqueous solution of hydrochloric acid a quantity soluble lead compound exceeding, when calculated as lead monoxide, five percent of the dry weight of the portion taken analysis.in the case of paints and similar products and other mixtures containing oil or fat the “dry weight” means the dry weight of the material remaining after the substance has been thoroughly mixed and treated with suitable solvents to remove oil, fats, varnish or other media.

(173) “lanyard” means a rope, cable or webbing that connects the fall arrest attachment element of the harness to an anchor or lifeline to ensure that the worker does not cross beyond the limit set by the rope, cable or webbing into some hazardous area or situation

(174) “lifeline” means a cable, rope, or webbing, attached to one or more anchors,a beam or truss, or to rigid rail, and to which a fall restraint or fall arrest clamp or grip,from one or more workers can be attached, to prevent their fall, or to mitigate the consequences after the fall.

(175) “lead process” means the melting of lead or any material containing lead, casting, pasting, lead burning, or any other work, including trimming, or any other abrading or cutting of pasted plates, involving the use, movement or manipulation of or contact with, any oxide of lead.

(176) “leadless glaze” means a glaze which does not contain more than one per cent of its dry weight, of a lead compound calculated as lead monoxide.

(177) “leaching” process of a solute extracted from its carrier substance by way of a solvent

(178) “loom” means a machine for effecting the interlocking of two series of yarns crossing one another at right angles. the warp yarns are wound on a warp beam and pass through headless and reeds. the filling is shot across in a shuttle and settled in place by reeds and slay, and the fabric is wound on a cloth beam.

(179) ”life belt” means a belt made of leather or other suitable material which can be securely fastened round the body with a suitable length of rope attached to it, each of which is sufficiently strong to sustain the weight of a man;

(180) “low solubility glaze” means a glaze which does not yield to dilute hydrochloric acid more than five per cent of its dry weight, of a soluble lead compound calculated as lead monoxide.

(181) “maintained” means maintained in an efficient state, in efficient working order and in good repair.

(182) “manager” means the person responsible to the occupier for the working of the factory for the purpose of the code.

(183) “major accident” means an incident involving loss of life inside or outside the site or injury to 10 or more persons inside the site or injury to one or more persons outside the site or release of toxic chemical or explosion or fire or spillage of hazardous chemical resulting in ‘on-site’ or ‘off-site’ emergencies or damage to equipment leading to stoppage of process or adverse effects to the environment

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(184) “major accident hazards (MAH) installations" means isolated storage and industrial activity at a site handling (including transport through carrier or pipeline) of hazardous chemicals equal to or, more than the threshold quantities specified in column 3 of schedule 2 and 3 respectively

(185) “manganese process” means processing, manufacture or manipulations of manganese or any ore or any mixture containing manganese.

(186) “manipulation” means mixing, blending, filling, emptying, grinding, sieving, drying, packing, sweeping, handling, using, etc..

(187) “manipulation of raw oxide of lead” means any lead process involving any manipulation or movement of raw oxides of lead other than its conveyance in a receptacle or by means of an implement from one operation to another.

(188) “match works" means any establishment which manufactures safety matches or colour matches by the use of chemicals mentioned in clause (a).

(189) “maximum permissible working pressure” means the maximum pressure at which a pressure vessel or plant is permitted to be operated or used under this rule and is determined by the technical requirements of the process;

(190) “mechanical vibration” means vibration occurring in a piece of machinery or equipment or in a vehicle as a result of its operation.

(191) “mercerizing range” means a 3-bowl mangle, a tenter frame, and a number of boxes for washing and scouring. the whole set up is in a straight line and all parts operate continuously. the combination is used to saturate the cloth with sodium hydrozide stretch it while saturated and washing out most of the caustic before releasing tension.

(192) “mercerising” means the fabric is treated with caustic soda solution to cause swelling of the fibers. this results in improved luster, strength, and dye affinity

(193) metal pouring hole lancing- lance pipes are used to open the tap holes of bottom pouring furnaces.

(194) "mounded vessel" means a pressure vessel for the storage of flammable liquefied or compressed as, which is sited above ground and is completely covered by a mound of earth or similar inert material except for nozzles, manhole covers, inspection covers fitted on the top of the vessel ;re

(195) “mobile elevated work platform (MEWP)” means a work platform on wheels which can be moved to the desired location and elevated by some mechanical means to the desired height, used for temporary tasks.

(196) “mule” means a type of spinning frame having a head stock and a carriage as its two main sections. the headstock is stationary. the carriage is movable and it carries the spindles which draft and spin the roving into yarn. the carriage extends over the whole width of the machine and moves slowly toward and away from the head stock during the spinning operation.

(197) “naked light certificate” means a certificate which is given by a person who is competent analyst and who is competent to give such certificates, and certifies that he has in an adequate and suitable manner tested for the presence of flammable vapour the oil-tank, compartment, space or other part of the vessel specified in the certificate and found it to be free therefrom and that having regard to all the circumstances of the case, including the likelihood or otherwise of the atmosphere becoming flammable, the use of naked

lights, fires, lamps or heated rivets or any hot work to be carried out may in his opinion be permitted in the oil-tank, compartment, space or other part of the vessel specified in the certificates

(198) "nip" is the danger zone between two rolls or drums which by virtue of their positioning and movement create a nipping hazard.

(199) "nitro or amino process" means the manufacture of nitro or amino derivatives of phenol and of benzene or its homologues, and the making of explosives with the use of any of these substances;

(200) "noise" means any unwanted sound.

(201) "operating procedures" means written, step-by-step instructions and associated information (cautions, notes, warnings) that describe how to safely perform a task

(202) "oil" means any liquid which has flash point below 132 degrees centigrade and also includes lubricating oils, liquid methane, liquid butane and liquid propane.

(203) "oil-tank" means any tank or compartment in which oil, or has been carried.

(204) "openers and pickers" means a general classification of machinery which includes breaker pickers, intermediate pickers, finisher pickers, single process pickers, multiple process pickers, willow machines, card and picker waste cleaners, thread extractors, shredding machines, roving waste openers, shoddy pickers, bale breakers, feeders, vertical openers, lattice cleaners, horizontal cleaners, and any similar machinery equipped with either cylinders, screen section, calendar section, rolls, or beaters used for the preparation of stock for further processing.

(205) "oven or drier" means any enclosed structure receptacle, compartment or box, which is used for baking, drying or otherwise processing of any article or substance at a temperature higher than the ambient temperature of the air in the room or space in which the oven or drier is situated, and in which a flammable substance is likely to be evolved within the enclosed structure, receptacle, compartment or box or part thereof on account of the article or substance which is baked, dried or otherwise processed within it.

(206) "outrigger" means a cantilever projection from roof or intermediate level of a high-rise building, to permit a seat or a platform with guard-rails to be suspended from its end, enabling one or more workers to carry out a task safely, without falling from the seat or platform.

(207) "oxygen deficiency" means that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. oxygen deficiency exists in atmosphere where the percentage of oxygen by volume is less than 19.5 percent.

(208) "ozone generator" a device designed to produce the ozone gas with different arrangements

(209) "paddler" means a trough for a solution and two or more squeeze rolls between which cloth passes after being passed through a mordant or dye bath.

(210) "permissible exposure limit" means the exposure, inhalation or dermal permissible exposure limits of chemicals and toxic substances in manufacturing processes.

(211) "petroleum" means any liquid hydrocarbon or mixture of hydro-carbon and any inflammable mixture (liquid, viscous or solid) containing any liquid hydro-carbon

(212) "petrochemical" petrochemical means chemical product derived from petroleum

(213) "pesticides" means any product proposed or used for controlling, destroying or repelling any pest or for preventing growth or mitigating effects of such growth including any of its formulations which is considered toxic under and is covered by the insecticides act, 1968 and the rules made thereunder and any other product, as may be notified from time to time

(214) "personal fall-arrest system (PFAS) " system designed to arrest a fall from a height, to

minimize the fall-arrest forces, to control the total fall distance in order to prevent collision with the ground or other obstacle, and to maintain the fallen person in a suitable post-fall attitude.

(215) "pipeline" means a pipe (together with any apparatus and works associated therewith), or system of pipe (together with any apparatus and works associated therewith), for the conveyance of a hazardous chemical, other than a flammable gas as set out in column(2)in part ii of schedule 3 at a pressure of less than 8 bars absolute

(216) "plaiting machine" means a machine used to lay cloth into folds of regular length for convenience of subsequent process or use.

(217) "planning machine" means a machine for overhand planning or for thicknessing or for both operations.

(218) "potter's shop" includes all places where pottery is formed by pressing or by any other process and all places where shaping, fettling or other treatment of pottery articles prior to placing for the biscuit fire is carried on

(219) "pottery" includes earthenware, stoneware, porcelain, china tiles, and any other articles made from such clay or from a mixture containing clay and other materials such as quartz, flint, feldspar, and gypsum.

(220) "power press" means a machine used in metal or other industries for moulding, pressing, blanking, raising, drawing and similar purposes.

(221) "pouring aisle" means an aisle leading from a main gangway or directly from a cupola or furnace to where metal is poured into moulds.

(222) "ppm" means parts of vapour or gas per million parts of air by volume at 25 degrees centigrade and 760 mm of mercury pressure;

(223) "plant" means a system of piping that is connected to a pressure vessel and is used to contain a gas, vapour or liquid under pressure greater than the atmospheric pressure, and includes the pressure vessel;

(224) "pressure plant" means a system of piping that is connected to a pressure vessel and is used to contain a gas, vapour or liquid under pressure greater than the atmospheric pressure, and includes the pressure vessel.

(225) "pressure vessel" means a vessel that may be used for containing, storing, distributing, transferring, distilling, processing or otherwise handling any gas, vapour or liquid under pressure greater than the atmospheric pressure and includes any pipeline fitting or other equipment attached thereto or used in connection therewith.

(226) "printing" printing, is the application of color in the form of a paste or ink to the surface of a fabric, in a predetermined pattern. it may be considered as localised dyeing. the common processes are block printing, roller printing and screen printing.

(227) "protective equipment" means apron, goggles, face shields, footwear, gloves and overalls made of suitable material

(228) "process safety management (PSM)" is a management system that is focused on prevention of, preparedness for, mitigation of, response to, or restoration from releases of chemicals or energy from a process associated with a facility

(229) "process incident" an event that is potentially catastrophic, i.e., an event involving the release/loss of containment of hazardous materials that can result in large-scale health and environmental consequences

(230) "protective clothing" means overalls and head covering, which (in either case) will when worn exclude asbestos dust

(231) “polyethylene terephthalate (PET)” process consists of esterification of pure terephthalic acid (pta) with ethylene glycol (EG) and followed by polycondensation to produce polyester polymer

(232) “polymerization” where chemical reaction takes place to produce high viscose polymer melt and other is spinning where this high viscose material is passed through mesh under high pressure which is converted into the yarn and this yarn is wound upon winder machines in spinning

(233) “polymer” a chemical compound or mixture of compounds formed by polymerization and consisting essentially of repeating structural units.

(234) "purging into service" means the replacement of air in a closed system by an inert gas and then replacement of the inert gas by the flammable gas, vapour or liquid; of a closed system by an inert gas and then replacement of the inert gas by air to such an extent that it is gas free and safe for any person to work;

(235) "purging out of service" means the replacement of normal flammable content

(236) “racing” means the turning up, cutting or dressing of a revolving grindstone before it is brought into use for the first time.

(237) “reactor” it is an enclosed volume in which a chemical reaction takes place under defined operational conditions

(238) “reference mass” mass (weight) of load considered appropriate for worker use on the basis of risk assessment of the task and the worker under the prevailing circumstances

(239) "remoteoperatedemergencyvalve"meansashut-offvalvecapableofremote operationwhichclosesautomaticallyonlossoftheactuatingpowerorfireengulfment and which is fire-safe.

(240) “repairable asbestos fibres” means asbestos fibres having diameter of less than 3 micrometre and a length to diameter ratio greater than 3:1.

(241) “replacement-in-kind” means an item (equipment, chemical, procedure, etc.)that meets the design specification of the item it is replacing. this can be an identical replacement or any other alternative specifically provided for in the design specification, as long as the alternative does not in any way adversely affect the use of the item or associated items

(242) “refractory material" means any refractory material containing not less than 25 percent total silica;

(243) “refractory bricks" means any brick or article composed of refractory material and containing not less than 25 percent total silica

(244) “receiving structure” means the same as ‘anchor point’

(245) “responsible person” means a person appointed by the employer to be responsible for the performance of specific duty or duties and who has knowledge and experience and the requisite authority for the proper performance of such duty or duties;

(246) “rodding” means the dressing of the surface of a revolving grindstone by the application of a rod, bar or strip of metal to such surface.

(247) “rotary staple “cutter” means a machine consisting of one or more rotary blades used for the purpose of cutting textile fibres into staple lengths.

(248) “roller printing machine” means a machine consisting of a large central cylinder, or pressure bown, around the lower part of the perimeter of which is placed a series of engraved color rollers (each having a color through), a furnisher roller, doctor blades, etc. the machine is used for printing fabrics.

(249) “rope access”, means the device and process of locating and supporting a worker at the vertical or steeply inclined façade of a structure at any desired level to enable him to carry out finishing, maintenance or repair work at that location

(250) "ribbon lapper" means a machine or a part of a machine used to prepare laps for feeding a cotton comb; its purpose is to provide a uniform lap in which the fibres have been straightened as much as possible.

(251) "safety device" means the fencing and any other safeguard provided for the tools of a power press.

(252) "Safety Critical Equipment" the elements, equipment & systems on failure (or non-operation) can directly result in (or contribute substantially to) a Major Accident or Major Loss to people, assets, environment and/or reputation

(253) "safe work practices" procedures to safely maintain and repair equipment, such as permits to work, line breaking, and hot work permits. this applies to non-routine operations

(254) "safe operating limits" means limits established for critical process parameters, such as temperature, pressure, level, flow, or concentration, based on a combination of equipment design limits and the dynamics of the process

(255) "scouring" is a chemical washing process carried out on cotton fabric to remove natural wax and non-fibrous impurities (e.g. the remains of seed fragments) from the fibers and any added soiling or dirt

(256) "shears" or "shearing machine" means a machine ordinarily equipped with straight, bevel-edged blades operating vertically against resisting edges, or with rotary, overlapping cutting wheels, and used for shearing metals or non-metallic substances;

(257) "self-retracting lifeline (SRL)" means a lifeline which permits the user to move around freely over a work area, and is designed and anchored overhead (– unless the particular device is specifically approved to be designed in a horizontal plane) such that if and when the user slips and experiences a free fall, the device will stop the fall within a short distance so as to avoid subjecting the body to undue forces.

(258) "ship and vessel" have the same meanings as in the merchant shipping act, 1958

(259) "ship" means a vessel of any type whatsoever operating or having operated in the marine environment and includes submersibles, floating craft, floating platforms, self elevating platforms, floating storage units, and floating production storage and offloading units (fpsos), including a vessel stripped of equipment or being towed.

(260) "shock absorber" the device used in a lanyard or a life line, interposed between the 'd'-ring and the lanyard connecting the body harness and the anchor or lifeline to provide a certain decelerating distance to cushion the shock on the body.

(261) "styrene monomer" is a clear, colourless to yellow, oily liquid, with a sweet odour at low concentrations. it is used to make plastics, paints, synthetic rubbers, protective coatings, and resins

(262) "suspension trauma", also known as 'venous pooling' or 'orthostatic intolerance' means the ill-health occurring to certain persons standing completely still in the same position or suspended by a sling such as full body harness, for long periods from 20 minutes to half an hour, possibly leading to heart stoppage if not attended to promptly.

(263) "ship breaking" means the activity of complete or partial dismantling of a ship at a ship breaking facility in order to recover components and materials for reprocessing and re-use, whilst

taking care of hazardous and other materials, and includes associated operations such as storage and treatment of components and materials on site, but not their further processing or disposal in separate facilities.

(264) "ship breaking plan" means ship breaking plan developed by the ship breaking facility to recycle a ship in safe and environmentally sound manner;

(265) "ship owner" means the person or persons or company registered as the owner of the ship or, in the absence of registration, the person or persons or company owning the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship. however, in the case of a ship owned by a state and operated by a company which in that state is registered as the ship's operator, "owner" shall mean such company. this term also includes those who have ownership of the ship for a limited period pending its sale or handing over to a ship recycling facility

(266) "shipyard" means any yard or dry dock (including the precincts thereof) in which ships or vessels are constructed, reconstructed, repaired, refitted or finished;

(267) "shoaring machine" means a machine used for shoaring cloth. cutting action is provided by a number of steel blades spirally mounted on a roller. the roller rotates in close contact with a fixed ledger blade. there may be from one to six such rollers on a machine.

(268) "singering machine" means a machine which comprises of a heater roller, plate, or an open gas flame. the cloth or yarn is rapidly passed over the roller or the plate or through the open gas flame to remove fuzz or hairiness by burning.

(269) "site inspection" means an inspection of the ship recycling facility confirming the condition described by the verified documentation.

(270) "sliver lapper" means a machine or a part of a machine in which a number of parallel card slivers are drafted slightly, laid side by side in a compact sheet, and wound into a cylindrical package

(271) "slasher" means a machine used for applying a size mixture to warp yarns. essentially, it consists of a stand for holding section beams, a size box, one or more cylindrical dryers or an enclosed hot air dryer, and a beaming and for winding the yarn on the loom beams.

(272) "slag granulation" liquid slag is 'quenched' by pouring onto it an excess water stream

(273) "slitter" or "slitting machine" means a machine ordinarily equipped with circular disc-type knives, and used for trimming or cutting into metal or non-metallic substances or for slitting them into narrow strips; for the purpose of this schedule, this term includes bread or other food slicers equipped with rotary knives or cutting discs.

(274) "sliver lapper" means a machine or a part of a machine in which a number of parallel card slivers are drafted slightly, laid side by side in a compact sheet, and wound into a cylindrical package.

(275) "smelting" process of applying heat to ore in order to extract a base metal

(276) "solvent extraction plant" means a plant in which the process of extracting oils and fats from vegetable and animal sources by use of solvents is carried on.

(277) “solvent” means an flammable liquid such as pentane, hexane and heptane use for the recovery of vegetable oils.

(278) “sow casting” in sow casting metal is transferred from ladles into large steel moulds where the metal cools and solidifies

(279) “sound or powdered flint or quartz” does not include natural sands

(280) “spinning process” polyester polymer is melt spun by extruding through fine capillaries and solidified in form of yarn

(281) “substances containing benzene” means substances wherein benzene content exceeds 1 per cent by volume.

(282) “suspension" means suspension from employment in any processes in which toxic and inflammable solvents are used, by written certificate in the health register signed by the certifying surgeon, who shall have the power of suspension as regards all persons employed in any such process

(283) “substitute” means a chemical which is harmless or less harmful than benzene and can be used in place of benzene;

(284) “stage” means any temporary platform on or from which persons employed perform work in connection with the operations, but does not include a boat-swain’s chair;

(285) “staging” includes any stage, and any upright, thwart, thwart pin, wedge, distance piece, belt or other appliance or material, not being part of the structure of the vessel, which is used in connection with the support of any stage, and any guard-rails connected with a stage;

(286) “starch mangle” means a mangle that is used specifically for starching cotton goods it commonly consists of two large rolls and a shallow open vat with several immersion rolls. the vat contains the starch solution

(287) “steeping process” a process in which pulp is soaked in 18% caustic & removal of excess caustic by squeezing by compression.

(288) “stone or any other material containing free silica” means a stone or any other solid material containing not less than 5% by weight of free silica

(289) “tanker” means a vessel constructed or adopted for carrying a cargo of oil in bulk.

(290) “tapping” opening the pouring hole of a melting furnace to remove molten metal

(291) “tender frame” means a machine for drying cloth under tension it essentially consists of a pair of endless travelling chains fitted with clips of fine pins and carried on tracks. the cloth is firmly held at the salvages by the two chains which diverge as they move forward so that the cloth is brought to the desired width.

(292) “time weighted average concentration” means the average concentration of a substance in the air at any work location in a factory computed from evaluation of adequate number of air samples taken at that location, spread over the entire shift on any day, after giving weightage to the duration for which each such sample is collected and the concentration prevailing at the time of taking the sample.

time weighted average $c_1t_1 + c_2t_2 + ...c_nt_n$

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$$\text{concentration} = \frac{}{t_1 + t_2 + \ldots\ldots tn}$$

where $c_1$represents the concentration of the substance for duration t_1 (in hours)
c_2 represents the concentration of the substance for duration t_2 (in hours); and
c_n represents the concentration of the substance for duration t_n (in hours).

(293) “toxic substances” means all those substances which when they enter into the human body, through inhalation or ingestion or absorption through skin, in sufficient quantities cause fatality or exert serious affliction of health, or chronic harmful effects on the health of persons exposed to it due to its inherent chemical or biological effects. in respect of substances whose tlv is specified in this standard, exceeding the concentration specified therein would make the substance toxic.

(294) “toxic inflammable solvents" mean

(i) solvents like accetone, tetra-chlorethane, alcohol, denatured spirit, phenol, amyl-acitate, butyle, acetate, di-acetone, alcohol and such other substances which in the opinion of this chief inspector-cum-facilitator are toxic and inflammable,

(ii) bangle polish" and "bangle mixture" and such other solvents, by whatever trade name they are known used in the manufacture of bangles and other articles from cellulose films.

(295) “tool lanyard” is a device that prevent dropping of tools, and thus eliminating the likelihood of a serious injury occurring to anyone below

(296) “tower scaffold” means a free-standing scaffold comprising a work platform with edge protection and accessed by an external vertical ladder or internal stairs with handrails

(297) “tundish” a broad, open container with one or more holes in the bottom

(298) “tuyere” small pipes that permit hot air from the bustle pipe to enter the blast furnace

(299) “vibration” means a mechanical phenomenon where by oscillations occur about equilibrium point. the oscillations may be periodic or random.

(300) “water mangle” means a calendar having two or more rolls used for squeezing water from fabrics before drying. water mangles also may be used in other ways during the finishing of various fabrics.

(301) “warper” means a machine for preparing and arranging the yarns intended for the warp of a fabric, specifically, a beam warper.

(302) “warehouse” means any building or part of a building used for the storage or sheltering (including servicing, processing or repairs incidental to storage) of goods, ware or merchandise, vehicles or animals

(303) “whole-body vibration” means mechanical vibration which is transmitted into the body, when seated or standing, through the supporting surface, during a work activity

(304) “white liquor” chemicals used in the pulping process, with combination of sodium hydroxide and sodium sulphide, based on the process.

(305) “woodworking machine” means a circular saw, band saw, planning machine, chain mortising machine or vertical spindle moulding machine operating on wood or cork;

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(306) “work location” means a location in a factory at which a worker works or may be required to work at any time during any shift on any day.

(307) “work positioning” means the same as rope access. (this does not cover work-positioning on a ladder.)

(308) “work positioning harness” means either a seat attached to afbh, or a suspension harness comprising a full body harness with wide thigh straps, used for work positioning

(309) “work restraint” means the same as fall restraint

(310) “work at height” means when work is carried out at a height of 2 m and more, above the floor level or through a depth of 2 m and more, below the floor level.

(311) “work envelope” a robot performs its tasks in a physical area known as the robot operating work envelope. the work envelope is the volume swept by all possible programmable robot movements. this includes the area where work is performed by robot tooling.

(312) “workforce” means a general term used to refer to employees and contractors at a facility

(313) “xanthation” is a heterogeneous (gaseous CS_2-wet alkaline cellulose) reaction, where vaporized CS_2 reacts with fluffy wet alkali cellulose to produce alkcell xanthate.

(314) “yankee cylinder” it is a cylinder used in the production of glazed paper or a tissue paper

(315) “100% tie-off” means ensuring that a person is prevented from or protected after falling off an edge of or into an opening in the working area, by the use of two lanyards, both attached to the user’s, fall-arrest attachment element.so that he can attach the second lanyard to another anchor beyond the area covered by the present anchor while the first lanyard is still attached to the original anchor, and then go back and release the first anchor to enable access to the fresh zone.

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CHAPTER II - GENERAL

4. **Safety and health policy:** under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) The occupier of every factory shall prepare a written policy statement in respect of safety and health of employees at work.

(2) The Safety and Health Policy shall contain and deal with:

(a) declared intention and commitment of the top management to health and safety of the employees and compliance with all the relevant statutory requirements;

(b) organizational set-up to carry out the declared policy clearly assigning responsibility at different levels; and

(c) arrangements for making the policy effective.

(3) In particular, the Policy shall specify the following:

(a) arrangements for involving the employees in the policy making process;

(b) intention of taking into account the health and safety performance of individuals at different levels while considering their career advancement;

(c) fixing the responsibility of the contractors, sub-contractors, transporters, and other agencies entering the premises;

(d) providing a resume of health and safety performance of the factory in its annual report;

(e) relevant techniques and methods, such as safety audits and risk assessment for periodical assessment of the status on health, safety and environment and taking all the remedial measures;

(f) stating its intentions to integrate health and safety, in all decisions including those dealing with purchase of plant, equipment, machinery and material as well as selection and placement of personnel;

(g) arrangements for informing, educating, training, and retraining its own employees at different levels and the public, wherever required.

(4) A copy of the declared Safety and Health Policy prepared in English and in a language understood by majority of employees and signed by the occupier shall be sent electronically or otherwise to the Inspector-cum-Facilitator having jurisdiction over the factory and to the Chief Inspector-cum-Facilitator;

(5) The Policy shall be made widely known by –

(a) making copies available to all employees.

(b) displaying copies of the policy at conspicuous places within the factory premises and

(c) any other means of communication; in a language understood by majority of employees.

(6) The occupier shall revise the Safety and Health Policy as often as may be appropriate, but it shall necessarily be revised under the following circumstances: -

(a) whenever any expansion or modification having implications on safety and health of the employees at work is made; or

(b) whenever new substance(s) or articles are introduced in the manufacturing process having implications on health and safety of employees exposed to such substances.

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5. Safety organization: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Structure

The Safety organization of every factory shall be headed by the occupier with the following members:

(a) Manager, or Factory Head or Plant Head.

(b) One or more safety managers or safety officers, if available.

(c) One or more factory medical officers, if available; and,

(d) One or more safety supervisors

Provided that the Safety Officer and the Factory Medical Officer shall perform their duties and functions as given under the relevant Standards declared under Section 18 of the Code.

(2) Role and Responsibilities of Manager, Factory Head and Plant Head

Manager, Factory Head and Plant Head shall:

(a) Implement and follow all the instructions, guidelines, SOP's and work permits on safety and health issued by the organisation.

(b) Ensure that the operation and maintenance works are performed by ensuring compliance to safety and health standards.

(c) Check and confirm that the prescribed PPE are issued to the workers and worn by them as per requirement and also ensure that such PPE shall conform to National Standards.

(3) Role and Responsibilities of Safety Supervisor

Safety supervisor shall be appointed by the occupier and his roles and responsibilities shall be to:

(a) Follow all the instructions, guidelines, SOP's, and work permits on safety and health issued by the organisation and assist in implementation.

(b) Ensure that the work under their control is supervised by ensuring compliance to safety and health standards.

(c) Check and confirm that the prescribed PPE are worn by them as per the requirement.

(d) Conduct toolbox meetings and On the Job Training (OJT) for the workers on safety and health employed under his supervision.

(4) Budget and Infrastructure

The following shall be provided for establishing and ensuring an effective safety organization:

(a) Adequate budget for ensuring occupational Safety and Health.

(b) Office space for safety department/division with essential furniture, phone and other facilities.

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(c) Supporting Staff, Vehicle, Instruments, Gauges, Devices and Equipment, which are necessary to carry out the activities towards ensuring compliances under the Occupational Safety and Health Standards laid down under Section 18 of the Code.

6. Plan Approval Mechanism: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Under no circumstances shall the plan be returned unapproved.

(2) In case any additional document or information is sought the same shall be limited to the safety and health standards and rules laid down under Section 18, 23 and 24 of the Code.

(3) A Certificate of Stability in respect of the buildings of the factory, in the Form 1 provided herewith, shall be obtained from the competent person and sent to the Chief Inspector-cum-Facilitator electronically.

7. Training : under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

Training Requirements

(a) Workers shall undergo training, awareness, and competence building to carry out safe work in each respective department.

(b) The training shall be done at various levels as follows:

(i) Induction or Initial Training– Induction/orientation for new workers before being deployed to job/role execution, or initial training for those who are already employed who have not had the induction training;

(ii) Refresher Training – Updating of significant safety-related developments and changes, and review of safety-critical components of equipment, safety aspects of the process, PPE, etc.;

(iii) Specialised Training – To provide information and develop familiarity on the specific hazards and controls for hazardous chemicals and dangerous activities, to workers entering such tasks;

(iv) Role-change Training – For those who are assigned a role change with no change in the equipment, process, PPE, etc., but with different or increased responsibilities; and,

(v) Briefing Sessions – Short 'Toolbox Meetings' to update workers on latest safety-related developments, and demonstrate or review use of special PPE, etc.

(c) The training and briefing in as described in para (2) shall:

(i) Cover the provisions of the Code and the Standards and Rules made there under;

(ii) Be delivered by trainers who have had the proposed training (or their approved equivalent) themselves, and, have had hands-on experience with the process, equipment, products, PPE and all safety requirements therefor, for a period of at least two years, or have approved trainer-training in the particular module they teach; and,

(iii) Be delivered according to the Training Matrix as per the schedule given herewith

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below.

SCHEDULE

TRAINING MATRIX

S.No.	*Level*	*Duration*	*Topics to be covered*
(i)	Induction or Initial Training	8 Hours minimum	i. Factory overview ii. Main processes and products iii. Duties and responsibilities iv. SOP, SWP, Permit-to-work and other formal actions v. Hazardous materials and processes vi. Engineering controls and safeguards provided and PPE vii. Incident and accident reporting process viii. Fire hazards ix. Escape routes and procedures x. First-aid and emergency procedures xi. Welfare facilities available to workers
(ii)	Refresher and Specialised Training	8 Hours minimum	i. Updating with improvements on safety and health during previous year ii. Review of previous year's performance and lessons learnt iii. Summary review of critical safety procedures and PPE iv. Basic description of hazards involved v. Standards and rules shall be followed vi. Specific information on equipment, process, safety measures, signs to watch out for etc. vii. Specific first-aid and emergency procedures

8. **Floors, Stairs and Means of Access:** under serial no. 12 in the second schedule under clause (f) of sub-section (2) of section 18

In every establishment—

a) All floors, steps, stairs, passages, gangways, emergency exits and refuge areas shall be of sound construction, and be provided with handrails, adequate illumination and signage. They shall be properly maintained through good housekeeping, and be kept free from all obstructions and substances that are likely to cause persons to slip or trip. Special care shall be taken to prevent fall from heights above 2 meters.

b) Areas having unguarded edges shall have proper edge protection and all measures of fall prevention and fall protection, including but not limited to collective protective measures like use of safety nets, where applicable, shall be put in place.

c) There shall, so far as is reasonably practicable, be provided and maintained safe means of access to every place at which any person is at any time required to work.

9. Pits, Sumps, Openings in floors and Other similar indentation areas: under serial no. 13 in the second schedule under clause (f) of sub-section (2) of section 18

(1) In every factory, all fixed vessels, sumps, tanks, pits, excavations, trenches, shafts or other openings in the ground or on a floor or any other confined spaces, which, by reason of its depth, situation, construction or contents, is or may be a source of danger, shall be either securely covered or securely fenced.

(2) For persons entering into or working inside the confined spaces, the occupier shall arrange to identify the nature of hazards that are encountered therein, normally or abnormally, and arrange to develop the most appropriate safeguards for their safety and health;

(3) Entry or work inside the confined spaces shall be regulated with a 'permit to work system' designed based on the risk assessment done by the occupier and shall include the safeguards so developed as required under para (2) above.

(4) The area shall be rendered safe for entry into or work therein, by first testing of the confined space environment by the responsible person declared by the occupier for the presence of toxic gases, chemicals, liquids and other hazards beyond the permissible oxygen levels, and then washing or cleaning with suitable ventilation arrangements. Such testing shall be carried out as often as is necessary during the course of work to ensure its continued safety.

(5) Appropriate precaution against deficiency of oxygen, residual or accumulated toxic gases or vapours shall be taken. No employee shall enter or remain in any confined space without:

(a) the space having been and remaining adequately ventilated and the responsible person having tested it and certified that it is safe for entry.

(b) the employee wearing an appropriate respiratory protection equipment, as required.

(6) Only employees trained about the work and hazards in confined spaces shall be authorised to enter and work in such areas. Employees shall be provided with appropriate and certified personal protective, gas detection, purging, flame proof lighting, access, fall protection, rescue and retrieval equipment and first aid as required.

(7) Supervision of the work at all times shall be ensured by a responsible person. An attendant shall be positioned outside the confined space entry to monitor and maintain continuous communication with the person entering the confined space. Proper signal shall be established to raise an emergency alarm and measures for swift retrieval and revival shall be made available.

(8) The responsible person shall maintain a record of every entry into or work in confined spaces and such record shall contain the details of persons assigned for the work, the location of the work and such other details that would have a bearing on the safety and health of the persons assigned for this work. The records so maintained shall be retained as long as the concerned workers are in service, and be produced to the Inspector-cum-Facilitator when demanded.

(9) Regular inspection of all the equipment mentioned in para (6), and calibration of gas testing monitors shall be done and a proper record shall be maintained of such inspection and/or calibration.

(10) Minimum dimensions of manholes.- Every chamber, tank, vat, pipe, flue or other confined space, which persons may have to enter and which may contain dangerous fumes to such an extent as to involve risk of the persons being overcome thereby, shall unless there is other effective means of egress, be provided with a man hold which may be rectangular, oval or circular in shape and which shall

(a) in the case of a rectangular or oval shape, be not less than 40 centimetres long and 30 centimetres wide; and

(b) in the case of a circular shape, be not less than 40 centimetres in diameter.

10. Precautions against dangerous fumes, gases, etc.: under serial no. 16 in the second schedule under clause (f) of sub-section (2) of section 18

(1) No person shall be required or allowed to enter any chamber, tank, vat, pit, pipe, flue or other confined space in any factory in which any gas, fume, vapour or dust is likely to be present to such an extent as to involve risk to persons being overcome thereby, unless it is provided with a manhole of adequate size or other effective means of egress.

(2) Where in any factory work is being carried out in the vicinity of dangerous fumes, gases etc, the occupier shall ensure that the hazards associated with them, in respect to their impact on the safety and health of workers are assessed. The plant and equipment shall be so constructed and maintained as to enable quick isolation of plant or part of plant or equipment and relevant safety measures planned and executed accordingly. Exposure to gases and fumes shall not exceed permissible limits as prescribed by the State Government.

(3) Occupier shall provide appropriate methods for storage, handling, distribution, and transportation of gases ensuring that there is no leakage of the same. Methods to monitor and regulate temperature and pressure of the gases shall be in place, along with continuous means of detection for any leakage.

(4) The working area shall be constantly supplied with fresh air through appropriate methods of ventilation, and to prevent dangerous concentration of gas or fumes in the following situations;

(a) Areas with pipe-racks, movable pipes, hoses or cylinders used for conveying any dangerous fumes, gases, etc.

(b) Areas where any such raw material, by-product or waste product/ effluent likely to produce any dangerous fumes, gases etc, is stored

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(c) Areas where any process is carried out that generates dangerous fumes, gases etc.

(5) Effective arrangements shall be provided to control the escape and spread of dangerous fumes, gases etc during normal working and in the event of accident or emergency. Inspection and maintenance of the conveying pipes and storage cylinder shall be carried out annually.

(6) The occupier shall provide suitable respiratory protective equipment for use by workers to prevent inhalation of dusts, fumes or mists in an emergency. Sufficient number of complete sets of such equipment shall always be kept within accessible limits of the workplace, and their proper storage, adequate arrangements for cleaning and maintenance, periodic inspection and safe disposal shall be provided. Adequate provision to the workers like eye-wash and general showers for cleaning/ treating post exposure shall be made available.

(7) Occupier shall provide for an alarm system giving audible and visible indications to raise an alert for evacuation, when the gases cross the permissible levels in the atmosphere. Such alarm systems shall be checked and calibrated as per manufacturer's recommendations.

(8) The occupier shall have an emergency preparedness plan in place, and the steps for such plan shall, be defined and communicated through proper training of appointed responsible personnel at site and shall include:

(a) In the event of the failure of the arrangements for control resulting in the escape of dangerous fumes and gases in the work atmosphere, immediate steps shall be taken to control the process in such a manner, that further escape is brought down to the safe level.

(b) Rendering of the dangerous fumes and gases that have escaped into the work atmosphere before taking immediate steps as required in sub-para (a), as soon as possible, innocuous by suitable methods.

11. Precautions regarding the use of portable electric light: under serial no. 17 in the second schedule under clause (f) of sub-section (2) of section 18

In any factory—

(1) no portable electric light or any other electric appliance of voltage exceeding twenty-four volts shall be permitted for use inside any chamber, tank, vat, pit, pipe, flue or other confined space unless adequate safety devices are provided; and

(2) if any inflammable gas, fume or dust is likely to be present in such chamber, tank, vat, pit, pipe, flue or other confined space, no lamp or light other than that flame-proof construction shall be permitted to be used therein.

12. Explosive or inflammable dust, gas, and other like dust or gases: under serial no. 18 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Where in any factory any manufacturing process produces dust, gas, fumes or vapour of such character and to such extent as to be likely to explode on ignition, all practicable control measure shall be taken to prevent any explosion by—

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(a) effective enclosure of the plant or machinery used in the process such as pressure resistant construction, having inherently safer process design, providing suitable safety relief valves, explosion vents, rupture disc etc, and calibrating them regularly for effectiveness.

(b) regular controlling and monitoring of the process parameters (Pressure, temp, flow rate, etc), maintaining strict adherence to the equipment's Standard Operating Procedure(SOP) during pre-start, Regular operation and Shut down activities.

(c) effective steps shall be taken for removal or prevention of the accumulation in the air of inflammable dust, gas, fume or vapour to an extent which is likely to be dangerous.

(d) no waste material of a inflammable nature shall be permitted to accumulate on the floors and the same shall be removed regularly. Such waste material shall be placed in suitable non-combustible containers with covers.

(e) all precautions as are reasonably practicable, shall be taken to prevent ignition from any possible sources such as open flames, frictional sparks, overheated surfaces of machinery or plant, chemical or physio-chemical reactions, radiant heat and static charges.

(f) appropriate dust extraction and/or suppression systems shall be provided wherever there is generation of dust.

(g) employees shall be provided suitable PPE and tools which will not cause sparks by friction or static charge.

(h) smoking, lighting or carrying of matches, lighters or smoking materials shall be prohibited.

(2) Where any part of the plant or machinery in a factory contains any explosive or inflammable gas or vapour under pressure greater than atmospheric pressure, that part shall not be opened except in accordance with the following provisions, namely: —

(a) before the fastening of any joint of any pipe connected with the part or the fastening of the cover of any opening into the part is loosened, any flow of the gas or vapour into the part of any such pipe shall be effectively stopped by a isolation-valve or other means;

(b) before any such fastening as aforesaid is removed, all practicable measures shall be taken to reduce the pressure of the gas or vapour in the part or pipe to atmospheric pressure;

(c) where any such fastening as aforesaid has been loosened or removed effective measures shall be taken or prevent any explosive or inflammable gas or vapour from entering the part or pipe until the fastening has been secured, or the case may be, securely replaced and a pre-startup safety review shall be carried out;

(3) Work permit system shall be implemented during maintenance activities for plant, tank, vessel or machinery that contains any explosive or inflammable gas or vapour under pressure greater than atmospheric pressure. SOP shall be prepared and followed during planned maintenance.

(4) Work shall be carried out under proper supervision with adequate safety measures such as, but not limited to- de-pressurising, Purging with inert gas, venting, Blanking, etc.

(5) Smoking, lighting or carrying of matches, lighters or smoking materials shall be strictly prohibited.

(6) Effective house keeping with frequent removal of inflammable dust.

(7) No plant, tank or vessel which contains or has contained any explosive or inflammable substance shall be subjected in any factory to welding, brazing, soldering, cutting or other operations which involve the application of heat unless adequate measures have first been taken to remove such substance and any fumes arising there from or to render such substance and fumes non-explosive or non-inflammable, and no such substance shall be allowed to enter such plant, tank or vessel after any such operation until the metal has cooled sufficiently to prevent any risk of igniting the substance.

13. Welding, Cutting and Brazing: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to every factory in which or in any part of which the welding, cutting and brazing operations and connected works are carried on.

(2) General requirements:

(a) The Supervisor shall be responsible for the safe handling of the cutting or welding equipment and the safe use of the cutting or welding process. He shall determine that the cutter or welder secures his approval that conditions are safe before going ahead.

(b) No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which when subjected to heat, might produce flammable or toxic vapors. Any pipe lines or connections to the drum or vessel shall be disconnected or blanked.

(c) All hollow spaces, cavities or containers shall be vented to permit the escape of air or gases before preheating, cutting or welding. Purging with inert gas is recommended.

(d) When arc welding shall be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders

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carefully located so that accidental contact cannot occur and the machine shall be disconnected from the power source.

(e) In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight. Where practicable, the torch and hose shall also be removed from the confined space.

(f) Welders shall place welding cable and other equipment so that it is clear of passageways, ladders, and stairways.

(g) Where the work permits, the welder shall be enclosed in an individual booth painted with a finish of low reflectivity such as zinc oxide (an important factor for absorbing ultraviolet radiations) and lamp black, or shall be enclosed with non-combustible screens similarly painted. Booths and screens shall permit circulation of air at floor level. Workers or other persons adjacent to the welding areas shall be protected from the rays by non-combustible or flameproof screens or shields or shall be required to wear appropriate goggles.

(h) Employees exposed to the hazards created by welding, cutting, or brazing operations shall be protected by personal protective equipment and they shall conform to the applicable National standards.

(i) After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning other workers.

(j) When welding must be performed in a space entirely screened on all sides, the screens shall be so arranged that no serious restriction of ventilation exists.

(k) Local exhaust or general ventilating systems shall be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable concentration.

(l) The employer shall include the potentially hazardous materials employed in fluxes, coatings, coverings, and filler metals, all of which are potentially used in welding and cutting, or are released to the atmosphere during welding and cutting, in the program established to comply with the Hazard Communication Standards and the employer shall ensure that each employee has access to labels on containers of such materials and safety data sheets.

(m) Where brazing (welding) filler metals contain cadmium in significant amounts, the labels shall indicate the hazards associated with cadmium including cancer, lung and kidney effects, and acute toxicity effects.

(n) Where brazing and gas welding fluxes contain fluorine compounds, the labels shall

indicate the hazards associated with fluorine compounds including eye and respiratory tract effects.

(o) Welding fumes and gases shall be prevented from breathing and adequate ventilation such as fume collectors, exhaust ventilators, or air-supplied respirators provided.

(p) Freely movable or fixed hoods intended shall be placed as near as practicable to the work being welded and provided with a rate of air-flow sufficient to maintain a velocity in the direction of the hood of 100 linear feet (30 m) per minute in the zone of welding when the hood is at its most remote distance from the point of welding.

(q) All welding and cutting operations carried on in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency. This applies not only to the welder but also to helpers and other personnel in the immediate vicinity. The fresh air replacing that of withdrawn air shall be clean and respirable.

(r) In confined spaces or indoors, welding or cutting operations involving metals containing lead, other than as an impurity, or metals coated with lead-bearing materials, including paint, shall be done using local exhaust ventilation or airline respirators.

(s) When arc welding is performed in wet conditions, or under conditions of high humidity, special protection against electric shock shall be supplied.

(t) Oxygen – Fuel Gas Welding and Gas Cutting:

(u) Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas. Such marking shall be by means of stencilling, stamping, or labelling, and shall not be readily removable.

(i) Cylinders shall be kept away from radiators and other sources of heat.

(ii) Oxygen cylinders shall not be stored near highly combustible material, especially oil and grease; or near reserve stocks of carbide and acetylene or other fuel-gas cylinders, or near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.

(iii) Cylinders, cylinder valves, couplings, regulators, hose, and apparatus shall be kept free from oily or greasy substances. Oxygen cylinders or apparatus shall not be handled with oily hands or gloves. A jet of oxygen shall never be permitted to strike an oily surface, greasy clothes, or enter a fuel oil or other storage tank.

(iv) When transporting cylinders by a crane or derrick, a cradle, boat, or suitable platform shall be used. Slings or electric magnets shall not be used for this purpose. Valve-protection caps, where cylinder is designed to accept a cap, shall always be in place.

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(v) Cylinders shall not be dropped or struck or permitted to strike each other violently.

(vi) Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them, or fire-resistant shields shall be provided. Cylinders shall not be placed where they might become part of an electric circuit.

(vii) The pipeline and hoses shall conform to the applicable National Standards.

(viii) Flash back arrestors at both ends of the gas pipeline or hose and Non Return valves with pressure gauges shall be provided for each gas line.

(3) Arc Welding and Cutting:

(a) Standard machines for arc welding service designed in conformance with the applicable National standards and constructed to carry their rated load with rated temperature rises shall be used and it shall be suitable for operation in atmospheres containing gases, dust, and light rays produced by the welding arc.

(b) For AC welding under wet conditions or warm surroundings where perspiration is a factor, the use of reliable automatic controls for reducing no load voltage is recommended to reduce the shock hazard.

(c) Terminals for welding leads shall be protected from accidental electrical contact by personnel or by metal objects i.e., vehicles, crane hooks, etc. Protection shall be obtained by use of Dead-front receptacles for plug connections; recessed openings with non removable hinged covers; heavy insulating sleeving or taping or other equivalent electrical and mechanical protection.

(d) Where a structure, conveyor, or fixture is regularly employed as a welding current return circuit, joints shall be bonded or provided with adequate current collecting devices.

(e) All ground connections shall be checked to determine that they are mechanically strong and electrically adequate for the required current.

(f) A disconnecting switch or controller shall be provided at or near each welding machine which is not equipped with such a switch or controller mounted as an integral part of the machine.

(g) For individual welding machines, the rated current-carrying capacity of the supply conductors shall be not less than the rated primary current of the welding machines.

(h) All Direct Current machines shall be connected with the same polarity.

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(i) All Alternating Current machines shall be connected to the same phase of the supply circuit and with the same phase sequence.

(j) Before starting operations all connections to the machine shall be checked to make certain they are properly made. The work lead shall be firmly attached to the work; magnetic work clamps shall be freed from adherent metal particles of spatter on contact surfaces. Coiled welding cable shall be spread out before use to avoid serious overheating and damage to insulation.

(k) Electrode holders when not in use shall be so placed that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.

(l) The operator shall report any equipment defect or safety hazard to his supervisor and the use of the equipment shall be discontinued until its safety has been assured. Repairs shall be made only by qualified personnel.

(m) Machines which have become wet shall be thoroughly dried and tested before being used.

(n) Cables with damaged insulation or exposed bare conductors shall be replaced. Joining lengths of work and electrode cables shall be done by the use of connecting means specifically intended for the purpose. The connecting means shall have insulation adequate for the service conditions.

(4) Resistance Welding:

(a) Ignition tubes used in resistance welding equipment shall be equipped with a thermal protection switch.

(b) Workmen designated to operate resistance welding equipment shall have been properly instructed and judged competent to operate such equipment.

(c) Controls of all automatic or air and hydraulic clamps shall be arranged or guarded to prevent the operator from accidentally activating them.

(d) All doors and access panels of all resistance welding machines and control panels shall be kept locked and interlocked to prevent access, by unauthorized persons, to live portions of the equipment.

(e) All press welding machine operations, where there is a possibility of the operator's fingers being under the point of operation, shall be effectively guarded by the use of a device such as an electronic eye safety circuit, two hand controls or protection similar to that prescribed for punch press operation,

(f) The hazard of flying sparks shall be, wherever practical, eliminated by installing a

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shield guard of safety glass or suitable fire-resistant plastic at the point of operation.

(g) All foot switches shall be guarded to prevent accidental operation of the machine.

(h) Two or more safety emergency stop buttons shall be provided on all special multispot welding machines, including 2-post and 4-post weld presses.

(i) On large machines, four safety pins with plugs and receptacles (one in each corner) shall be provided so that when safety pins are removed and inserted in the ram or platen, the press becomes inoperative.

(j) Where technically practical, the secondary of all welding transformers used in multispot, projection and seam welding machines shall be grounded.

(k) All portable welding guns shall have suitable counterbalanced devices for supporting the guns, including cables, unless the design of the gun or fixture makes counterbalancing impractical or unnecessary.

(l) All portable welding guns, transformers and related equipment that is suspended from overhead structures, eye beams, trolleys, etc. shall be equipped with safety chains or cables. Safety chains or cables shall be capable of supporting the total shock load in the event of failure of any component of the supporting system.

(m) All initiating switches, including retraction and dual schedule switches, located on the portable welding gun shall be equipped with suitable guards capable of preventing accidental initiation through contact with fixturing, operator's clothing, etc. Initiating switch voltage shall not exceed 24 volts.

(n) The movable holder, where it enters the gun frame, shall have sufficient clearance to prevent the shearing of fingers carelessly placed on the operating movable holder.

(o) The secondary and case of all portable welding transformers shall be grounded.

(p) Flash welding machines shall be equipped with a hood to control flying flash.

(5) Welding/Cutting Operation with the Use of LPG/Acetylene/Argon.

(a) Equipment:-

(i) Gas cylinder whether filled or empty shall not be stored in rooms where welding or cutting work is being done.

(ii) Liquefied Gas Cylinder, when is used shall always be kept in an upright position and shall be so placed that they cannot be knocked over.

(iii) Opens flames, lights, lighting of fire and smoking shall be prohibited in close proximity to any cylinder containing flammable gases, except those which are in use for welding cutting or heating.

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(iv) All cylinders shall be stored at a safe distance of not less than 10 meters from all operation which produce flames, sparks or molten metal or result in excessive heat.
(v) Every gas cylinder shall be provided with efficient Standard type pressure regulator and backflow of gas will be restricted by second non-return type valve.
(vi) All welding/cutting torches shall be standard type which shall be provided with non-return valve.
(vii) Suitable type of fire extinguishers shall be provided near the welding/cutting place and also near the gas cylinder storage.
(viii) Pipe line from gas cylinders shall be painted with distinctive colours for identification of each gas.

(b) (i) Welding and cutting operation shall be prohibited in areas containing explosive or flammable dusts, gases, oil or vapours.

(i) (2) Welding/cutting operations that are carried out in places where persons other than the welder sand their helpers are working or passing shall be means of suitable stationary or portable screens at least 2.15 (7-Ft.) in height.
(ii) All equipments like welding/cutting torch, pipe lines, brackets, non return valves and pressure regulators shall-be examined by a competent person having know how of such equipments, at least once in a period of 15 days;
(iii) The welding/cutting process shall be carried out by workers specially trained in that job and know of the hazards or fires, back-fire and explosion.
(iv) A log book of examination of equipments and a register of trained workers for welding/cutting operation shall be maintained in the forms as directed by the Inspector-cum-Facilitators.

Periodic inspection shall be made by qualified maintenance personnel, and a certification record maintained. The certification record shall include the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, for the equipment inspected. The operator shall be instructed to report any equipment defects to his supervisor and the use of the equipment shall be discontinued until safety repairs have been completed.

14. Safety of Buildings and Machinery: under serial no. 21 in the second schedule under clause (f) of sub-section (2) of section 18

(1) The buildings of the factory shall conform to National Standards.

(2) The structural strength, stability and safety of the building shall be got tested and examined by a competent person as per National Standards.

(3) The occupier shall maintain and ensure that the buildings are structurally safe and are not dangerous to human life and health.

(4) The occupier shall assess the risks involved during erection and commissioning of the machines. Safe Operating Procedures and adequate safety measures including

appropriate material handling equipment shall be ensured.

(5) In case of dismantling or decommissioning of machinery and plants, the occupier shall assess the risk caused to the employees in the process. The occupier shall ensure energy isolation, decontamination and provide appropriate material handling equipment and follow correct lifting procedures.

15. Maintenance of Buildings: under serial no. 22 in the second schedule under clause (f) of sub-section (2) of section 18

The occupier of the factory shall ensure that no building or part of a building in a factory is in such a state of disrepair as is likely to lead to conditions detrimental to the health and welfare of the workers.

16. Warehouse: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Location of Warehouse

(a) Every warehouse shall abut on a public/private means of access like streets/roads duly formed.

(b) Warehouse shall not be located in a low lying area or area at risk of flooding. Sufficient measures shall be taken to limit the chances of flood water entering the building.

(2) Design and layout

(a) Warehouses shall be designed, constructed and maintained as per National Standards.

(b) A safe traffic management system shall be ensured. This shall include methods and procedures for arrival, reception, unloading, loading and movement of vehicles within the premises. People and vehicles shall be segregated as far as is reasonably practicable.

(3) Floors and Supporting Surfaces

(a) Supervision shall be exercised to prevent safe load limit are not exceeded.

(b) Level of floor shall be maintained.

(c) Floors or surfaces required to support stacks, shelving, racks or other means of storage shall be capable of sustaining the intended load together with shock loads.

(d) If there is a possibility of the stored material becoming waterlogged through rain or by other means, due allowance shall be made for this extra weight.

(e) The supporting surface shall also be sufficiently strong to withstand the effects of any damage to or deterioration of stored materials.

(4) OPERATION SAFETY

(a) General

(i) All materials shall be handled and stacked with due regard to the materials characteristic.

(ii) Neat stacking and good housekeeping shall be maintained at all times

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(iii) Materials which are particularly susceptible to water damage shall be stored on skids, pallets, elevated platforms or such other devices of at least 20 cm in height.

(iv) Material Safety Data Sheet shall be made available near the storage and in the office of warehouse.

(v) Important information on safety and health shall be displayed prominently at one or more conspicuous places in English and a language understood by majority of employees.

(b) Segregation of Materials

(i) Hazardous materials shall be segregated from other non-hazardous materials. Inflammable liquids, gas cylinders, aerosols, materials liable to spontaneous combustion and hazardous chemicals shall not be stored in same area as other goods.

(ii) Materials which may be hazardous in combination shall be stored separately in and segregated areas. Chemicals liable to react with each other materials shall not be stored together unless adequately protected from contacting each other, either directly or by spillage.

(iii) Materials which emit large amount of smoke and or toxic gases shall be stored in separate well ventilated warehouses.

(iv) For the storage of certain materials, which are solids at ordinary temperature, but melt easily under heat or fire, precautions shall be taken to prevent propagation of fire.

(v) Electrical equipment used in or around the storage area or building where explosive materials are stored shall be explosion proof.

(vi) Earthing and bonding shall be used to eliminate the possible build-up of static electricity

(vii) The storage area or building shall be signposted to indicate that it contains inflammable or hazardous chemical materials and that smoking and naked flames are prohibited

(viii) All containers, drums and cans shall be clearly labeled with their contents

(c) Indoor Storage

(i) Aisles and Passageways

(a) Aisles and passageways shall be maintained at reasonable intervals to provide convenient access to all portion of storage.

(b) These passageways or aisles shall be so spaced that the total content of individual stacks does not exceed 700 m^2. In case of baled fibres or other combustible goods, however aisles shall be placed as intervals not exceeding 15 m.

(c) The passageways or aisles shall be of sufficient width for the removal or transfer of material and in general shall have a minimum width of 2.0 m.

(d) Where mechanical handling appliances are used a minimum width of 2.5 m shall be provided.

(e) Wall aisles, that is, the aisles alongside walls shall be of sufficient width to permit passage of an employee. In case of storage of baled fibre products and all other water absorbent materials in bales, the width of wall aisles shall not be less than 1.0 m.

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(ii) Positioning of stacks

(a) Stacks shall not be built within 450 mm of a wall. Most building and party walls are not retaining walls and may not withstand the pressure set up by stacks laid against them. A 450 mm gap between the stack and the wall also enables the construction and the condition of stacks shall be checked.

(b) Stacks shall not be created where any part will be within 1.5 m of a rail track. This clearance shall be continued all the way along the stack. Extra care shall be taken if the storage area is subject from rail or road traffic, outside or inside the premises.

(c) Care shall also be taken in stacking material in the vicinity of machinery or operations which cause vibrations. Some objects are liable to creep and lose stability under the influence of vibration. Sacks or bales made of synthetic materials are particularly susceptible, especially when first used.

(d) Stacks, shelving and other fixtures for holding or storing materials shall be so laid out and

i). designed that there is sufficient access for safe loading and unloading by either manual or

ii). mechanical means.

(e) Storage areas shall be specifically designated, be clearly marked and be in the charge of a responsible employee. Aisles shall be clearly marked with a minimum of 1 m width and kept free from obstacles and waste materials.

(f) Stacks shall not be created which will block gangways, aisles, walkways, thoroughfares and particularly doors and exits

(g) Stacks shall have clear spaces of at least 1 m on all sides, apart from walls, where a 450 mm space shall be allowed. Goods shall not be stacked within 1 m of the ceiling, roof or sprinkler heads

(h) Goods shall be kept well clear of light fittings, heating pipes and appliances, firefighting and alarm equipment and doors

(i) No stack, shelving, fixture or other means of storage shall be placed in a position or extended in height, so that a person climbing on to it or removing stored goods either manually or mechanically, can come into contact with live electrical wiring or unfenced machinery

(j) No material shall be loaded or unloaded from stacks, shelving or fixtures if there is a risk of workers directly or indirectly contacting unfenced machinery, or touching live electrical wiring, until that machinery or wiring is isolated or made safe

(k) Storage racks and shelves shall preferably be non-combustible and not prone to retain water

(l) Suitable means shall be used to protect workers from injury due to sharp corners, projections or edges on structures and/or stored material.

(m) Safe access, by means of ladders, platforms or walkways shall be provided for workers required to climb or remove goods from stacks, shelves and fixtures

(n) Markings on labels and signs for identification and selection of materials and goods shall be clear and easy to read

(iii) Stack heights

(a) Stacks shall not be piled so high as to make them unstable. In general, they shall not be more than 4.50 m in height where no automatic sprinklers are installed. In high bay

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storehouses where the stack heights exceed 4.5 m, automatic sprinklers shall be provided. In any case, the maximum height of stacks shall not exceed 12 m. In no case, however the clearance of the top of the highest storage level from undersides of the lowest beams, girder or other ceiling projections shall be less than 1.0 m.

(b) A colour band shall be painted on the walls of the godown indicating the maximum height to which materials are shall be stacked.

(iv) Destacking

(a) The stack shall be taken down tier by tier, so that no part is in danger, as would happen if the stack were bitten into locally.

(b) All stacking and destacking shall be carried out under adequate supervision.

(v) Outdoor storage

(a) Goods shall be stored on raised brick or concrete platforms. The storage site shall be kept free from accumulation of combustible materials, weeds and grass.

(b) The storage area shall be surrounded by a fence or other suitable means to prevent access of unauthorized person. Adequate number of gates shall be provided to such barriers to permit ready access of fire apparatus

(c) Materials shall be stacked in as low and small piles as possible in respect of the particular type of materials stored.

(d) The minimum aisle width and maximum height and quantity of material stored in a single pile shall depend on the commodity stored as per National Standards.

(vi) Pallet construction and loading

(a) Pallets shall be of sound construction, and be of adequate strength for the loads and conditions under which they are used.

(b) Racks, Shelves, Pallets shall preferably be of non-combustible material.

(c) If hazardous liquids stored in the warehouse, the drum shall be stored on spill pallet.

(d) Where pallet loads are stacked tier on tier, the lower pallets shall be of suitable strength and in good condition and the unit loads shall be capable to support the weight above.

(e) The stability of stacked pallets or unit loads shall be maintained by suitable bonding, avoiding excessive stack heights, to ensure that the contents of any pallet or unit load cannot collapse. The stability and structural strength of each pallet or unit load shall be assured by bonding, taping, shrink wrapping or other means.

(f) When pallet or unit loads of cartons or sacks are stacked, care shall be taken that they are not damaged by material handling equipments.

(g) Pallets or other supports used for forming unit loads shall be regularly inspected for damage and wear. Items which could cause damage to materials shall be taken out of use until repaired or be destroyed.

(vii) General Housekeeping

Keep work areas, offices, mess rooms, storage areas, aisles and gangways, washing and toilet facilities clean and tidy at all times.

(5) MATERIAL HANDLING SAFETY

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(a) Manual handling

(i) A manual handling task, where reasonably practicable shall be avoided.

(ii) If the manual handling cannot be avoided, the work shall be carried out following the ergonomics principles according to National Standards.

(b) Mechanical handling

(i) The risk of loads falling from the truck shall be reduced by the use of suitable attachments, eg fork extensions or barrel clamps. Suitability of the attachment for a particular task and truck shall be decided in consultation with the manufacturers.

(ii) Unclamped heavy loads shall not be carried resting under gravity on a clamped load item below.

(iii) The truck when fitted with an attachment shall have a rating plate specifying the capacity of the truck when fitted with that attachment.

(iv) Truck operators shall be given additional training on the use of such attachments.

(c) Protecting pedestrians

(i) Pedestrian activities shall be separated from areas where trucks are operating.

(ii) Pedestrian routes and crossing places shall be defined, designated and clearly marked.

(iii) Sufficient clear and unambiguous warning signs shall be provided at strategic locations to inform people that trucks operate in the premises or area.

(iv) Suitable and sufficient notices at strategic locations shall be provided and truck operators shall be instructed to sound the horn.

(d) Drivers

(i) Drivers shall not operate if a pedestrian is in their immediate area. Employees shall be instructed to stand clear of trucks that are lifting or lowering loads and to use separate walkways where provided. People shall be reminded of the dangers of entering areas such as those behind the truck where they may not be fully visible to the driver and also that the tail swing, particularly on counterbalanced trucks is very pronounced.

(ii) Flashing, warning beacons and reverse audible warning shall be used appropriately by the truck operators.

(e) Industrial truck operating areas

(i) All industrial truck operating areas shall be suitably designed and properly maintained.

(ii) Driving areas shall be as flat as possible and free from obstructions. Features of the building or operating areas, eg support columns, pipework or other plant shall be identified, protected and clearly marked by black and yellow diagonal stripes. The edges of loading bays shall be clearly marked in a similar way.

(iii) Roads, gangways and aisles shall have sufficient width and overhead clearance for the largest industrial truck using them to do so safely.

(iv) Visibility aids shall be considered when vision is restricted.

(v) Notices instructing industrial truck operators to sound horns at appropriate locations shall be displayed.

(vi) Sufficient parking areas for all industrial trucks shall be provided. Parking areas

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shall be away from the main through fare and work areas. Suitable parking areas shall be provided for recharging or maintenance.

(f) Controlling the use of industrial trucks

(i) Keys shall be kept in a secure place when the industrial truck is not in use and shall be issued by a responsible person and retained by the operator(s) until the end of the work period.

(ii) At no time shall the truck be left unattended with the keys in the ignition or the keypad energized. At the end of the shift, a truck shall be parked safely and keys returned to the responsible person.

(iii) The manufacturer's instructions shall be followed on inspection, maintenance and servicing.

(iv) At the beginning of each shift, all trucks shall be checked and results documented by the operator in accordance with the manufacturer's operator's manual.

(v) Areas used for refuelling industrial trucks with diesel, LPG or petrol shall be outside and the risk of fire and explosion shall be considered.

(vi) Refuelling shall not take place where there is a likelihood of an accumulation of flammable vapours in the event of a spillage, eg drains, pits, gulley's etc.,

(vii) Smoking shall be prohibited and notices shall be clearly displayed in these areas and engines shall be switched off before refuelling.

(viii) The cylinders of LPG fuelled lift trucks shall be changed outside the warehouse away from all possible sources of ignition

(6) EQUIPMENT SAFETY

(a) Stack holding structures

(i) Racks, shelving, bins, hoppers and other structures for the storage of materials shall be adequately designed to support and contain the materials for which they are used.

(ii) The corners or ends of shelving and racks shall be protected from damage by forklift trucks or mechanised equipment by steel posts, angle irons or other means.

(b) Materials Handling equipment

(i) Equipment such as trolleys, hand trucks, pallet trucks, chain blocks and slings used for moving and handling materials shall be kept in a safe and serviceable condition.

(ii) Equipments shall be free from cracks or other defects which could cause failure of the equipment or injury to employees using it. Such equipment shall be used only for the purpose for which it was designed.

(iii) Mechanical equipment such as cranes, hoists, scoops, stackers, forklift trucks and ladders used in stacking, moving or loading materials shall be kept in a safe and serviceable condition, and regularly inspected and maintained.

(iv) Materials handling equipment shall be used only for the purposes for which it was designed and shall not be operated on steep or rough surfaces which could result in an accident

(v) No worker shall ride on equipment used for the moving, handling or storage of

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material unless it has been designed for the purpose

(vi) All equipment shall be operated in a safe and efficient manner and shall not be loaded beyond the capacity for which it was designed

(vii) All such equipment shall be inspected regularly and maintained in good working order. A system of regularly scheduled maintenance based on engine-hour or motor -hour use is recommended

(c) Hand Pallet Truck

(i) Ensure all manual handling equipment such as hand pallet truck are sound in construction and fit for use

(ii) Carry pre operational checks for damage or cracks or leakage of oil before using the pallet truck

(iii) Employee operating pallet truck shall be familiar with the operating capacity and instructions to use it safely.

(7) STORAGE

(a) Carry out hazard analysis and risk assessment before the equipment is used for the first time to ensure that people are adequately safeguarded.

(b) Where automated, computer or remote controls are used for racking, selection of materials or other stores functions, care shall be taken that employees or other people in the area are not exposed to risk of injury through operation of equipment.

(c) Automated storage equipment is designed for machine access, which can create hazardous areas between moving equipment and fixed installations. Non-essential people shall therefore be kept away from operating areas.

(d) Automated equipment shall be isolated, or manual control applied, before attempting to rectify faults, particularly if parts of the equipment are extended.

(e) A means of access or egress from extended equipment shall be provided to eliminate the need to escape through any racking system installed

(f) Controls shall be such that, when switched from the disconnected “off” mode back to automatic, the previous cycle is unable to continue until a reset control has been operated.

(g) Access to racks from other than the operating side shall be prevented unless complete safety is assured.

(h) Conveyors and elevators shall be properly guarded and be capable of being isolated from automatic control.

(i) Human interface to the automation system shall be protected with gates, sensors or light curtains.

(j) Provide clear, unambiguous warning notices prominently displayed at all access gates and strategic locations. Such notices may include, “Restricted access. Authorized persons only” etc.,

(8) COLD STORAGE

(a) Only authorized people shall be allowed to enter the temperature-controlled storage. They shall be fully instructed on the means of escape, the use of locked door opening

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devices and trapped man alarms.

(b) Clear, conspicuous signs shall be prominently displayed at the entrance door(s), indicating "No unauthorized entry".

(c) At least one emergency exit shall be provided. Such exist shall be suitably positioned with de regard to the operational layout, and shall not be obstructed by racking, stock or equipment. They shall be adequately signed with either emergency lighting or luminous signs located in such a position as not be obstructed by racking, stock or equipment.

(d) Clear illuminated instructions on the method of escape shall be marked on the emergency exit.

(e) Emergency exit doors shall be capable of being opened from the inside at all times and in sub-zero stores it is advisable to fit door strip heaters.

(f) All doors in temperature-controlled stores shall be capable of being opened from the inside, even when padlocked from the outside.

(g) Temperature controlled storage shall have a communication method available for workers to raise an alarm. As a minimum, a trapped man alarm, mains operated with battery backup shall be provided. The call point shall be located no higher than 900 mm above the floor of the cold store and be suitably marked (illuminated or luminous sign) to indicate its position and function.

(h) Battery operated emergency lighting shall be provided to clearly indicate the escape route(s)

(i) Trapped man alarms, door release devices and emergency exits shall be properly maintained and regularly tested to ensure that they are in good working order

(j) Before a temperature-controlled storage is locked, a thorough check shall be made by an appointed member of staff to ensure that it is unoccupied.

(9) Refrigeration Plant:

Plant rooms shall be provided with adequate and suitable ventilation including:

(i) Refrigerant vapour detectors shall be provided in plant rooms to activate an alarm shall the workplace exposure limit be exceeded. Where mechanical ventilation is required for the plant room, the activation of this alarm shall automatically switch on the ventilation fans

(ii) The selection of suitable PPE shall involve the process of risk assessment, taking into consideration temperature, length of exposure, type of operation and personal preference.

17. Hazard Evaluation and Risk Management: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Hazard Evaluation and Risk Management Process

(a) All measures shall be taken to initiate and maintain equipment, materials, processes, and conditions in the factory to protect every employee from injury or other harm from the task he is assigned to perform.

(b) In every factory, efforts shall be taken to bring down all risks to 'As Low As Reasonably Practicable (ALARP)', specifically in the following tasks, but not limited to:

(i) Working at height or depth, including access to and egress from height or depth

(ii) Working in confined space

(iii) Work involving manual handling

(iv) Working with and around machines

(v) Extreme hot and cold work

(2) Steps involved

The implementation of this Standard shall constitute the following steps, for each individual job chosen for risk management:

(i) Preparation for risk management

(ii) Hazard identification and evaluation

(iii) Assessment of components of risks arising from the hazards

(iv) Analysis and assessment of risks

(v) Control of risks according to a hierarchy

(3) Preparation

(a) With the participation of appropriate qualified and experienced persons, all relevant data and documents covering various aspects of the hazards and risk management of the job shall be made available.

(b) The information relevant to the job shall include, but not be limited to, the following:

(i) Principal facts about:
  (a) Project design, erection or construction;
  (b) Materials and equipment used;
  (c) Processes and activities involved, and flow charts; and.
  (d) Budget and time frame.

(ii) Workplace layout plan;

(iii) Records of past incidents and accidents;

(iv) Relevant Regulations, Standards and Codes of Practice

(v) Material Safety Data Sheets (MSDS), and manufacturer's instruction manuals;

(vi) OSH inspection records, health and safety audit reports;

(vii) Details of existing risk controls;

(viii) Feedback from employees, clients, suppliers and other stakeholders;

(ix) Standard Operating Procedures and Permits-to-Work;

(x) Previous relevant risk management records;

(xi) Medical conditions of employees at the workplace; and,

(xii) Training records of employees.

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(4) Hazard Identification and Evaluation

(a) Hazards in the job shall be identified and evaluated by any appropriate method, including but not limited to the following:

(b) Common qualitative techniques for hazard identification, such as:

(i) 'Brain-storming', that is, group discussion, sharing individual expertise;

(ii) Discussions with experienced personnel and experts outside the team;

(iii) Documents such as videos, published literature, internet, news media, statistics, etc.;

(iv) Previous risk assessment and accident reports, internal and external audits, etc.; and,

(v) Walk-through or video observation of a similar facility.

(c) Formal qualitative techniques for hazard identification, such as:

(i) Failure Modes and Effects Analysis (FMEA) Method;

(ii) Fishbone or Ishikawa Method

(iii) HAZOP Method

(iv) 'WHAT IF?' Method

(v) Butterfly or Bow-tie Method

(d) Formal quantitative techniques for hazard identification, such as

(i) Maximum Credible Loss Scenario

(ii) Quantitative Risk Analysis

(5) Assessment of Components of Risks

(a) Risk shall be considered to be mainly dependent on two components namely:

(i) Likelihood of occurrence of the hazardous event or exposure, and,

(ii) Severity of consequence of the event or exposure.

(b) If components other than the above are also known to contribute to the risk, they may also be included in the considerable manner of risks.

(c) Likelihood shall be assessed at a minimum of three levels, which may be referred to as L1, L2, L3 (termed 'Low', 'Medium', and 'High', for instance) on the basis of whether the frequency (– as so many times a year, for example) or percentage probability of occurrence, of the event or exposure is acceptable, tolerable, or unacceptable to the management, within the resources available, on the basis of existing likelihood controls.

(d) Severity shall also be assessed at a minimum of three levels, which may be referred to as S1, S2, S3 (termed 'Low', 'Medium', and 'High', for instance) on the basis of whether the consequences of the event or exposure to the worker's safety and health are acceptable, tolerable, or unacceptable to the management, within the resources available, on the basis of existing severity controls.

(e) In (2) and (3) above, 'Low' shall be taken to mean the adverse impact is negligible; 'High'

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shall be taken to mean that the activity shall not be permitted; and 'Medium' will mean that the risk lies in the ALARP domain, and hence is manageable.

(f) If more than three levels of likelihood or severity are determined to be desirable, their inclusion shall be justified for every extra component, on the basis of:

(i) Need for inclusion of more levels,

(ii) Data supporting the inclusion, and,

(iii) Availability of resources for the additional effort.

(6) Determination and Assessment of Risks

(a) Risk arising from hazards shall be assessed by any appropriate method depending on the need and available resources for the job, with the aim of categorising them at one of a minimum of three levels, which may be referred to as R1, R2, R3 (termed as 'Low', 'Medium', and 'High', for instance) on the basis of whether the total cost and other impacts of the risk are acceptable, tolerable, or unacceptable to the management, within the resources available.

(b) In the absence of any other method traditionally used for or freshly introduced into the risk management system for the particular industry and job under consideration, the method or Job Safety Analysis (JSA) by Risk Matrix shall be used, as described herein for the two-component case.

(c) The risk matrix shall consist of the three (or more, say *m*) levels of Likelihood as the rows of the matrix, and the three (or more, say *n*) levels of Severity as the columns of the matrix, to produce a combination of (*m.n*) cells of risks, shall be analysed and controlled, as shown for the 3 by 3 matrix below:

Table 1. 3 by 3 Qualitative Risk Matrix

Severity → Likelihood ↓	S1 (Low)	S2 (Medium)	S3 (High)
L3 (High)	Medium	High	High
L2 (Medium)	Low	Medium	High
L1 (Low)	Low	Low	Medium
Low = Negligible; Medium = Manageable with risks; High = Not to be permitted.			

(d) The (*m. n*) risk cells shall be categorised into a minimum of three levels of risk, which may be referred to as R1, R2, R3 (termed 'Low', 'Medium', and 'High' for instance), on the basis of whether the total cost and other impacts of the risk are acceptable, tolerable, or unacceptable to the management, within the resources available.

(e) If more than three categories of risk are determined to be desirable, their inclusion shall be justified on the basis of:

(i) Need for inclusion of extra categories,

(ii) Data supporting the inclusion, and,

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(iii) Availability of resources for the additional effort.

(f) Instead of the qualitative risk analysis above, numerical assessment may be done thus:

(i) Assign numbers 1, 2, …, (referred to as 'ranks', as they are not values) to the different component levels chosen, starting from the lowest level of each component of risk, up to the respective maxima, *m*, *n*, …

(ii) Enter these ranks as row and column headings in the risk matrix.

(iii) Enter the products of the column and row ranks into the cells of the matrix, as shown below for the 3 by 3 matrix, to get the 'Risk Priority Number' (RPN), i.e. RPN = *L.R.*

(iv) Group the RPN into three (or more) categories as for the qualitative matrix in (4) above, to obtain the numerical risk matrix, with the numerical ranges for the different categories listed underneath the matrix, as shown below.

Table 2. 3 by 3 Numerical Risk Matrix

Severity → Likelihood ↓	S1 (Low) = 1	S2 (Medium) = 2	*S3 (High) = 3*
L3 (High) = 3	3	6	9
L2 (Medium) = 2	2	4	6
L1 (Low) = 1	1	2	3
1-2 = Low; 3-4 = Medium; 6-9 = High Risk, where 'Low', 'Medium', and 'High' are as defined in Table 1.			

(vii) The numerical method may be applied to more than two components considered for the risk, as in the FMECA (Failure Modes, Effects, and Criticality Analysis) method, wherein a third factor namely the detectability of the onset of the hazard can also be ranked, with each of the three components ranging in rank from 1 to 10.

(g) Quantitative method of risk analysis, in which every component of the risk is measurable in quantitative terms, and the risk may be quantified in terms of money and other resources by suitable calculations, shall be resorted to, with the following considerations:

(i) The job entails critical and high-risk activities;

(ii) Robust data to determine the quantities for every factor are available; and,

(iii) Reliable and tested mathematical tools and expertise underlie the risk calculations.

(iv) Two of the methods commonly used to compute probabilities of likelihood and consequences for a mishap are:

(a) Fault Tree Analysis (FTA), to obtain probability of likelihood of occurrence from failure of preventive safeguards before the mishap, and,

(b) Event Tree Analysis (ETA), to obtain probability of the consequences from failure of mitigating safeguards after the mishap.

(7) Control of Risks according to a Hierarchy

(a) The various risk categories R1, R2, … shall be managed with appropriate controls, to

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protect the workers from injury or other harm according to the following principles:

(i) Activities with the lowest risks considered acceptable will not require further consideration, apart from being monitored at intervals to check they do not worsen.

(ii) Activities with the highest risks considered unacceptable shall not start, or if started, shall be stopped forthwith, and additional controls investigated to eliminate the risk:

(a) By omitting the activity if feasible,

(b) By transferring it to another competent entity, or

(c) By reducing one or more of the risk components below their current level by additional controls.

– Once eliminated, no further consideration of the item will be necessary.

(iii) Activities with intermediate risk levels considered tolerable shall be managed with existing controls to conform to the ALARP principle, aimed to continuously mitigate the consequences of the risks, according to the following hierarchy:

(a) Elimination of the hazard or exposure to it as in (ii) above;

(b) Substitution of any hazardous material, device, or process with a less hazardous material, device, or process;

(c) Engineering controls, utilising the products and processes of available technology, including the facilities of digitalisation;

(d) Administrative controls, involving proactive measures by the management to improve

(i) the hazard conditions at the site, and

(ii) the capability of the worker to respond to risk, including by continuous supervision and updated training;

(e) Personal Protective Equipment (PPE), which shall be resorted only

(i) after the preceding four controls have been considered and found inadequate or infeasible, and/or

(ii) in addition to one or more of the preceding three controls to supplement their effectiveness.

(b) The risk controls shall be continuously monitored to ensure that they have been implemented correctly and continue to be effective, and to implement further controls as and when they change, or have to be modified.

(c) The entire process of hazard evaluation and risk management shall be reviewed and repeated,

(i) at intervals of three years,

(ii) whenever there is a change in any critical risk component, product or process, or

(iii) when authorities issue revised or fresh regulations.

(8) Documentation and Record-keeping

(a) All decisions and actions during the application of and compliance with these Standards shall be recorded, the records maintained in hard-copy and preferably in digital form.

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(b) The records shall be kept available for inspection by authorities as sought.

(9) Chemical Process Factories

Hazard Identification and Risk Analysis in chemical process factories shall be done as per National Standards, in addition to the above prescribed requirements.

18. Work Permit System: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Every factory shall establish a formal work permit system with a documented procedure to control hazardous works and the following types of works:
   (a) Non-production work (e.g. maintenance, repair, inspection, testing, alteration, construction, dismantling, adaptation, modification, cleaning etc.);
   (b) Non-routine operations;
   (c) Jobs where two or more individuals or groups need to co-ordinate activities to complete the job safely;
   (d) Jobs where there is a transfer of work and responsibilities from one group to another.

(2) **Identification of all work requiring a work permit:** Every factory shall identify the list of potentially hazardous works and other works that requires to be controlled by a work permit. The list shall include at minimum:
   (a) Work at height
   (b) Confined Space Entry
   (c) Hot Work
   (d) Line/ Equipment Opening
   (e) Excavation
   (f) Work on high voltage electrical equipment or other work on electrical equipment which may give rise to danger.

(3) **Work flow**: The work flow for different work permits shall be clearly defined in the procedure.

(4) **Isolations**: Necessary mechanical or electrical isolations shall be ensured through use of isolation certificates. Isolations shall be clearly detailed on the permit or a supporting cross-referenced isolation certificate.

(5) **Risk Assessment**: Appropriate risk assessment documents such as Job Safety Analysis or Hazard Identification and Risk Assessment or Task Based Risk Assessment shall be carried out and attached to the permit.

(6) **Permit Interaction:** Cross referencing shall be done on different permits issued for the same work to ensure that one activity under a work permit does not create danger for another.

(7) **Roles and Responsibilities**: The permit shall always work on "Owner – Issuer" concept. Roles and responsibilities of different stakeholders involved in the permit system shall be clearly defined in the procedure. Occupier shall maintain the list of designated personnel who are authorized for different roles. The roles shall include at minimum:

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(a) Permit Issuer or area authority, who is designated to issue the permit and responsible for day-to-day management of the work permit process within his area of responsibility.

(b) Permit Receiver or performing authority, who is designated to receive the permit and responsible person for the activity being carried out.

(c) Permit Approver, who is designated to inspect the site where work has to be carried out and certify that condition stipulated in the work permit is fulfilled.

(8) **Validity and Extension of permits:** The validity of any permit shall be stated in the procedure and extension of permits shall be controlled through appropriate authorizations.

(9) **Permit Form(s):** Permit form(s) shall be developed for all types of permits used at the site. All necessary controls for the type of job shall be incorporated in the forms. The permit forms shall include at minimum:

(a) Description of the job
(b) Location of the job
(c) The declarations of the relevant stakeholders with their name and signature.
(d) Details of hazards and controls
(e) Cross references of associated permits and isolation certificates
(f) The validity of the permit
(g) Provision for extension of the permit
(h) Provision for closure of the permit
(i) Details of tool box talk conducted.

(10) **Training of permit procedures**: The different designated stakeholders involved in the work permit system shall be trained on their roles and responsibilities. Records for the same shall be maintained.

(11) **Permit Audits and monitoring**: All the Permits issued shall be retained by the factory for at least 1 year. Audit of work permits shall be carried out to check the compliance status of the Work Permit System. Audit shall be carried out using checklist developed based on the site-specific conditions. Minimum of 10% of total work permits issued shall be audited and the records for the same shall be maintained.

19. **Ergonomics:** under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Manual Lifting and Carrying of Objects

(a) Employees shall not be made to or permitted to bend and lift, or carry objects beyond a reference mass, further depending on the heights of lift, distance from the body, angular position, frequency, and duration of lifting, according to the National Standards.

(b)The reference mass ordinarily shall be 25 kg for a male employee and 15 kg for a female employee.

(c) To facilitate lifting and carrying, mechanical aids shall be made available, such as hand-held straps, slide mats, hooks or suction pads.

(d) If the reference mass for a single worker is exceeded, sufficient number of workers shall

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be assigned to the lifting task, ensuring that the distribution of the load is fairly uniform and the load per worker is below the reference mass limit applicable to a single worker.

(e) Apart from the weight, risks associated with the size, shape, surface characteristics and chemical properties shall be assessed and appropriate controls implemented to conform to National Standards.

(f) Deviations from the reference mass and its position shall be made under exceptional circumstances only in conformity with National Standards.

(2) Pushing and Pulling of Objects and Carts

The load limits and various other pertinent considerations in pushing or pulling the object or cart shall conform to National Standards.

(3) Handling of Low Loads at High Frequency

(a) High frequency tasks involving hazardous materials shall be avoided or minimised as much as possible, and when unavoidable, a participative ergonomics approach with the practical involvement of employees shall be adopted.

(b) The various pertinent considerations in handling low loads at high frequency shall conform to National Standards.

(c) The risk assessment of repetitive movements/exertions at high frequency shall be carried out by using OCRA, RULA, REBA, or other methods listed in National Standards.

(4) Tasks involving Excessive Forces, Shock or Vibration

Safeguards in processes and precautions in use of equipment exposing workers to shock and vibrations shall conform to National Standards.

(5) Precautions and Good Practice at Workstations

Design, set-up, and use of workstations shall conform to National Standards.

(6) Control Room Ergonomics

(a) The control room and facilities therein shall conform to relevant National Standard in the following aspects:

(i) Control room layout, thermal environment, air quality, lighting, acoustics, vibration and other aspects of interior design;

(ii) Workstation and furniture for the operator.

(b) Control panel, and gauge and dial displays shall conform to the following requirements:

(i) Gauges and dials displayed in a control room shall be sequentially arranged in a logical grouping which follows the general chronology and critical items of the process.

(ii) They shall be sufficiently large and clearly marked for the operator to easily observe and interpret without eye strain or having to get closer to the instruments or referring to manuals.

(iii) Action controls based on operator's observations shall be within easy reach of his hands without his having to reach far forward or upward, and clearly marked with letters or symbols which are familiar to him, with fail-safe mechanisms.

(c) Computer monitors in the control room shall be sufficiently large, and the data

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processing and display software so designed that the displayed material on the screen is clear, simple, and familiar to the operator for smooth and safe operation.

20. Conveyor Safety: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) The conveyors shall be designed, installed, operated and maintained conforming to National Standards on safety of conveyors. In addition to the requirements specified in relevant National Standards, the following requirements shall be ensured:

(2) Design

(a) *Sheaves shall be provided with suitable cable guards to prevent cable from jumping the sheave.*

(b) *The lubrication points shall be located at accessible points.*

(c) *The slope conveyors shall be provided with "anti-runaway" or "backstop" devices.*

(d) *The counter weights attached to the cables or chains shall be confined in a suitable enclosure having a stop designed to withstand the impact of the falling weight.*

(e) *Where a conveyor passes over working areas, aisles, over head or thoroughfares suitable guards shall be provided to protect worker from falling materials.*

(f) *Stop devices shall be provided to automatically stop a conveyor when the conveyor, bin, hopper, chute, etc., to which it feeds has been choked with loads.*

(g) *The tail-end drum mechanism of belt conveyors shall be guarded appropriately to prevent access to the in running nip.*

(3) Installation:

(a) *Walkways, platforms, balconies, and access ladders shall be provided and installed in accordance with the National Standards*

(b) *Inspection doors or illuminated peep holes shall be provided to make inspections.*

(c) *Openings with removable door or panels shall be provided to clean out housings and enclosures or make minor repairs without entering housings or enclosures.*

(d) *All conveyors installed within 2 m of the floor or walkway surface shall be provided with crossovers or passages.*

(e) *All crossovers, aisles and passages shall be indicated by warning signs in conspicuous locations.*

(f) *Emergency stop switches attached through pull chord shall be provided throughout the length of the conveyor and the conveyor cannot be started again until the actuating stop switch has been reset to running or "on" position.*

(g) *Audio and visual warnings shall be provided in all the drive stations of conveyor to alert worker during application of the pull chord emergency switch.*

(h) *All conveyors shall be programmed to start with siren.*

(i) *Public address system shall be installed and maintained, wherever required.*

(4) Maintenance:

(a) *All machine parts shall be properly lubricated and maintained according to OEM guidelines and applicable National Standards.*

(b) *If the guards and hand rails are removed for unavoidable reasons, the conveyor shall be started only after replacing them.*

(5) General

(a) *No employee working near a conveyor shall wear loose clothing.*
(b) *The area around all starting and stopping devices shall be kept free of obstructions.*
(c) *No "riding" shall be permitted near a conveyor at any time.*
(d) *Maintenance work shall not be taken up while conveyor is in operation.*
(e) *When the conveyor is stopped for maintenance purposes, the starting devices shall be locked so that no one but the employee working on the conveyor only can restart.*
(f) *Standard Operating Procedures (SOP) shall be developed for the safe operation of Conveyors and Connected SOPs shall be displayed in vernacular language in control room, machines and conveyors.*
(g) *All the spillages shall be cleaned and good housekeeping shall be maintained at all times.*
(h) *Employees shall not be allowed to work, clean and cross beneath a running conveyor.*
(i) *No employee shall be permitted to work alone with the conveyor and Conveyor crossing permitted only through cross-over bridges.*

21. Transport Safety: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Safety Measures

(a) Entry / Exit gates

(i) Width of the gate shall be ensured as per the National Standards.

(ii) Provision of sufficient turning radius for unobstructed movement shall be provided based on the National Standards.

(iii) Separate pedestrian pathway shall be provided for the segregation of pedestrians from all kinds of vehicular traffic.

(iv) Access to the main roadway outside the facility entry and exit gates shall not be perpendicular to the direction of traffic movement on the main roadway. The gate shall be installed with an appropriate clearance apron to ensure free traffic flow outside the roadway.

(b) Parking:

(i) The area used for parking of vehicles shall be leveled to the extent possible and wheel stoppers used.

(ii) Adequate safety clearance shall be ensured while parking vehicles.

(iii) Parking space shall be identified and vehicles parked in a safe manner.

(c) Road Design

(i) Width of the road, design of rigid pavements, drainage, cross fall or camber for clearing run-off water and pavement condition shall be designed and ensured as per the National

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Standards.

(ii) Adequate turning radius shall be provided at all the curves and intersections for safe manoeuvre of longest vehicle and fire tenders as per the National Standards.

(d) Road Shaller: Adequate shaller width shall be provided to make it easier for a driver to steer the vehicle back onto the road at a shallower angle.

(e) Road Intersections: Road intersections shall be designed as per National Standard in order to ensure safe maneuverability.

(f) Speed limit boards/speed breakers with appropriate indications shall be installed before entrance/exit of plants, sharp curves, blind corners and also before such places where speeding vehicles would pose a particular hazard to pedestrian traffic and/or other vehicles moving in the area. This shall be in line with the relevant National Standards

(g) Adequate traffic management shall be ensured to prevent traffic congestion at the weighbridge.

(h) Pedestrian pathway shall be designed as per National Standard so as to facilitate man-machine segregation.

(i) Pedestrian crossing shall be made visible as per National Standard, so that the driver of approaching vehicle has clear view of the persons on the pedestrian crossing and on the pedestrian footpath.

(j) At the road crossing location, suitable arrangements shall be provided so that pedestrians do not land on the road abruptly and provide them with time to look for approaching vehicles.

(k) If roads are used at night, traffic signs shall be made of reflective or luminous materials.

(l) Properly trained assistant shall be deployed to guide the reversing movements of vehicle.

(m) Adequate fall protection mechanisms shall be provided wherever vehicle covering activity takes place

22. Railways in Factories: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1)This shall apply to railways in the precincts of a factory which are not subject to Indian Railways Act, 1890.

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(2) Gateways.- A gateway through which a railway track passes shall not be used for the general passage of workers into out of a factory.

(3) Barriers and Turngates.-

(a) Where building or wall contain doors or gates which open to a railway track, a barrier about 1 metre high shall be fixed parallel to and about 60 cm. away from the building or wall outside the opening and extending several feet beyond it at either end, so that any person passing out become aware of an approaching train when his pace is checked at the barrier.
If the traffic on the nearest track is all in one direction, the barrier shall be in the form of an "L" with the end of the short leg abutting on to the wall and the other end opening towards the approaching train.

(b) If the distance between wall and track cannot be made to accommodate such a barrier, the barrier or a turngate shall be placed at the inside of the opening.

(c) Where a footway passes close to a building or other obstruction as it approaches a railway track, a barrier or a turngate shall be fixed in such a manner that a person approaching the track is compelled to move away from the building or obstruction and thus obtain timely sight of an approaching locomotive or wagon.

(4) Crowds.-

(a) Workers' pay-windows, first-aid stations and other points where a crowd may collect shall not be placed near a railway track.

(b) At any time of the day when workers are starting or ending work, all railway traffic shall cease for not less than five minutes.

(5) Locomotives.-

(a)No locomotive shall be used in shutting operations unless it is in good working order.

(b)Every locomotive and tender shall be provided with efficient brakes, all of which shall be maintained in good working order. Brake shoes shall be examined at suitably fixed intervals and those that are worn out replaced at once.

(c) Water-gauge glasses of every locomotive, whatever its boiler pressure, shall be protected with substantial glass or metal screens.

(d) Suitable steps and hand-holds shall be provided at the corners of the locomotive for the use of shunters.

(e)Every locomotive crane shall be provided with lifting and jacking pads at the four corners of the locomotive for assisting in re-railing operations.

(f)It shall be clearly indicated on every locomotive crane in English and in language understood by the majority of the workers in the factory, for what weight of load and at what radius the crane is safe.

(6) Wagons.-

(a) Every wagon (and passenger coach, if any) shall be provided either with self-acting brakes capable of being applied continuously or with efficient hand brakes which shall be maintained in good working order. The hand brakes shall be capable of being applied by a person on the ground and fitted with a device for retaining them in the applied position.

(b) No wagon shall be kept standing within 3 metres of the authorised crossing.

(c) No wagon shall be moved with the help of crow bars or pinch bars.

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(7) Riding on locomotive wagon or other rolling stock.- No person shall be permitted to be upon (whether inside or outside) any locomotive, wagon or after rolling stock except where secure foothold and handhold are provided.

(8)Attention to brakes and doors.-

(a) No locomotive, wagon or other rolling stock shall be kept standing unless its brakes are firmly applied and, where it is on a gradient, without sufficiently number of properly constructed scotches placed firmly in position.

(b) No train shall be set in motion until the shunting jamadar has satisfied himself that all wagon doors are securely fastened.

(9) Projecting loads and cranes.-

(a) If the load on a wagon projects beyond its length, a guard or dummy-truck shall be used beneath the projection.

(b) No loco-crane shall travel without load unless the jib is completely lowered and positioned in line with the track.

(c) When it is necessary for a loco-crane to travel with a load, the jib shall not be swung until the loco-crane has
come to rest.

10) Loose shunting.- Loose-shunting shall be permitted only when it cannot be avoided. It shall never be performed
on a wagon not accompanied by a man capable of applying and pinning down the brakes. A wagon not provided
with brakes in good working order and capable of being easily pinned down shall not be loose shunted unless there
is attached to it at least another wagon with such brakes. Loose-shunting shall not be performed with, or against a
wagon containing passengers, live stock or explosives.

(11) Fly-shunting.- Fly-shunting shall not be permitted on any factory railway.

(12) The shunting jamadar.-

(a) Every locomotive or wagon in motion in a factory shall be in charge of a properly trained jamadar.

(b) Before authorising a locomotive or wagon to be moved, the shunting jamadar shall satisfy himself that no person is under or in-between or in front of the locomotive or wagon.

(13) Hand signals.- The hand signals used by the shunting jamadar by day and night shall be those prescribed by the shunting rules of railways, working under the Indian Railway Act (IX of 1890).

(14) Night work and fog.-

(a) In factories where persons work at night, no movement of locomotive, wagon or other rolling stock otherwise

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than by hand shall be permitted between sunset and sunrise unless the tracks and their vicinity are lighted in a scale of not less than 10 lux as measures at the horizontal plane at the ground level.

(b) In no circumstances shall any locomotive or train be moved between sunset and sunrise or at any time when there is fog, unless it carries a white head light and a rear light.

(15) Speed control.-

(a) A locomotive or train shall not be permitted to move at a speed greater than seven kilometres per hour.

(b) A train, locomotive, wagon or other rolling stock shall not be moved by mechanical or electrical power unless it is preceded at a distance of not less than 10 metres during the whole of its journey by a shunting jamadar. He shall be provided with signalling flags or lamp and whistle necessary for calling the attention of the driver.

(16) Tracks.- (a)The distance

(i) between tracks and

(ii) between tracks and buildings, blind walls or other structures and

(iii) tracks and materials deposited on the ground shall be respectively not less than :-

(aa) from centre to centre of parallel tracks, the overall width of the widest wagon of that guage plus twice the width of the door of such a wagon when opened directly outward plus 1 metre.

(bb) from a building or structure other than a loading platform to the centre of the nearest track, half the overall width of the widest wagon of that guage, plus the width of its door when opened outward, plus 1.5 metres.

(cc) from material stacked or deposited alongside the track, on the ground or on a loading platform, to the centre of the widest wagon of that guage, plus half the width of its door when opened directly outward, plus 1 metre.

(b) Sleepers of a track shall be in level with the ground and at the crossings of the track with a road or walkway, the surface of the road or walkway shall be in level with the top of the rails.

(c) All track ends shall be equipped with buffer stops of adequate strength.

(d) Barriers of substantial construction shall be securely and permanently fixed across any doorway or gateway in a building or in a wall which conceals an approaching train from view, between the building and the track as prescribed in sub-para (a) of para (3).

(e) Where track are carried on a gantry or other elevation, a safe footway or footways with hand rails and toe-boards shall be provided at all positions where persons work or pass on foot; and where there is an opening in the stage of an elevated track for dropping of material to a lower level, the position shall be adequately fenced or the opening itself provided with a grill through which a person cannot fall.

(f) All point levers shall have their movements parallel to, not across, the direction of the track.

(g) All loading platforms which are more than 60 cm above the level of the ground on which the track is laid and more than 15 metres in length, shall be provided with stops at intervals not

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greater than 15 meters apart to enable the platform to be easily mounted from the track.

(h) Turn tables on plant railways shall be provided with locking devices which will prevent the tables from turning while locomotives or wagons are being run on or off the tables.

(i) Workers shall be prohibited from passing under, between or above railway wagons.

(17) Crossings.-

(a) At all crossings of a track with a road or walkway, danger or crossing signs and wherever reasonable practicable, blinking lights or alarm lights shall be provided. At all important crossings, gates or barriers manned by watchmen shall be provided. Swinging gates and barriers shall be secured against inadvertent opening or closing.

(b) All crossings, warning signs, gates and barriers shall be illuminated during hours of darkness.

(18) Duties of drivers and shunters.- It shall be the duty of every driver of a locomotive, or a shunter including a shunting jamadar, to report without delay to their superior any defect in permanent way, locomotive or rolling stock.

(19) Adolescents not to be employed as drivers of locomotive or as shunters.- No person who is under 18 years of age and no person who is not sufficiently competent and reliable shall be employed as a driver of a locomotive or as a shunter.

(20) The Chief Inspector may by an order in writing exempt a factory or part of it from all or any of the provisions of this standard to such extent and on such conditions as he deems necessary.

23. Work at Height: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) General Requirements for Fall Management

(a) Work at height shall be required or allowed only after issuance of a Work at Height permit.

(b) All personnel assigned to work at heights shall be given proper training and also be medically fit.

(c) Appropriate means of rescue after a fall shall be made available.

(d) When a worker has to work on a fragile and/or sloping surface like a sloping roof, he shall be prevented from falling while accessing and working on the work site by either a Mobile Elevating Working Platform or with a crawling board to distribute the worker's weight over one or more purlins along with fall protection systems.

(e) In case of fragile roofing (skylight) sheets, the same shall be securely fenced or covered to avoid accidental stepping on it.

(f) Work at height shall be avoided in low light, inclement weather, or near power lines, surfaces of extreme temperatures, and other hazardous processes or situations, unless appropriate protective devices and PPE are provided, and their use continuously monitored by a supervisor.

(g) All components of the fall control system and its components shall be inspected and maintained as per National Standards.

(h) A job-specific fall control plan shall be prepared, to eliminate or reduce the risk of falls by documenting and ensuring the following prior to the commencement of work.

(2) Fall Prevention, by Edge-Protection

(a) Every temporary or permanent working area, access way, stairs and other spaces whose edges, surface openings, or fragile coverings present a fall hazard, shall be protected by edge protection and the same shall conform to relevant National Standards.

(b) If the task at height is of a temporary nature and no permanent access or work platform is available, then a ladder, or MEWP, or other means of safe access and work, complying with relevant National Standards shall be provided,

(3) Fall Prevention, by Fall Restraint

When and where for a working area fall prevention by edge-protection as prescribed in para 2 is not available or feasible, then every worker assigned to or exposed to work in such area shall be prevented from falling off the unprotected edge by appropriate fall restraint systems.

(4) Fall protection and work positioning, while suspended

(a) When the worker must carry out a task on a vertical or steeply inclined surface where there is no fixed work platform available or feasible, he shall carry out the task by work positioning.

(b) The worker shall sit on a work positioning harness, suspended on working rope and a back-up support rope.

(c) The work positioning equipment shall conform to applicable National Standards.

(d) Every loose tool and accessory that the worker will use during work positioning shall be secured against fall.

(5) Fall Arrest, by Soft Landing

(a) If fall prevention according to paras (2), (3), and (4) are not feasible or effective, then, fall protection methods shall be adopted, to mitigate the consequences of the fall, primarily by fall arrest, to stop the fall before the individual hits the ground or other base.

(b) Safety nets, air bags or soft filled mats shall be used for collective fall protection.

(c) The safety net or other soft landing shall conform to applicable national standards.

(6) Fall Arrest, by Self-Retracting Lifeline (SRL)

(a) Where a soft landing is not feasible for fall arrest, a self-retracting lifeline shall be used. The SRL shall conform to relevant national standards.

(b) The SRL shall be checked and approved for use before every use, a pre use inspection

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check list shall be maintained

(c) Once the SRL has been subjected to an impact by the worker slipping off an edge during his work, the equipment shall be sent for integrity check and replacement, or refurbishment as needed.

(d) Unless the manufacturer has approved otherwise, the worker shall remain within a 30° cone from the centre of the overhead anchor point.

(e) The receiving structure shall have adequate strength to resist the impact force, without excessive deformation during use.

(7) Fall Arrest, by Personal Fall Arrest System (PFAS)

(a) If and when all the earlier preventive or protective fall control methods are infeasible or ineffective, a PFAS consisting of a full body harness with a suitable connecting element shall be used by the worker,

(b) The harness, and all its associated requirements such as shock absorber, fall clearance and anchor capacity, shall fully conform to relevant national standards.

(c) In case the worker moves on a vertical or an elevated horizontal plane, a lifeline shall be provided which acts as a continuous anchor throughout the movement path of the employee.

(d) The employee shall be trained to put on the safety harness on by himself correctly, and to adjust the straps, to snug-fit properly.

(f) There shall be an external or in-house rescue system available to extricate the worker who has fallen from height and is suspended from his PFAS.

(g) The employee shall be rescued promptly and be provided first aid as appropriate.

(h) To allow for delays in the rescue, employee shall be supplied with trauma-straps (attached to their waist-belt) into which they can place their feet soon after they fall, to maintain blood circulation and prevent suspension trauma; alternatively, they shall be trained to keep moving their feet to maintain circulation.

(i) Critical factors including fall clearance, anchor strength and proper fit may be ensured as per National Standards.

(8) Lifelines for Working at Height

(a) When a person working at height is required to anchor the clamp of his waist-belt for fall restraint or his PFAS for fall arrest at a location away from a fixed anchor at a specified location, he shall be provided a rope, cable or webbing designed and installed as a lifeline in one of the following modes:

(i) Horizontal lifeline for fall restraint or fall arrest, while working in a horizontal plane, at trucks for loading or unloading, cranes or any elevated horizontal plane.

(ii) Vertical lifeline for fall arrest while falling off an edge, or while working in a vertical plane.

(iii) Inclined lifeline, on sloping roofs and other sloping surfaces.

(b) Implementation and use of lifelines for working at height shall conform to applicable

national standards.

(c) The lifeline shall be chosen specifically for the particular task intended, either acquired from an approved vendor, or designed and implemented by a responsible person;

24. Protective Equipment and Clothing: under serial no. 46 in the second schedule under clause (f) of sub-section (2) of section 18

(1) All employees shall be provided with Personal Protective Equipment (PPE) as required under any of the provisions of the Code and such PPE shall conform to the relevant National Standard.

The occupiers shall require the employees to use such PPEs and the same shall be maintained in proper working conditions by the occupier. No charge whatsoever shall be charged by the occupier from the workers for provision of such PPEs.

(2) Without prejudice to the generality of the provisions of para (1), the various types of PPEs to which this standard shall extend for use in factories shall be as prescribed below:

(a) Safety Helmet: All workers who are likely to be exposed to any hazard which may cause head injury shall be provided with safety helmets conforming to relevant National Standards. All the workers shall be adequately trained on proper use of such PPEs. When work at height is being carried out such safety helmet shall be provided with a nape strap. No safety helmet which has resisted an impact shall be reused. Periodic cleaning and visual inspection to check any deformation in size or shape shall be carried out.

(b) Protective Footwear: Protective footwear shall be provided to workers who are exposed to hazards which are likely to cause injury to them by way of materials being dropped on their feet or nail or other sharp objects penetrating their sole. The type and nature of foot wear to be used at workplaces shall be decided by the occupier based on nature of work being carried at such workplaces. Proper disinfection shall be carried out to prevent contagious fungal infection of the skin that causes scaling, flaking, and itching of the affected areas. Proper medical care shall be carried out to prevent workers from suffering from ingrown nails, metatarsalgia, heel spur, hammer toes and nerve damage after wearing safety shoe.

(c) Safety Goggles and Spectacles: The relevant National Standard shall be applicable for eye-protection intended for use in industrial undertakings to provide protection for the eyes of the workers against hazards such as flying particles and fragments, splashing materials and molten metal’s harmful dust, gases or vapours, aerosols and radiations which are likely to impair vision or damage the eyes. Additional eye protection over their prescription lenses shall be used ensuring that the protective eyewear does not disturb the proper positioning of the prescription lenses.

(d) Equipment for eye and face protection during welding: Relevant National Standard shall be followed or the requirements of goggles, hand shield and helmet intended to protect an operator above the shaller from harmful radiation, spark and particles of hot metal during welding, cutting and similar operations employing a gas flame or electric arc.

(e) Gloves and Protective Clothing: Suitable gloves, leather gauntlets and mittens conforming to relevant National Standard shall be used for protection of hand of the workers from getting injured. Such protective gloves shall be provided where the hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical
burns; thermal burns; and harmful temperature extremes. Suitable proactive clothing as per relevant National Standard available for apron (Rubberized, acid and alkali resistant) shall be used for protection of workers who are likely to be exposed to any hazard which may cause injury to their skin.

(f). Ear protection when exposed to noise: Protection against the effects of noise exposure shall be provided when the sound levels exceed the prescribed Standards. The relevant National Standard shall be followed while selection of suitable ear protection. Periodic disinfection of reusable ear protectors shall be carried out to eliminate hearing loss caused by infection, discharge, pain etc. in the ear.

(g) Respiratory Protection: Respiratory Protective equipment based on the nature of hazard as per the relevant National Standard shall be provided by the occupier of the factory to the workers for their respiratory protection against dust, fumes, gases, particulates etc. Clinical examination and appropriate medical tested shall be undertaken to avoid Irritant dermatitis, nose bridge sores, etc. because of prolong use of respiratory personal protective equipment.

(h) Other Protective Equipment: Appropriate personal protective equipment based on the nature of hazards as per the relevant National Standard shall be provided by the occupier to the workers. These shall include the following:-

(i) Safety harnesses with independently secured lifelines where protection against falls cannot be provided by other appropriate means.
(ii) Life vests and life preservers where there is a danger of falling into water.
(iii) Distinguishing clothing or reflective devices or otherwise conspicuously visible material when there is regular exposure to danger from moving vehicles.
(iv) Horizontal and vertical lifelines

(3) The Inspector-cum-Facilitator may, having regard to the nature of the hazards involved in work and process being carried out, order the occupier or the manager in writing to supply to the workers exposed to particular hazard any personal protective equipment conforming to relevant National Standard as may be found necessary.

(4) The Inspector-cum-Facilitator may, having regard to the nature of the hazards involved in work and process being carried out, order the Occupier or the Manager in writing to supply to the workers exposed to hazard any or additional personal protective equipment conforming to relevant National Standard and, if no such National Standard is available, they shall conform to international standards.

(5) The Personal Protective Equipment not having relevant National Standard shall be:

(a) Compliant with EN (European Standard) or ANSI (American National Standards Institute) or ISO (International Organization for Standardization) as modified from time to time till the relevant National Standard(s) is made available.
(b) Certified by DGFASLI, if such personal protective equipment are compliant with international standard other than those standards specified under sub-para (a).
(c) Used only after thorough testing by NABL accredited test facility adhering to such testing procedure as prescribed under the relevant international standard(s) as modified from time to time.

(6) The Occupier shall be responsible for the following–

(a) In every factory, Occupier shall provide necessary and suitable PPE as per the applicable National Standards, at his cost, to the workers to protect their safety and health as required under any of the provisions of the Code.

(b) The occupier shall ensure to eliminate any risk to the workmen by suitable engineering, substitution, or administrative controls after performing Hazard Identification and risk assessment. PPE matrix considering common manufacturing process is given as schedule to this standard. The occupier shall accordingly do proper selection of PPE below:

(i) All PPE provided shall be certified to the relevant National Standards,

(ii) That the PPE shall be most suitable to reduce the risk (i.e., matched to the hazard and as per degree of protection required), be ergonomic in use (size, fit and weight) and be made easily available to the worker. The PPE selected shall be able to counter the hazards mentioned in the Material Safety Data Sheet or/ and as specified by manufacturer of any machine or installed system.

(iii) Wherever the workers may be exposed to two or more different hazards, the PPE shall be selected to cover all the hazards suitably.

(iv) If more than one item of PPE is worn at the same time, their compatibility shall be ensured.

(v) PPEs for all the activities and processes carried on in every department of an establishment shall be prepared and displayed at a conspicuous place, such as at entry of the specified work place. Such displays shall be such as to be visible from a distance.

(vi) The workplace shall be periodically reassessed for any changes in conditions, equipment or operating procedures that could affect occupational hazards and consequently, requirement of PPE. This periodic reassessment shall also include a review of injury and illness records, and suitability of existing PPE to spot any trends or areas of concern requiring appropriate corrective and preventive action.

(vii) Workers requiring use of PPE shall be adequately informed about the hazards they are exposed to and shall be trained before they use the PPE. Retraining shall be done if there are any process changes, PPE requirements change or as often as needed.

The trainings shall cover the following points:

(a) What PPE to use and when to use it
(b) Limitations of the PPE
(c) Process to obtain PPE and deposit after usage
(d) Pre-use Inspection
(e) How to put it on, adjustments for a proper fitment, and take it off.
(f) Proper understanding of the manufacturer's instructions, user manual, and warnings mentioned therein.
(g) post-use care and maintenance
(h) Procedure to report when the PPE has been damaged while in its intended use, caused discomfort or allergies.

SCHEDULE-PPE MATRIX

S. No.	Workplace/Operation	Personal Protective Equipment
1	Factories	Safety shoes, Safety helmet* and Safety goggles[#] (*-To be used, if head injury hazard is prevalent) ([#]-To be used, if eye injury hazard is prevalent)
2	Building or other construction work (Ground level)	Safety helmet, Respirator, Safety goggles and Gloves.
3	Building or other construction work (Over the Ground level)	Safety helmet, Respirator, Safety goggles, Gloves, Full body harness, Lanyards, Fall arrestors, Retractable fall arrestors, Vertical lifelines, Horizontal lifelines, Anchors, Anchorage ropes, Descending devices, Hooks and karabiners and Work positioning lanyard.
4	Loading & unloading	Safety helmet, Respirator, Cotton gloves, Safety goggles, Full body harness, Lanyards, Retractable fall arrestors and Horizontal lifelines.
5	Furnace operation	Face shield, Leather gloves, Leather apron, Respirator and Heat resistant gloves.
6	EOT crane operation	Safety goggles, Gloves, Vertical lifelines, Horizontal lifelines, Full body harness and Retractable fall arrestor.
7	Oven & Drier Process	Leather gloves, Helmet with face shield, Respirator, Cotton apron and Heat resistant gloves.
8	Saw operation	Respirator, Face shield, Apron, Cut resistant gloves, Ear plugs and Earmuffs.
9	Finishing and packing operation	Safety helmet, Respirator, Apron, Cotton gloves and Safety goggles.
10	Chemical Handling	Chemical handling gloves, Respirator, Face shield, Safety goggles, Chemical splash apron & coverall and High-pressure suit.
11	Forklift operation	Respirator, Safety goggles and Gloves.
12	Welding & Gas cutting	Leather gloves, Leather apron, Welding leg guard, Welding hand sleeve, Respirator, Welding goggles, Welding shield,

		Safety helmet, Earmuff and Ear plug.
13	Confined space entry	Safety helmet with 24 Volt lamp, Gloves, Respirator, Davit arms, Retractable fall arrestors, Full body harness, Powered air purifying respirator, Breathing apparatus and Cartridge respirators
14	Height work	Safety goggles, Full body harness, Lanyards, Fall arrestors, Retractable fall arrestors, Vertical lifelines, Horizontal lifelines, Anchors, Anchorage ropes, Descending devices, Automatic descenders, Pulleys, Hooks and karabiners and Work positioning belt.
15	Electrical work	Electrical grade rubber gloves, Safety goggles, Safety helmet, Arc flash suit and Arc flash face shield.
16	Excavation Work	Gumboot, Safety goggles and Respirator.
17	Sludge handling	Chemical handling gloves, Respirator, Gumboot, Safety goggles, Davit arms, Retractable fall arrestors, Full body harness and Safety helmet
18	Scrap disposal	Respirator and Cut resistant gloves
19	Toilet cleaning	Chemical handling gloves, Respirator, PVC slip resistant shoe and Safety goggles
20	Housekeeping	Respirator, Apron and Cotton gloves
21	Canteen work	Head net, Apron and Polythene gloves
22	Gardening	Safety helmet, Respirator and Gloves
23	Plant visit	Safety helmet, Respirator, Safety goggles and Gloves

(7) Occupier shall provide adequate supervision to ensure use of PPE by workers at all places where such PPE are to be used.

(8) Storage: PPE shall be stored in a separate designated area with temperature, humidity, ventilation, stacking and other parameters as per Manufacturers' instructions. The PPE shall be kept safe from ingress of water, chemicals, fumes or attacks of mold, mildew, rodents, or pests for optimal functioning. PPE earmarked for sanitization, inspection or disposal shall be stored in a clearly marked area to avoid accidental mixing and usage. A proper register shall be maintained to record manufacturing date, shelf life, first date of use, expiry date, last inspection, and next inspection dates for proper tracking of PPE lifecycle.

(9) Inspection and Maintenance: Occupier shall ensure that regular inspection and maintenance is carried out to check for any deformation or defect. Responsibility shall be assigned for maintenance and this person shall be trained on the maintenance process as per Manufacturer guidelines. There shall be three types of inspections carried out as under –

(a) Pre-use Visual Inspection by workers to see any obvious defects or failures
(b) Periodic Inspection by a qualified person within an establishment, as per applicable national standards of the PPE.
(c) Annual Inspection by authorized third-party agency revalidating continued use. Preventive maintenance shall be carried out at regular intervals as necessary or as recommended by Manufacturer.

(10) Sufficient quantity of replacement PPE shall be made available to ensure no work is done without PPE due to non-availability. Suitable replacement parts which match the original (such as respirator filters) shall be made available.

(11) Cleaning and Disinfection: PPE once issued to the worker, shall be kept free of dirt, paints, chemicals, oil, grease, sweat and other body fluids for the purpose of optimum functioning, equipment longevity, avoid spread of communicable diseases and personal hygiene. The occupier shall set-up a regular cleaning and disinfection schedule as per manufacturer's recommendation.

(12) Disposal: All PPE shall be safely disposed-off such that its components can be recycled to maximum extent possible and cause least environmental burden upon discharge. Occupiers shall engage with recyclers with a proven capability to recycle both metal and synthetic material with least environmental damage and in accordance with applicable national standards.

(13) With regard to use of PPE, the workers shall be responsible for the following:

(a) To attend safety trainings and safety briefings to understand the various hazards they are likely to be exposed to,
(b) To follow the control measures in place and ensure that these measures are not bypassed or violated.
(c) To use the PPE correctly at all times and as directed and in accordance with any training, instructions or information received.
(d) To maintain PPE provided in good order and condition.
(e) To return the PPE to its storage place after use, unless directed otherwise.
(f) To report any defect, unsuitability or failure which may compromise the effectiveness of PPE.
(g) To report any loss of equipment as soon as they become aware of them.

(14) Recommended PPE for Worker's Safety

(a) Protection of Head: The occupier shall provide suitable head gear to protect the worker's head from possible hazards such as impact of falling or flying objects, head bumping or lateral impact, electric current, hair getting tangled in machinery, chemical drips or splashes, climate, or temperature and/or any other hazard. The helmet shall have proper means of adjustment to fit securely on to the wearer's head.
(b) Protection of Eyes: Suitable Safety Goggles and Spectacles shall be provided for protection for the eyes of the workers against injury or impairment of vision due to flying particles and fragments, splashes of chemicals or molten metal, gases or vapours, aerosols and radiations, and other such hazards. Additional eye protection over prescription lenses, where worn, shall be used ensuring also that the protective eyewear does not disturb the positioning and vision of the prescription lenses.
(c) Protection of Face and Neck: The worker's face and neck shall be protected from injuries due to high-speed particles, welding splatters, dangerous fumes, heat,

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chemical splashes, electric arc flash and harmful light sources/ radiations and/or any other hazard by suitable face shields, guards, hoods, and neck scarves.

(d) Respiratory Protection: Suitable Respiratory Protective equipment based on the nature of hazard shall be provided by the occupier of the factory to the workers for their respiratory protection against dust, fumes, gases, particulate matter, chemical vapour, aerosols, etc. These PPE shall include dust mask, half face masks/ full face mask with appropriate cartridges, Powered Air Purifying Respirator (PAPR), Self-Contained Breathing Apparatus (SCBA), Escape Masks and similar equipment.

(e) Hearing Protection: Protection against the effects of noise exposure shall be provided when the sound levels exceed the prescribed Standards. Suitable hearing protection devices like ear plugs and ear muffs shall be provided keeping in mind the combination of sound level and duration of exposure.

(f) For areas having a noise level in excess of 85 decibels, hearing protection devices like ear plugs, earmuffs, etc. shall be provided. In case the noise level cannot be reduced to an acceptable level even after sound attenuation achieved using hearing protective devices, the time of exposure to the noise shall be reduced as per the table given herein below.

Exposure Time limit	Permissible Exposure Level
8 hours	90 dBA
4 hours	95 dBA
2 hours	100 dBA
1 hour	105 dBA
30 minutes	110 dBA
15 minutes	115 dBA

Note 1: The Ear protection devices may be used along with compatible communication devices as long as these devices do not pose an additional hazard.

Note 2: PPE that protect body-parts over the neck (head, eye, ear, face) as per the hazard, may be worn separately or in combination; for example- an Earmuff mounted over a helmet. PPE so used shall be compatible with each other and shall be individually certified to applicable national standards.

(g) Hand and Arm protection: Suitable protective gloves, sleeves, gauntlets, arm guards and mittens shall be provided to protect the hands and arms of the workers from injury, if exposed to hazards like those from skin absorption of harmful substances, exposure to

chemicals, prolonged immersion in water, cuts, abrasions, lacerations, punctures, chemical burns, thermal burns, harmful temperature extremes (hot, cold or cryogenic), micro-biological hazards, harmful radiations, vibrations, impact, cuts from chainsaws, electrical contact or other hazards.

(h) Body protection:

(i) When exposed to extreme temperatures (hot, cold, or cryogenic), flames, welding splatters, harmful chemicals, electric arc flash, high electric potential, bomb, nuclear radiations, micro-biological hazards including blood borne pathogens/ viruses, or any such hazard, the skin and body of the workers shall be protected from injury/ infection by suitable protective body suits/ coveralls. Suitable Aprons/ body shields shall be used for protection of the torso.

(ii) To provide safety and visibility of a worker, and signaling his presence in situations of dim light, in high vehicular traffic conditions, etc., conspicuous high visibility jackets, coveralls, and other such clothing shall be provided.

(iii) To protect against the hazard of drowning in water, suitable life vests shall be provided.

(iv) For hazards against which full body protection is required, body-suits that cover the user from head to toe, like a CBRN suit (Chemical, Biological, Radiation and Nuclear suit), shall be used.

Note: Protective clothing may be used in combination with compatible fall arrest equipment, SCBA sets, flame protective hoods or other PPE, and each PPE shall be individually certified to applicable national standards.

(i) Foot and Leg protection: The workers feet shall be protected against any injury arising out of exposure to hazards like impact from falling heavy objects on toes and metatarsals, compressive forces, slippage, extreme temperatures (hot surfaces, cold, snow or cryogenic conditions), electrical hazards, infections, fungal growth, electrostatic build-up, penetration of sharp objects, bites of venomous creatures and other conditions that may cause an injury. Depending upon the hazards present the worker shall be provided with shoes equipped with toe and/or metatarsal protection, anti-static soles, chemical resistant out soles, slip resistant out soles, waterproof uppers, penetration resistant mid sole and other components/ features that would help in mitigating the said hazards. Depending upon the work environment, the protective shoes provided shall be slip-on, low-ankle, high-ankle, or mid-knee. For extreme cold conditions or snow, specially lined boots shall be used.

(j) PPE while Working at Height:

(i) Personal Fall Protection System (PFPS) shall be provided to the worker working at a

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height. Components of Personal Fall Protection system shall include suitable Full Body Harness with required attachment points, suitable connecting elements (including, but not limited to- positioning/ restraint/fall arrest, work-positioning lanyards, guided-type fall arresters, and self-retracting lifelines) and anchorage. The elements of the system so used shall restrict the forces of fall on the worker to less than 6 kN.

(ii) In case of a possibility of exposure to any additional hazards such as electrical hazard, welding sparks, chemical splashes, sharp edges, prolonged UV exposure, or any other such hazards that can damage the PFPS while working at height:

(a) Suitable measures shall be taken to guard the PFPS against exposure to these hazards; and/or

(b) Suitable resistant PFPS shall be selected such that its performance is not affected.

(c) Anchors including Point Anchors, transportable anchors like slings, tripods or similar anchorage equipment that can be carried to the work site, Fixed Horizontal and Vertical Anchorage Lifelines, and Dead weight anchors shall be provided to secure anchorage of the worker.

(d) Where the worker is working while suspended, the Occupier shall provide Descent/Ascent Equipment/ suspension platforms along with Personal Fall Arrest Systems (PFAS).

(k) PPE for fall hazard in Confined Spaces:

(i) Suitable safety harness shall be provided to the worker to enable constant connection with him.

(ii) A stable anchor placed externally like a tripod, davit arm etc. shall be provided for safe anchorage of the worker.

(iii) Suitable devices allowing controlled descent/ ascent, such as personal fall arrest winches.

(iv) A backup fall arrest system with retractable and retrieval function such as a retrieval self-retracting lifeline, must always be provided, shall the primary ingress/ egress equipment fail.

(v) In case of a possibility of exposure to any additional hazards such as electrical hazard, welding sparks, chemical splashes, sharp edges, prolonged UV exposure, or any other such hazards that can damage the PFPS while working in a confined space:

aa) Suitable measures shall be taken to guard the PFPS against exposure to these hazards; and/or

ab) Suitable resistant PFPS shall be selected such that its performance is not affected.

(l) PPE against fall from fragile roof-tops:

(i) Vertical Life Lines (VLL) shall be used to provide safe and continuous anchorage

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to the user while climbing to access the fragile roof-tops.

(ii) While working on the fragile roof-top, the worker shall be connected at all times to a Horizontal Life Line (HLL).

25. Occupational Health and Medical Examination: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) First-aid appliances**.-** The first-aid boxes or cupboards shall be distinctively marked with a red cross on white back ground and shall contain the following equipment:-

(a) For factories in which the number of persons employed does not exceed ten, (in the case of factories in which mechanical power is not used) does not exceed fifty persons, each first-aid box or cup-board shall contain the following equipment:-

(i) Six small size sterilised dressings.
(ii) Three medium size sterilised dressings.
(iii) Three large size sterilised dressings.
(iv) Three large size sterilised burn dressings.
(v) One (60 ml) bottle of cetrimide solution (1%) or a suitable antiseptic solution.
(vi) One (60 ml) bottle of mercurochrome solution (2%) in water.
(vii) One (30ml) bottle containing sal-volatile having the dose and mode of administration indicated on the label.
(viii) One pair of scissors.
(ix) One roll of adhesive plaster (2 cm x i m.)
(x) Six pieces of sterilised eye pads in separate sealed packets
(xi) A bottle containing 100 tablets (each of 325 mg) of aspirin or any other analgesic.
(xii) Polythene wash bottle (1/2 litres i.e., 500 cc) for washing eyes.
(xiii) A snake-bite lancet.
(xiv) One (30 ml) bottle containing potassium permanganate crystals.

(b) For factories in which mechanical power is used and in which the number of persons employed exceeds ten but does not exceed fifty, each first-aid box or cupboard shall contain the following equipment :-

(i) Twelve small size sterilized dressings.
(ii) Six medium size sterilized dressings.
(iii)Six large size sterilized dressings.
(iv)Six large size sterilized burn dressings.
(v) Six (15 gm) packets of sterilized cotton wool.
(vi)One (120) bottle of cetrimide solution (1%) or a suitable antiseptic solution.
(vii) One (120 ml) bottle of mercurochrome solution (2%) in water.
(viii) One (60 ml) bottle containing sal-volatile having the dose and mode of administration indicated on the label.
(ix) One pair of scissors.
(x) Two rolls of adhesive plaster (2 cm x 1 m)
(xi) Eight pieces of sterilized eye pads in separate sealed packets.
(xii) One tourniquot.
(xiii) One dozen safety pins.

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(xiv) A bottle containing 100 tablets (each of 325 mg) of aspirin or any other analgesic.
(xv) One polythene wash bottle (1/2 litre i.e., 500 cc) for washing eyes.
(xvi) A snake-bite lancet.
(xvii) One (30 ml) bottle containing potassium permanganate crystals.

(c) For factories employing more than fifty persons, each first-aid box or cupboard shall contain the following equipment :-

(i) Twenty-four small size sterilized dressings.
(ii) Twelve medium size sterilized dressings.
(iii)Twelve large size sterilized dressings.
(iv)Twelve large size sterilized burn dressings.
(v) Twelve (15 gm) packets of sterilized cotton wool.
(vi)One (200) bottle of cetrimide solution (1%) or a suitable antiseptic solution.
(vii)One (200 ml) bottle of mercurochrome solution (2%) in water.
(viii) One (120 ml) bottle of salvolatile having the dose and mode of administration indicated on the label.
(ix) One pair of scissors.
(x) One roll of adhesive plaster (6 cm x 1 m)
(xi)Two rolls of adhesive plaster (2 cm x 1 m)
(xii)Twelve pieces of sterilized eye pads in separate sealed packets.
(xiii) A bottle containing 100 tables (each of 325 mg) of aspirin or any other analgesic.
(xiv)One polythene wash bottle (500 cc) for washing eyes.
(xv) Twelve roller bandages 10 cm wide.
(xvi) Twelve roller bandages 5 cm wide
(xvii) Six triangular bandages
(xviii) One tourniquet
(xix) A supply of suitable splints
(xx) Two Packets of safety pins
(xxi) Kidney tray
(xxii) A snake-bite lancet
(xxiii) One (30 ml) bottle containing Potassium permanganate crystals

Provided that item (xiv) to (xxi) inclusive, need not be included in the standard first-aid box or cupboard (a) where there is a properly equipped ambulance room, or (b) if at least one box containing such items shall be placed and maintained.

(2) Medical Examination and Health Surveillance:

(a) Workers employed in a 'hazardous process' and 'dangerous operations' shall be medically examined by a qualified medical practitioner who has successfully completed 'Associate Fellowship in Industrial Health' course conducted by DGFASLI/DGOSH and appointed by the occupier, herein after referred to as a Factory Medical Officer, in the following manner: -

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(i) Pre-employment Medical Examination: once before employment, to ascertain physical fitness of the person to do the particular job and to have a baseline health data for future reference.
(ii) Periodic Medical Examination shall be conducted annually or at shorter interval as may be prescribed, by the Factory Medical Officer, for all the workers.
(iii) Medical examination shall consider radiography, biochemistry and biological examinations and their entry into the body, metabolism, excretory routes and potential cause to the health of the workers.
(iv) As and when required to check the fitness of the worker on his return to work after a long absence for health reasons attributed to his occupation.

(b) Medical examination including criteria for detection and reporting of occupational diseases shall be extended to the employee even after he ceases to be in employment, if he is suffering from an occupational disease, which arises out of or in the course of employment.

(c) The certificate of fitness shall be issued by the Factory Medical Officer in Form V of Occupational Safety, Health and Working Conditions (Central) Rules.

(d) No person shall be employed for the first time without a certificate of fitness issued by the Factory Medical Officer.

(e) If the Factory Medical Officer declares a person unfit for being employed in any process, such person shall have the right to appeal to the Chief Inspector-cum-Facilitator who shall refer the matter to the Medical Officer appointed under section 42 of the Code.

(f) Any findings of the Factory Medical Officer revealing any abnormality or unsuitability of any person employed in the process shall immediately be reported to the Medical Officer who shall in turn, examine the concerned worker and communicate his findings to the occupier within 30 days. If the Medical Officer is of the opinion that the worker so examined is required to be taken away from the process for health protection, he will direct the occupier accordingly, who shall not employ the said worker in the same process. However, the worker so taken away shall be provided with alternate placement unless he is in the opinion of the Medical Officer, fully incapacitated in which case the worker affected shall be suitably rehabilitated.

(g) The worker who is taken away from any employment under para (a) and (b) shall be taken back for work, may be employed again only after obtaining fitness certificate from the Medical Officer, appointed under section 42 of the Code and after making entries to that effect in the Health Register.

(h) The worker required to undergo medical examination under this standard and for any medical survey conducted by or on behalf of the Central or the State Government shall not refuse to undergo such medical examination.

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(i) Factory medical officer shall visit the factory premises for health surveillance at frequent intervals and report his observations on Health to the occupier. If needed he shall take the advice of workers, safety committee members and experts in hygiene and toxicology.

(3**)** Occupational Health Centres:

(a) An occupational health centre shall be provided and maintained in every factory and shall have;
(i)One full-time Factory Medical Officer for factories employing upto 1000 workers and one more Medical Officer for every additional 1000 workers or part thereof;
(ii) Two nurses, and one sweeper-cum-ward boy throughout the working period;

(b) (i)The Occupational Health Centre shall be suitably equipped to manage medical emergencies.
(ii)An Occupational Health Centre having at least 2 well maintained rooms each with a minimum floor area of 15 sq.metre and equipment as per the schedule under this standard.

(c) In respect of any factory carrying on 'hazardous process', and 'dangerous operations', there shall be provided and maintained in good order an Occupational Health Centre with the services and facilities as per scale laid down hereunder and the schedule given hereunder: -
(i) For factories employing upto 50 workers -

(a) The services of a Factory Medical Officer on retainer-ship basis, in his clinic to be notified by the occupier. He will carry out the pre-employment and periodical medical examination as stipulated in para (1) and render medical assistance during any emergency.

(b) A minimum of 5 persons trained in first-aid procedures amongst whom atleast one shall always be available during the working period;

(c) A fully equipped first-aid box.

(ii) For factories employing 51 to 200 workers –

(a) An occupational Health Centre having a well maintained room with a minimum floor area of 15 sq.meter and equipment as per the Schedule given herein below.

(b) A part-time Factory Medical Officer shall be in overall charge of the Centre who shall visit the factory at least twice in a week and whose services shall be readily available during medical emergencies;

(c) One qualified and trained dresser-cum-compounder on duty throughout the working period;

(d) A fully equipped first aid box in all the departments;

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(iii) for Factories employing above 200 workers;

(a) One full-time Factory Medical Officer for factories employing upto 500 workers and one more Medical Officer for every additional 1000 workers or part thereof;
(b) There shall be two nurses, and one sweeper-cum-ward boy throughout the working period;

(c) The Occupational Health Centre shall be suitably equipped to manage medical emergencies.

(d) An Occupational Health Centre having at least 2 well maintained rooms each with a minimum floor area of 15 sq.metre and equipment as per the schedule under this standard.

SCHEDULE

Equipment for Occupational Health Centre in Factories

1. A glazed sink with hot and cold water always
2. A table with a smooth top at least 180 cm x 105 cm.
3. Means for sterilizing instruments
4. A cough
5. Two buckets or containers with close fitting lids
6. A kettle and spirit stove or other suitable means of boiling water
7. One bottle of spiritus ammoniac aromaticus (120 ml.)
8. Two medium size sponges
9. Two 'kidney' trays
10. Four cakes of toilet, preferably antiseptic soap
11. Two glass tumblers and two wine glasses
12. Two clinical thermometers
13. Two tea spoons
14. Two graduated (120 ml) measuring glasses
15. One wash bottle (1000 cc) for washing eyes
16. One bottle (one litre) carbolic lotion 1 to 20.
17. Three chairs
18. One screen
19. One electric Rechargeable hand torch
20. An adequate supply of tetanus toxoid
21. Coramine liquid (60 ml)
22. Tablets – antihistaminic, antispasmodic (25 each)
23. Syringes with needles – 2cc, 5 cc and 10 cc
24. Two needle holders, big and small suturing needless and materials
25. Suturing needles and materials
26. One dissecting forceps
27. One dressing forceps
28. One scalpels

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29. One stethoscope
30. Rubber bandage – pressure bandage
31. Oxygen cylinder with necessary attachments
32. One Blood Pressure apparatus
33. One Patellar Hammer
34. One Peak-flow meter for lung function measurement
35. One stomach wash set
36. Any other equipment recommended by the Factory Medical Officer according to specific need relating to manufacturing process
37. In addition –

(1) For factories employing 51 to 200 workers –

1. Four plain wooden splints 900 mm x 100mm x 6mm
2. Four plain wooden splints 350 mm x 75mm x 6mm
3. Two plain wooden splints 250 mm x 50mm x 12mm
4. One pair artery forceps
5. Injections – morphia, pethidine, atronine, adrenaline, coramine, novacan (2 each)
6. One surgical scissors

(2) For factories employing above 200 workers –

1. Eight plain wooden splints 900 mm x 100mm x 6mm
2. Eight plain wooden splints 350 mm x 75mm x 6mm
3. Four plain wooden splints 250 mm x 50mm x 12mm
4. Two pairs artery forceps
5. Injections – morphia, pethidine, atronine, adrenaline, coramine, novacan (2 each)
6. One surgical scissors

(d)The nurses shall have graduation in nursing or Diploma in Nursing and midwifery with one year experience in a factory Occupational Health Center

(e)Within one month of the appointment of a Factory Medical Officer, the occupier of the Factory shall furnish the following information to the Chief Inspector-cum-Facilitator.

(i) Name and address of the Factory Medical Officer;
(ii) Qualifications
(iii)Experience, if any, and

If no reply is received from Chief Inspector-cum-Facilitator it is deemed to be accepted.

(f). A cluster of factories having hazardous processes and substances may establish a common Occupational Health Center having the required specialty Medical facilities connected to hazardous nature of the processes.

(4) Duties, Functions and Conditions Of Service Of Factory Medical Officer:

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(a)Conditions of service

(i) Where the number of Factory Medical Officers to be appointed in a factory as prescribed in the Occupational Health Standard, exceeds one, one of them shall be designated as the Chief Factory Medical Officer and shall have a status higher than that of the others. The Chief Factory Medical Officer shall be overall in-charge of the occupational health services, and the other Factory Medical Officers, working under his control.

(ii) The Chief Factory Medical Officer or the Factory Medical Officer in the case of factories where only one Factory Medical Officer is required to be appointed shall be given the status of a senior executive and he shall work directly under the control of the chief executive of the factory. All other Factory Medical Officers shall be given appropriate status to enable them to discharge their functions effectively.

(iii)The scale of pay and the allowances to be granted to the Factory Medical Officers including the Chief Factory Medical Officer, and the other conditions of their service shall be the same as those of the other officers of corresponding status in the factory.

(iv)In the case of dismissal or discharge, a Factory Medical Officer shall have a right to appeal to the Chief Inspector cum Facilitator whose decision thereon shall be final.

(b) Duties of Factory Medical Officer. -

(i) the examination and certification of adolescent under the Code;

(ii) Medical Examination as specified in the Occupational Health Standard under the Code.

(iii)The exercising of such medical supervision as may be prescribed for any factory or class or description of factories where—

(a) cases of illness have occurred which it is reasonable to believe are due to the nature of the manufacturing process carried on, or other conditions of work prevailing, therein;

(b) by reason of any change in the manufacturing process carried on or in the substances used therein or by reason of the adoption of any new manufacturing process or of any new substance for use in a manufacturing process, there is a likelihood of injury to the health of workers employed in that manufacturing process;

(c) adolescents are, or are about to be, employed in any work which is likely to cause injury to their health.

(iv)Prevention of Occupational Diseases by means of Health Promotion Activities including Health Education and Behavioural Change Communication, Nutritional Intervention,

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Work environment monitoring, Biological Monitoring, Biological Effect Monitoring, Suitable Immunization, Early Diagnosis and appropriate management, Disability Limitation and Rehabilitation, Appropriate Preventive Programmes like Hearing Loss Prevention Programme, Smoking Cessation Programme, Healthy Lifestyle Programme.

(v) Nodal person in the factory for successful implementation of the national health programmes by the Government of India, to extend the benefits to the workers.

(vi) Report to occupier / manager of the factory as early as possible whenever any Notifiable Disease is diagnosed.

(vii) Maintain data on occupational injuries and illnesses as per Occupational Injury and Illness Classification System.

(viii) Maintain Report of Radiographs preferable as per the ILO International Classification of Radiographs of Pneumoconiosis system.

(c) Factory Medical Officer shall advise and assist the factory management in the fulfilment of its obligations, statutory or otherwise, concerning prevention of occupational illness and injuries and promote and maintain highest degree of physical, mental and social well-beings of the workers by preventing departure from health, controlling risk factors and adaptation of work to people. These shall include the following, namely -

(i) to advise in planning and organising measures necessary for the effective control of occupational illnesses;

(ii) to advise on occupational health aspects in job studies, and to carry out detailed studies of selected jobs;

(iii) to check and evaluate the effectiveness of the action taken or proposed to be taken to prevent occupational illnesses and injuries;

(iv) to advise the purchasing and stores departments in ensuring availability and quality of personal protective equipment.

(v) to provide advice on matters related to carrying out plant safety and health inspections;

(vi) to carry out plant occupational health inspections in order to observe the conditions of work and the work practices and procedures followed by workers and to render advice on measures to be adopted for removing the occupational health hazards;

(vii) to render advice on matters related to reporting and investigation of industrial accidents and diseases;

(viii) to be part of investigation of accident as an expert on Occupational Health .

(ix) to investigate the cases of industrial diseases contracted and dangerous occurrences;

(x) to advise on the maintenance of such records as are necessary relating to accidents,

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dangerous occurrences and industrial diseases;

(xi) to promote setting up of safety committees and act as adviser and catalyst to such committees;

(xii) to organise in association with the concerned departments, campaigns, competitions, contests, and other activities which will develop and maintain the interest of the workers in establishing and maintaining healthy conditions of work and procedures; and

(xiii) to design and conduct either independently or in collaboration with the training department, suitable training, and educational programme for the prevention of occupational illnesses.

(xiv) to visit the factory premises for health surveillance at regular intervals and report his observations on health issues to the occupier. If needed he shall take the advice of workers representatives, safety committee members and experts in hygiene, toxicology and any other expert he deems fit.

(d) Facilities to be provided to Factory Medical Officer. - An occupier of the factory shall provide each Factory Medical Officer with such facilities, equipment, and information as are necessary to enable him to discharge his duties effectively.

(e) Prohibition of performance of other duties. - No Factory Medical Officer shall be required or permitted to do any work which is inconsistent with or detrimental to the performance of the aforesaid duties

(5) Ambulance Van

(a) The occupier of every factory to which these standards apply shall for the purpose of removing serious cases of accident or sickness, provide in the premises and maintain in good condition a suitable conveyance unless he has made arrangements for obtaining such a conveyance from a hospital.

(b) in any factory carrying on 'hazardous process', there shall be provided and maintained in good condition, a suitably constructed ambulance van equipped with items as per sub-para (c) and manned by a full time Driver-cum-Mechanic and a Helper trained in first aid, for the purposes of transportation of serious cases of accidents or sickness. The ambulance van shall not be used for any purpose other than the purpose stipulated herein and will normally be stationed at or near to the Occupational Health Centre.

Provided that a factory employing less than 200 workers, may make arrangements for procuring such facility at short notice from a nearby hospital or other places, to meet any emergency.

(c)The Ambulance shall have the following equipment:

(i) General

- A wheeled stretcher with folding and adjusting devices; with the head of the

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stretcher capable of being tilted upward;
- Fixed suction unit with equipment;
- Fixed oxygen supply with equipment;
- Pillow with case; -Sheets; - Blankets; - Towels;
- Emesis bag; - Bed pan; - Urinal; - Glass

(ii) Safety equipment
- Flood lights;
- Flash lights;
- Fire extinguisher dry power type;
- Insulated gauntlets

(iii) Emergency Care Equipment

(a) Resuscitation
- Portable suction unit; Portable oxygen units;
- Bag-valve-mask, hand operated artificial ventilation unit, BIPAP with NIV
- Airways; -Mouth gags; - Tracheotomy adapters;
- Short spine board; I.V. Fluids with administration unit;
- B.P. Manometer; Stethoscope, AED, Cardiac Monitor, Pulse oxymeter, Infusion Pump
-

(b) Immobilization
- Long and short padded boards; - Wire ladder splints;
- Triangular bandage;
-
- Long and short spine boards

(c) Dressings
- Gauze pads – 4" x 4"; - Universal dressing 10" x 36",
- Roll of aluminum foils; - Soft roller bandages 6" x 5 yards; -Adhesive tape in 3" roll; - Safety pins;
- Bandage sheets; - Burn sheet.

(d) Poisoning
- Syrup of Ipecae; - Activated Charcoal Pre packeted in dozes; - Snake bite kit;
- Drinking water
- Diphoterine
- Anti Cyanide Kit

(e) Emergency Medicines
- As per requirement (under the advice of Factory Medical Officer or Medical Officer)

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(6) Decontamination Facilities**:**
4 every factory, carrying out 'hazardous process', the following provisions shall be made to meet an emergency:-

(i) fully equipped first aid box;

(ii) readily accessible means of water for washing by workers as well as for drenching the clothing of workers who have been contaminated with hazardous and corrosive substance; and one such facility shall be available for every 50 workmen ordinarily employed

(iii) Diphoterine eye wash and shower

(iv) a sufficient number of eye wash bottles filled with distilled water or suitable liquid, kept in boxes or cupboards conveniently situated and clearly indicated by a distinctive sign which shall be visible at all times.

(7) Making available health records to workers:

(a) The occupier of every factory carrying out a 'hazardous process' shall make accessible the health records including the record of worker's exposure to hazardous process or, as the case may be, the medical records of any worker for his perusal under the following conditions:-

(i) Once in every six months or immediately after the medical examination whichever is earlier;
(ii) If the factory Medical Officer or the Medical Officer as the case may be, is of the opinion that the worker has manifested signs and symptoms of any notifiable disease as specified in the Third Schedule of the Code
(iii) If the worker leaves the employment;
(iv) If any one of the following authorities so direct
- the Chief Inspector-cum-Facilitator of Factories;
- the Health Authority of the Central or State Government;
- the Commissioner of Workmen's Compensation;
- the Director, Employees State Insurance Corporation (Medical Benefits); and
- the Director General, Factory Advice Service and Labour Institutes.

(b) A copy of the upto date health records including the record of worker's exposure to hazardous process or, as the case may be, the medical records shall be supplied to the worker on receipt of an application from him. X-ray plates and other medical diagnostic reports may also be made available for reference to his medical practitioner.

26. Incident Notification, Investigation And Reporting: under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Notice in respect of accidents:

When any accident occurs inside any factory, notice in the format prescribed by the appropriate Government within the time specified therein shall be sent to the Inspector-cum-Facilitator.

(2) Incident Reporting and Investigation:

(a) The occupier of every factory shall implement and maintain a procedure(s) to record, investigate and analyse accidents in order to:
(i) Determine underlying occupational safety and health deficiencies and other factors that might be causing or contributing to the occurrence of accidents by carrying out a root cause analysis using appropriate methods.
(ii) Take corrective action to prevent the re-occurrence of such accidents; and
(iii) such investigation reports shall be submitted on demand to the Inspector-cum-Facilitator of Factories.

(b) All near-misses shall be analysed and corrective action shall be taken.

(c) Incident rates, frequency rates, and severity rates shall be computed as per National Standard by the establishment.

(d) The occupier shall inform the Inspector-cum-Facilitator, the return of the worker to duty, or discharge from hospital with total /partial disablement, or death of the worker as the case may be. On re-joining of the worker to duty, a Certificate of Fitness issued by a qualified medical practitioner shall be submitted by the employer/occupier to the Inspector cum Facilitator

27. Notice In Respect Of Accidents: under serial no. 24 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Where in any factory an accident occurs which causes death, or which causes any bodily injury by reason of which the person injured is prevented from working for a period of forty-eight hours or more immediately following the accident, or which is of such nature as may be prescribed in this behalf, the manager of the factory shall send notice thereof to such authorities, and in such form and within such time, as may be prescribed.
(2) Where a notice given under sub-para (1) relates to an accident-causing death, the authority to whom the notice is sent shall make an inquiry into the occurrence within one month of the receipt of the notice or, if such authority is not the Inspector, cause the Inspector to make an inquiry within the said period.
(3) When any dangerous occurrence specified in the schedule annexed hereto takes place in a factory, the manager of the factory shall forthwith send a notice electronically or otherwise to the Inspector cum Facilitator . When any accident or any dangerous occurrence specified in the schedule annexed hereto, which results in the death of any person or which results in such bodily injury to any person as is likely to cause his death, takes place in a factory, forthwith notice shall be sent also to the District Magistrate or

Sub-divisional Officer, to the officer-in-charge of the nearest police station; and to the relatives of the injured or deceased person.

SCHEDULE

1. Bursting of a plant used for containing or supplying steam under pressure greater than atmospheric pressure.
2. Collapse or failure of a crane, derrick, winch, hoist or other appliances used in raising or lowering persons or goods, or any part thereof, or the overturning of a crane.
3. Explosion, fire, bursting out, leakage or escape of any molten metal, or hot liquor or gas causing bodily injury to any person or damage to any room or place in which persons are employed, or fire in rooms of cotton pressing factories when a cotton opener is in use.
4. Explosion of a receiver or container used for the storage at a pressure greater than atmospheric pressure of any gas or gases (including air) or any liquid or solid resulting from the compression of gas.
5.Collapse or subsidence of any floor, gallery, roof, bridge, tunnel, chimney, wall, building or any other structure.

28. Court of Inquiry in Case of Accidents: under serial no. 25 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Upon receiving information or intimation of any accident and/or occupational disease in a factory, the committee so appointed by the Central Government shall be required to visit the factory immediately to inquire into the causes of the accident and/or occupational disease.

(2) In order to carry out the purposes of the Code.

(a) the Committee shall be authorized to enter any factory, and to inspect and investigate during regular working hours and any place of employment and all pertinent conditions, work area, structures, machines, apparatus, devices, equipment, and materials therein, and to question privately the occupier, manager, operator, employee or any other person as deemed fit.

(b) the occupier, or a representative of the occupier shall accompany the Committee during the physical inspection of any workplace for the purpose of aiding such inspection. Where there is no authorized employee representative, the Committee shall consult with not less than three of the employees concerning matters of health and safety in the workplace.

(c) the occupier of a factory shall furnish any information that the Committee may require for the purpose of satisfying itself whether the provisions of the Code have been complied with. Any demand by the Committee for any such information if made during the course of inspection, shall be furnished immediately if the said information is available in the factory, or, if made in writing, shall be provided within 5 (five) working days on receipt of such demand.

3. The Committee shall be required to prepare a site visit report, entailing the nature of accident or occupational disease and the provisions of the Code, if any, that the factory is in

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contravention of. A copy of this shall be sent to the occupier of the factory.

4. The Committee shall send the site visit report along with the conclusions and recommendations of the court of inquiry to the State Government for further necessary actions as necessary.

29. Employment Of Adolescents On Dangerous Machines: under serial no. 3 in the second schedule under clause (f) of sub-section (2) of section 18

(1) No adolescent shall be required or allowed to work at any machine to which this section applies, unless he has been fully instructed as to the dangers arising in connection with the machine and the precautions to be observed and—

(a) has received sufficient training in work at the machine, or

(b) is under adequate supervision by a person who has a thorough knowledge and experience of the machine.

(2) The machines such as hoists and lifts, lifting appliances, revolving machinery and machines mentioned below shall be deemed to be of such dangerous character that adolescents shall not work at them unless the provisions of sub-para (1) are complied with -

(a) Power presses other than hydraulic presses.
(b) Milling machines used in the metal trades.
(c) Circular saws.
(d) Platen printing machines.
(e) Guillotine machines.

30. Prohibition Of Employment Of Pregnant Women And Adolescent Near Cotton-Openers: under serial no. 7 in the second schedule under clause (f) of sub-section (2) of section 18

No pregnant woman or adolescent shall be employed in any part of a factory for pressing cotton in which a cotton opener is at work.

31. Prohibition in Certain Cases of Danger: under serial no. 23 in the second schedule under clause (f) of sub-section (2) of section 18

Where it appears to the Inspector cum facilitator that conditions in a factory or part thereof are such that they may cause serious hazard by way of injury or death to the persons employed therein or to the general public in the vicinity, he may, by order in writing to the occupier of the factory, state the particulars in respect of which he considers the factory or part thereof to be the cause of such serious hazard and prohibit such occupier from employing any person in the factory or any part thereof other than the minimum number of persons necessary to attend to the minimum tasks till the hazard is removed.

32. Protection of Eyes: under serial no. 15 in the second schedule under clause (f) of sub-section (2) of section 18

In respect of any such manufacturing process carried on in any factory, which involves—

(a) risk of injury to the eyes from particles or fragments thrown off in the course of the process, or
(b) risk to the eyes by reason of exposure to excessive light

effective screens or suitable goggles shall be provided, by the occupier, for the protection of employees in the immediate vicinity of the process.

33. Power to Require Specifications of Defective Parts or Tests of Stability: under serial no. 20 in the second schedule under clause (f) of sub-section (2) of section 18

If it appears to the Inspector-cum-Facilitator that any building or part of a building or any part of the ways, machinery or plant in a factory is in such a condition that it may be dangerous to human life or safety, he may serve on the occupier or manger or both of the factory an order in writing requiring him before a specified date—
(a) to furnish such drawings, specifications and other particulars as may be necessary to determine whether such building, ways, machinery, or plant can be used with safety, or
(b) to carry out such tests in such manner as may be specified in the order, and to inform the Inspector-cum-Facilitator of the results thereof.

34. Safety Officers: under serial no. 14 in the second schedule under clause (f) of sub-section (2) of section 18

(1) A person shall not be eligible for appointment as a safety officer relating to factories unless he –

(a) possesses -
  (i) a recognised degree in any branch of engineering or technology and has had practical experience of working in a factory in a supervisory capacity for a period of not less than 2 years; or
  (ii) a recognised degree in physics or chemistry and has had practical experience of working in a factory in a supervisory capacity for a period of not less than 5 years; or
  (iii) a recognised diploma in any branch of engineering or technology and has had practical experience of working in a factory in a supervisory capacity for a period of not less than 5 years.
(b) possesses a post-graduate degree or degree or diploma in industrial safety recognised by the State Government in this behalf or possesses a post-graduate degree or degree or diploma in industrial safety recognised by DGOSH, formerly known as DGFASLI, subject to the verification of syllabus; and
(c) has adequate knowledge of the language spoken by majority of the workers in the region in which the factory where he is to be appointed is situated.

(2) Notwithstanding the provisions contained in para (1), any person who -
(a) possesses a recognised degree or diploma in engineering or technology and has had experience of not less than 5 years in a department of the Central or State Government which deals with the administration of the Code.
(b possesses a recognised degree or diploma in engineering or technology and has had experience of not less than 5 years, full time, on training, education, consultancy, or research in the field of accident prevention in industry or in any institution; shall also be eligible for

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appointment as a Safety Officers:

Provided that the Chief Inspector-cum-facilitator may, subject to such conditions as may specify, grant exemption from the requirements of this sub-para, if in his opinion, a suitable person possessing the necessary qualifications and experience is not available for appointment.

Provided further that, in the case of a person who has been working as a Safety Officer for a period of not less than 3 years on the date of commencement of this para, the Chief Inspector-cum-facilitator may, subject to such conditions as he may specify, relax all or any of the above said qualifications.

(3) Duties of Safety Officer in case of factories. – The duties of a Safety Officer shall be to advise and assist the factory management in the fulfilment of its obligations, statutory or otherwise, concerning prevention of personal injuries and maintaining a safe working environment. These duties shall include the following, namely -

(a) to advise the concerned departments in planning and organising measures necessary for the effective control of personal injuries;
(b) to advise on safety aspects in all job studies, and to carry out detailed job safety studies of selected jobs;
(c) to check and evaluate the effectiveness of the action taken or proposed to be taken to prevent personal injuries;
(d) to advise the purchasing and stores departments in ensuring high quality and availability of personal protective equipment;
(e) to provide advice on matters related to carrying out plant safety inspections;
(f) to carry out plant safety inspections in order to observe the physical conditions of work and the work practices and procedures followed by workers and to render advice on measures to be adopted for removing the unsafe physical conditions and preventing unsafe actions by workers;
(g) to render advice on matters related to reporting and investigation of industrial accidents and diseases;
(h) (viii)to investigate selected accidents;
(i) to investigate the cases of notifiable diseases listed in the Third Schedule of the Code;
(j) to advise on the maintenance of such records as are necessary relating to accidents, dangerous occurrences and industrial diseases;
(k) to promote setting up of safety committees and act as adviser and catalyst to such committees;
(l) to organise in association with the concerned departments, campaigns, competitions, contests and other activities which will develop and maintain the interest of the workers in establishing and maintaining safe conditions of work and procedures; and
(m) to design and conduct either independently or in collaboration with the training department, suitable training and educational programme for the prevention of personal injuries.

(4) Conditions of service. -

(a) Where the number of Safety Officers to be appointed in a factory as required by a notification in the Official Gazette exceeds one, one of them shall be designated as the Chief Safety Officer and shall have a status higher than that of the others. The Chief Safety Officer

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shall be in overall charge of the safety functions as envisaged in para (3), the other Safety Officers working under his control.

(b) The Chief Safety Officer or the Safety Officer in the case of factories where only one Safety Officer is required to be appointed, shall be given the status of a senior executive and he shall work directly under the control of the chief executive of the factory. All other Safety Officers shall be given appropriate status to enable them to discharge their functions effectively.

(c) The scale of pay and the allowances to be granted to the Safety Officers including the Chief Safety Officer, and the other conditions of their service shall be the same as those of the other officers of corresponding status in the factory.

(d) In the case of dismissal or discharge, a Safety Officer shall have a right to appeal to the State Government whose decision thereon shall be final.

(5) Facilities to be provided to Safety Officers. - An occupier of the factory shall provide each Safety Officer with such facilities, equipment and information as are necessary to enable him to discharge his duties effectively.

(6) Prohibition of performance of other duties. - No safety Officer shall be required or permitted to do any work which is inconsistent with or detrimental to the performance of the duties prescribed in para (3).

35. Maximum Permissible Threshold Limits Of Exposure Of Chemicals And Toxic Substances In Manufacturing Processes: under serial no. 71 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Limits of concentration of substances at work location –

(a) The time weighted average concentration of any substance listed in table 1 or 2 of the schedule, at any work location in a factory during any shift on any day shall not exceed the limit of the permissible time weighted average concentration specified in respect of that substance:

Provided that in the case of a substance mentioned in Table 1 in respect of which a limit in terms of short term maximum concentration is indicated, the concentration of such a substance may exceed the permissible limit of the time weighted average concentration for the substance for short periods not exceeding 15 minutes at a time, subject to the condition that-

(i) such periods during which the concentration exceeds the prescribed time weighted average concentration are restricted to not more than 4 per shift;

(ii) the time interval between any two such periods of higher exposure shall not be less than 60 minutes; and

(iii) at no time the concentration of the substance in the air shall exceed the limit of

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short term maximum concentration.

(b) In the case of any substance given in Table 3, the concentration of the substance at any work location in a factory at any time during any day shall not exceed the limit of exposure for that substance specified in the table.

(c) In the cases where the word "skin" has been indicated against certain substance mentioned in Tables 1 and 3, appropriate measures shall be taken to prevent absorption through cutaneous routes particularly skin, mucous membranes, and eyes as the limits specified in these Tables are for conditions where the exposure is only through respiratory tract.

(d) (i) In case, the air at any work location contains a mixture of such substances mentioned in Table 1,2 or 3, which have similar toxic properties, the time weighted concentration of each of these substances during the shift shall be such that when these time weighted concentration divided by the respective permissible time weighted average concentration specified in the above mentioned tables, and the fractions obtained are added together, the total shall not exceed unity.

i. e. $\frac{C1}{L1} + \frac{C2}{L2} + \frac{Cn}{Ln}$ shall not exceed unity

Where C1 ,C2 ..... Cn are the time weighted concentration of toxic substances 1,2,.....and n respectively, determined after measurement at work location;

and L1,L2 .....Ln are the permissible time weighted average concentration of the toxic substances 1,2,.....and n respectively.

(ii) In case the air at any work location contains a mixture of substances, mentioned in Table 1,2,3 and these do not have similar toxic properties, then the time weighted concentration of each of these substances shall not exceed the permissible time weighted average concentration specified in the above mentioned tables, for that particular substance.

(iii) The requirement in sub-paras (i) and (ii) shall be in addition to the requirements in para (2) (a) and (2) (b).

(2) Sampling and evaluation procedures.-

(a) Work environment monitoring study shall be conducted once in every year to ascertain that the PEL values of the chemicals utilized, processed, stored and handled, as specified in the Table 1, are never exceeded.

(b) Notwithstanding provisions in any other paras, the sampling and evaluation procedures to be adopted for checking compliance with the provisions in the schedule shall be as per Standard procedures in vogue from time to time.

(c) Notwithstanding the provisions in para (1), the following conditions regarding the

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sampling and evaluation procedures relevant to checking compliance with the provisions in the schedule are specified.

(i) For determination of the number of particles per cubic metre in item (1) (a) (i) 1 in Table 2, samples are to be collected by Standard or midget impinger and the counts made by light-field technique.

(ii) The percentage of quartz in the formulae given in item (1) (a) (i) 3 of Table 2 is to be determined from air borne samples.

(iii) For determination of number of fibres as specified in item (2) (a) of Table 2, the membrane filter method at 430 x magnification (4mm objective) with phase contrast illumination shall be used.

(iv) Both for determination of concentration and percentage of quartz for use of the formula given in item (1) (a)(i)(2) of Table 2, the fraction passing through a size-selector with the following characteristics shall only be considered.

Aerodynamic diameter (unit density sphere)	Percentage allowed (by size-selector)
2.0	90
2.5	75
3.5	50
5.0	25
10.0	0

TABLE – 1

Substances	Permissible limits of exposure			
	Time-weighted average concentration		Short-term maximum concentration	
	Ppm	mg/m^3	ppm	mg/m^3
Acetaldehyde	180	150	270	
Acetic acid	10	25	15	37
Acetone	750	1,780	1,000	2,375
Acrelein	0.1	0.25	0.3	0.8
Acrylonitrile-Skin(S.C)	2	4.5	--	--
Aldrin-skin	-	0.25		0.75

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Allyl Chloride	1	3	2	6
Ammonia	25	18	35	27
Aniline-skin	2	10	5	20
Anisidine (o-poisoners)-skin	0.1	0.5	-	
Arsenic and compounds (as)	-	0.2	-	
Benzene	10	30	-	
Beryllium and compounds (as Be (S.C.)	--	0.002	--	--
Boron trifluoride-C	1	3	--	--
Bromine	0.1	0.7	0.3	2
Butane	800	1,900	--	--
2 ButaneneMethylethyl Ketone – MEK	200	590	300	885
n-Butyl acetate	150	710	200	950
sec/tert.Butyl acetate	200	950	250	1190
Butyl mercaptan	0.5	1.5	--	--
Cadmium-dust and salts (as Cd)	-	0.05	-	0.2
Calcium Oxide	-	2	-	-
Carbaryl (Sovin)	-	5	-	10
Carbofuran (Furadan)	-	0.1	-	-
Carbon disulphide-skin	2	60	30	90
Carbon monoxide	50	55	400	440
Carbon tetrachloride-skin	10	65	20	130
Carbonyl chloride (Phosgene)	0.1	0.4	-	-
Chlordane-skin	-	0.5	-	2
Chlorobenzene (mono chloro- benzene)	75	350	-	-
Chlorine	1	3	3	9
Chloroform (S.C.)	10	50	--	--
bis-Chloromethyl ether	0.001	-	-	-
Chromic acid and chromates (as Cr.)	-	0.05	-	-
Chromium, Sel-Chromic,				
Chromous salts (as Cr)	-	0.5	-	-
Copper fume	-	0.2	-	-

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Cotton dust, raw	-	0.2	-	0.6
Cresol, all isomers-skin	5	22	-	-
Cyanides, (as CN)-skin	-	5	-	-
Cyanogen	10	20	-	-
DDT(Dichlorodiphenyl-trichlore-ethane)	-	1	-	3
Demeton-skin	0.01	0.1	0.03	0.3
Diazion-skin	-	0.1	-	0.3
Dibutyl phthalate	-	5	-	10
Dichlorves (DDVP)-skin	0.1	1	0.3	3
Dieldrin-skin	-	0.25	-	0.75
Dinitrobenzene (all isomers) skin	0.15	1	0.5	3
Dinitrotoluene-skin	-	1.5	-	5
Diphenyl	0.2	1.5	0.6	4
Endosulfan (Thiodan)-skin	-	0.1	-	0.3
Endrin-skin	-	0.1	-	0.3
Ethyl acetate	400	1000	-	-
Ethyl alcohol	1000	1900	-	-
Ethyl amine	10	18	-	-
Flourides (as F)	-	2.5	-	-
Flourine	1	2	2	4
Formaldehyde (S.C.)	1	1.5	2	3
Formic acid	5	9	--	--
Gasoline	300	900	500	1,500
Hydrazine-skin (S.C.)	0.1	0.1	--	--
Hydrogen chloride-C	5	7	--	--
Hydrogen Cyanide-skin	10	11	15	16
Hydrogen fluoride(as F)-C	3	2.5	--	--
Hydrogen peroxide	1	1.5	--	--
Hydrogen sulfide	10	15	15	27
Iodine-C	0.1	1	--	--
Iron oxide fume (Fe2O3 as Fe)	-	5	-	10

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Isoamyl acetate	100	525	125	655
Isoamyl alcohol	100	360	125	450
Isobutylalcohol	50	150	75	225
Lead, inorg, fumes and dusts (as Pb)	-	0.15	-	0.45
Lindane-skin	-	0.5	-	1.5
Mala thion-skin	-	10	-	-
Manganese fume (as Mn)	-	1	-	3
Mercury (as Hg)	-	0.05	-	0.15
Mercury (alkyl compounds)-skin (as Hg)	0.001	0.01	0.003	0.03
Methyl alcohol (methanol) skin	200	260	250	310
Methyl cellosolve-skin (2-methoxy ethanol)	25	80	35	120
Methyl isobutyl ketone-skin	100	410	125	510
Methyl isocyanate-Skin	0.02	0.05	--	--
Naphthalene	10	50	15	75
Nickel carbonyl (as Ni)	0.05	0.35	-	-
Nitric acid	2	5	4	10
Nitric oxide	25	30	35	45
Nitrobenzene-skin	1	5	2	10
Nitrogen dioxide	3	6	5	10
Oil mist-mineral	-	5	-	10
Ozone	0.1	0.2	0.3	0.6
Parathion-skin	-	0.1	-	0.3
Phenel-skin	5	19	10	38
Phorate (Thimet)-skin	-	0.05	-	0.2
Phosgene (Carbonyl chloride)	0.1	0.4	-	-
Phosphine	0.3	0.4	1	1
Phosphoric acid (yellow)	--	1	--	3
Phosphorous (yellow)	-	0.1	-	0.3
Phosphorous pentachloride	-	1	-	3
Phosphorous trichloride	0.5	3	-	-
Picric acid-skin	-	0.1	-	0.3
Pyridine	5	15	10	30

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Silane (silicon tetrahydride)	0.5	0.7	1	1.5
Sodium hydroxide C	--	2	--	--
Styrene, monomer (phenyl-ethylene)	100	420	125	525
Sulphur dioxide	5	13	-	-
Sulphur hexafluoride	1,000	6,000	--	--
Sulphuric acid	-	1	-	-
Tetraethyl lead (as Pb)-Skin	--	0.1	--	--
Toluene (toluol)-skin	100	375	150	560
0-Toludine	5	22	10	44
Tributyl Phosphate	0.2	2.5	--	--
Trichloroethylene	100	535	150	800
Uranium, natural (as U)	--	0.2	--	0.6
Vinyl chloride	5	10	-	-
Welding fumes (NOC)	-	5	-	-
Xylene (o-m-isomers)-skin	100	435	150	655
Zinc oxide				
(i) Fume	--	5	--	10
(ii)Dust (Total dust)	--	10	--	--
Zirconium compounds (as Zr)	--	5	--	10

TABLE 2

Sl. No.	Substance	Permissible time weighted average concentration
1	Silica	
	a. Crystalline	
	i) Quartz	
	1. In terms of dust count :	$\frac{1060}{\%\ \text{Quartz} + 10}$ mppcm
	2. In terms of respirable dust	$\frac{10}{\%\ \text{respirable Quartz} + 2}$ mg/m^3
	3. In terms of total dust	30 mg/m^3

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		% Quartz + 3
	ii) Cristobalite	Half the limits given against quartz
	iii) Tridymite	Half the limits given against quartz
	iv) Silica fused	Same limit as for quartz
	v) Tripoli	Same limit as in formula in item 2 given against quartz
	b. Amorphous	705 mppcm
2.	Silicate having less than 1% free silica by weight	
	a) Asbestos (fibres longer than 5 microns)	2 fibres/cubic centimeter
	b) Mica	705 mppcm
	c) Mineral wool fiber	10 mg/m^3
	d) Porlite	1060
	e) Portland cement	1060
	f) Soap stone	705
	g) Talc (nonobostiform)	705
	h) Talc (fibrous)	Same limit as for asbestos
	i) Tromolite	Same limit as for asbestos
3.	Coal Dust	
	1) For airborne dust having less than 5 % silicon dioxide by weight	2 mg/m^3
	2) For airnorne dust having over 5 % silicon dioxide	Same limit as prescribed by formula in item 2 against quartz.

TABLE 3

Substance	ppm	mg/m^3
Acetic anhydride	5	20
O-Dichlorobenzene	50	300
Formaldehyde	2	3

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Hydrogen Chloride	5	7
Manganese and compounds (as Mn)	-	5
Nitrogen dioxide	5	9
Nitroglycerin-skin	0.2	2
Potassium hydroxide	-	2
Sodium hydroxide	-	2
2,4,6 - Trinitrotoluene (TNT)	-	0.5

CHAPTER – III- MACHINERY AND EQUIPMENT

36. Guarding and fencing of machinery- under serial no. 1 in the second schedule under clause (f) of sub-section (2) of section 18

(1) In every factory, every moving- rotating, reciprocating, or oscillating part of machine shall be securely fenced or safeguarded of substantial construction which shall be constantly maintained and kept in position while such parts are in motion conforming to applicable National Standards.

(2) Safeguards provided in sub-para (1) shall be such as to provide positive protection to all the persons working on or near machinery

(3) The guards and other appliances required under this section shall be maintained properly.

(4) All the machines installed in a factory shall have at least one-meter clear space around the periphery of the machine and the space shall be kept free from obstruction or accumulation of any material

(5) Revolving machinery such as grinding machines, vessels, cage, basket, flywheel, pulley, disc or other similar appliances shall be displayed with a notice indicating the maximum safe working peripheral speed and diameter of the pulley, and the speeds indicated in the notice shall not be exceeded.

(6) In case of dismantling or decommissioning of machines, the occupier shall assess the risk caused to the work force and environment in the process. The occupier shall ensure energy isolation, provide appropriate material handling equipment and follow correct lifting process.

(7) Where it becomes necessary to examine any part of machinery while the machinery is in motion, or, as a result of such examination, to carry out lubrication or other adjusting operation; or any mounting or shifting of belts, such examination or operation shall be made or carried out only by a specially trained adult worker wearing tight fitting clothing, supplied by the occupier or employer.

(8) No adolescent person shall be allowed to clean, lubricate or adjust any such part if it would expose the adolescent person to risk of injury.

(9) All machines shall have individual start and stop buttons within the reach of the operator.

(10) The operator , while working on or near machinery , shall -

(a) tie long hair behind his head.

(b) not wear loose clothing like ties, open cuffs or loose or open shirts.

(c) not wear loose jewelry like neck chains, bracelets, rings and watches.

(11) No adolescent shall be allowed to work at any machine to which this section applies, unless he has been fully instructed as to the dangers arising in connection with the machine and the

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precautions to be observed and—

(a) has received sufficient training in work at the machine, or

(b) is under adequate supervision by a person who has a thorough knowledge and experience of the machine.

(12) In every factory—

Suitable devices for cutting off power in emergencies from running machinery shall be provided and maintained and arrangements shall be provided for locking the device in safe position to prevent accidental starting of the transmission machinery or other machines and such gear or appliances shall be so constructed, placed and maintained as to prevent the belt from creeping back on the fast pulley;

(13)No traversing part of a self-acting machine in any factory and no material carried thereon shall, if the space over which it runs is a space over which any person is liable to pass, whether in the course of his employment or otherwise, be allowed to run on its outward or inward traverse within a distance of forty-five centimetres from any fixed structure which is not part of the machine.

(14) In all machinery driven by power and installed in any factory.

(a) every set screw, bolt or key on any revolving shaft, spindle, wheel or pinion shall be so sunk, encased or otherwise effectively guarded as to prevent danger;

(b) all spur, worm and other toothed or friction gearing which does not require frequent adjustment while in motion shall be completely encased, unless it is so situated as to be as safe as it would be if it were completely encased.

(15) Whoever sells or lets on hire or, as agent of a seller or hirer, causes or procures to be sold or let on hire, for use in a factory any machinery driven by power shall conform to this standard.

(16)No pregnant woman shall be employed in any part of a factory for pressing cotton in which a cotton opener is at work:

Provided that if the feed-end of a cotton-opener is in a room separated from the delivery end by a partition extending to the roof, pregnant woman may be employed on the side of the partition where the feed-end is situated.

37. Work on or near machinery in motion- under serial no. 2 in the second schedule under clause (f) of sub-section (2) of section 18.

(1) Where in any factory it becomes necessary to examine any part of machinery referred to in Standard 36, while the machinery is in motion, or, as a result of such examination, to carry out—

(a) in a case referred to in sub-para (i) of the proviso to para (1) of Standard 36, lubrication or other adjusting operation; or

(b) in a case referred to in sub-para (ii) of the proviso aforesaid, any mounting or shipping of belts or lubrication or other adjusting operation,

while the machinery is in motion, such examination or operation shall be made or carried out only

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by a specially trained adult male worker wearing tight fitting clothing (which shall be supplied by the occupier) whose name has been recorded in the register prescribed in this behalf and who has been furnished with a certificate of this appointment, and while he is so engaged,—

(a) such worker shall not handle a belt at a moving pulley unless—
(i) the belt is not more than fifteen centimetres in width;
(ii) the pulley is normally for the purpose of drive and not merely a fly-wheel or balance wheel (in which case a belt is not permissible); (iii) the belt joint is either laced or flush with the belt;
(iv) the belt, including the joint and the pulley rim, are in good repair;
(v) there is reasonable clearance between the pulley and any fixed plant or structure;
(vi) secure foothold and, where necessary, secure handhold, are provided for the operator; and
(vii) any ladder in use for carrying out any examination or operation aforesaid is securely fixed or lashed or is firmly held by a second person;

(b) without prejudice to any other provision of this Code relating to the fencing of machinery, every set screw, bolt and key on any revolving shaft, spindle, wheel or pinion, and all spur, worm and other toothed or friction gearing in motion with which such worker would otherwise be liable to come into contact, shall be securely fenced to prevent such contact.

(2) No pregnant woman or adolescent shall be allowed to clean, lubricate or adjust any part of a prime mover or of any transmission machinery while the prime mover or transmission machinery is in motion, or to clean, lubricate or adjust any part of any machine if the cleaning, lubrication or adjustment thereof would expose the pregnant woman or adolescent to risk of injury from any moving part either of that machine or of any adjacent machinery.

38. Striking gear and devices for cutting off power- under serial no. 4 in the second schedule under clause (f) of sub-section (2) of section 18.

(1) In every factory—
(a) suitable striking gear or other efficient mechanical appliance shall be provided and maintained and used to move driving belts to and from fast and loose pulleys which form part of the transmission machinery, and such gear or appliances shall be so constructed, placed and maintained as to prevent the belt from creeping back on the fast pulley;
(b) driving belts when not in use shall not be allowed to rest or ride upon shafting in motion.

(2) In every factory suitable devices for cutting off power in emergencies from running machinery shall be provided and maintained in every workroom:

(3) When a device, which can inadvertently shift from “off” to “on” position, is provided in a factory to cut off power, arrangements shall be provided for locking the device in safe position to prevent accidental starting of the transmission machinery or other machines to which the device is fitted

39. Self-acting machines- under serial no. 5 in the second schedule under clause (f) of sub-section (2) of section 18

No traversing part of a self-acting machine in any factory and no material carried thereon shall, if

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the space over which it runs is a space over which any person is liable to pass, whether in the course of his employment or otherwise, be allowed to run on its outward or inward traverse within a distance of forty-five centimetres from any fixed structure which is not part of the machine:

40. **Casing of new machinery**- under serial no. 6 in the second schedule under clause (f) of sub-section (2) of section 18

In all machinery driven by power and installed in any factory—

(a) every set screw, bolt or key on any revolving shaft, spindle, wheel or pinion shall be so sunk, encased or otherwise effectively guarded as to prevent danger;

(b) all spur, worm and other toothed or friction gearing which does not require frequent adjustment while in motion shall be completely encased, unless it is so situated as to be as safe as it would be if it were completely encased.

41. **Revolving machinery**- under serial no. 10 in the second schedule under clause (f) of sub-section (2) of section 18

(1) In every factory in which the process of grinding is carried on there shall be permanently affixed to or placed near each machine in use a notice indicating the maximum safe working peripheral speed of every grindstone 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.

(2) The speeds indicated in notices under para (1) shall not be exceeded.

(3) Effective measures shall be taken in every factory to ensure that the safe working peripheral speed of every revolving vessel, cage, basket, fly-wheel, pulley, disc or similar appliance driven by power is not exceeded.

42. **Pressure plant** - under serial no. 11 in the second schedule under clause (f) of sub-section (2) of section 18

(1) If any plant or machinery or any part thereof is operated at a pressure above atmospheric pressure, effective measures shall be taken to ensure that the safe working pressure of such plant or machinery or part is not exceeded.

(2) Exceptions.- Nothing in this standard shall apply to –

(a) vessels made of ferrous materials having an internal operating pressure not exceeding one kilogram per square centimetre.

(b) steam boilers, steam and feed pipes and their fittings coming under the purview of Indian Boilers Act, 1923.

(c) metal bottles or cylinders used for storage or transport of compressed gases or liquefied or dissolved gases under pressure covered by the Gas Cylinder Rules, 2016 framed under the Indian Explosives Act, 1884.

(d) vessels in which internal pressure is due solely to the static head of liquid.

(e) vessels with a nominal water capacity not exceeding five hundred litres connected in a water-pumping system containing air that is compressed to serve as a cushion.

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(f) vessels for nuclear energy application.

(g) refrigeration plant having a capacity of three tons or less of refrigeration in twenty four hours; and

(h) working cylinders of steam engines or prime movers, feed pumps and steam traps; turbine casings; compressor cylinders; steam separators or dryers; steam strainers; steam de-super-heaters; oil separators; air receivers for fire sprinkler installations; air receivers of monotype machines provided the maximum working pressure of the air receiver does not exceed 1.33 kilograms per square centimetre and the capacity 85 litres; air receivers of electrical circuit breakers; air receivers of electrical relays; air vessels on pumps, pipe coils, accessories of instruments and appliances such as cylinders and piston assemblies used for operating relays and interlocking type of guards; vessels with liquids subjected to static head only; and hydraulically operating cylinders other than any cylinder communicating with an air loaded accumulator.

(3)Every pressure vessel or plant used in a factory shall conform to the relevant National Standard and -

(a) shall be properly designed on sound engineering practice.

(b) shall be of good construction, sound material, adequate strength and free from any patent defects; and

(c) shall be properly maintained in a safe condition.

(4) Safety devices. - Every pressure shall be fitted with -

(a) a suitable safety valve, rupture disc or other effective pressure relieving device of adequate capacity to ensure that the maximum permissible working pressure of the pressure vessel shall not be exceeded. It shall be set to operate at a pressure not exceeding the maximum permissible working pressure and when more than one protective device is provided, only one of the devices need be set to operate at the maximum permissible working pressure and the additional device shall be set to discharge at a pressure not more than 5 per cent in excess of the maximum permissible working pressure;

(b) a suitable pressure gauge with a dial range not less than 1.5 times the maximum permissible working pressure, easily 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;

(c) The pressure gauge shall be calibrated once in a period of twelve months and the records of the same be maintained.

(d) a suitable stop valve or valve by which the pressure vessel may be isolated from other pressure vessels or 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

(e) a suitable drain cock or valve at the lowest part of the pressure vessel for the discharge of the liquid or other substances that may collect in the pressure vessel:

(5) 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

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valve or other suitable automatic device to prevent the maximum permissible working pressure of the pressure vessel 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.

(6) No new pressure vessel or plant shall be taken into use in the factory unless it has been hydrostatically tested by a competent person at a pressure as given in manufacturer's instruction manual.

(7)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 the competent person at a pressure 1.25 times the design pressure or 1.5 times the maximum permissible working pressure, whichever is less or as stated in manufacturers instruction manual.

(8) The pressure vessel or plant which is so designed and constructed that it cannot be safely filled with water or liquid or is used in service when even some traces of water cannot be tolerated, shall be pneumatically tested at a pressure not less than the maximum permissible working pressure.

(9) The pressure vessel or plant, which is lined with glass, shall be tested hydrostatically or pneumatically as required at a pressure not less than the maximum permissible working pressure.

Provided, however, that the pressure vessel or plant which is so designed and constructed that it cannot be safely filled with water or liquid or is used in service when even some traces of water cannot be tolerated, shall be pneumatically tested at a pressure not less than the maximum permissible working pressure.

Provided further that the pressure vessel or plant, which is lined with glass, shall be tested hydrostatically or pneumatically as required at a pressure not less than the maximum permissible working pressure.

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

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(11) In-service test and examinations. -

(a) Every pressure vessel or 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 or plant, a thorough internal examination is not possible, this examination may be replaced by a hydrostatic test which shall be carried out once in every period of two years.

Provided further that for a pressure vessel or plant in continuous process which cannot be frequently opened, the period of internal examination may be extended to four years; and

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

Provided that in respect of a pressure vessel or plant with thin walls, such as sizing cylinder made of copper or any other non- ferrous metal, periodic hydrostatic test may be dispensed with subject to the condition that the requirements laid down in para (8) are fulfilled.

Provided further that when it is impracticable to carry out thorough external examination of any pressure vessel or plant every six months as required in sub-para (i), or if owing to its construction and use a pressure vessel or plant cannot be hydrostatically tested as required in sub-para (ii)and (iii), a thorough external examination of the pressure vessel or plant shall be carried out at least once in every period of two years, and at least once in every period of four years a thorough 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 or plant shall be carried out.

non-ferrous metal, the maximum permissible working pressure shall be reduced at the rate of 5 percent of the original maximum permissible working pressure for every year of its use after the first five years and no such cylinder shall be allowed to continue to be used for more than twenty years after it was first taken into use.

(b) If any information as to the date of construction, thickness of walls, or maximum permissible working pressure is not available, the age of such pressure vessel or plant shall be determined by the competent person in consultation with the Chief Inspector-cum-Facilitator from the other particulars available with the manager.

(c) Every new and second hand pressure vessel or plant of thin walls to which repairs likely to affect its strength or safety have been carried out, shall be tested before use to at least 1.5 times its maximum permissible working pressure.

(12) Report by competent person. -

(a) If during any examination any doubt arises as to the ability of the pressure vessel or plant to work safely until the next prescribed examination, the competent person shall enter in the prescribed register his observations, findings and conclusions with other relevant remarks with reasons and may authorise the pressure vessel or plant to be used and kept in operation subject to

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a lowering of maximum permissible working pressure, or to more frequent or special examination or test, or subject to both of these conditions.

(b) A report of every examination or test carried out shall be completed in Form 2 and shall be signed by the person making the examination or test, and shall be kept available for perusal by the Inspector-cum-Facilitator at all hours when the factory or any part thereof is working.

(c) Where the report of any examination under this standard specified any condition for securing the safe working of any pressure vessel or plant, the pressure vessel or plant shall not be used unless the specified condition is fulfilled.

(d) The competent person making report of any examination under this standard, shall within seven days of the completion of the examination, send to the Inspector-cum-Facilitator a copy of the report in every case where the maximum permissible working pressure is reduced or the requirements of any other law in force.

(e) Certificates or reports of any examination, or test of any pressure vessel or plant to which paras (7) to (11) do not apply, conducted or required to be conducted under any other law in force and other relevant record relating to such pressure vessel or plant, shall be maintained.

43. **Water-sealed gasholder**- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

1) The expression "gasholder" means a water-sealed gasholder, which has a storage capacity of not less than 150 cubic meters.

(2)Every gasholder shall be of adequate material and strength, sound construction and properly maintained.

(3) Where there is more than one gasholder in a factory, every gasholder shall be with a distinguishing number or letter.

(4)Every gasholder shall be thoroughly examined externally by a competent person at least once in a period of twelve months.

(5) All possible steps shall be taken to prevent or minimise ingress of impurities in the gasholder.

(6) No gasholder shall be repaired or demolished except under the direct supervision of a person who, by his training, experience, and knowledge of the necessary precautions against risks of explosion and of persons being overcome by gas, is competent to supervise such work.

44. **Hoists and lifts**- under serial no. 8 in the second schedule under clause (f) of sub-section (2) of section 18

(1) In every factory
(a) every hoist shall be: -

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(i) of good mechanical construction sound material and adequate strength.
(ii) properly maintained and shall be thoroughly examined by a competent person at least once in every period of six months, and a register shall be kept containing the prescribed particulars of every such examination.
(iii) A register shall be maintained to record particulars of examination of hoists and lifts and shall give particulars as shown in Form 6.

(b) every hoist way and lift way shall be sufficiently protected by an enclosure fitted with gates, and the hoist or lift and every such enclosure shall be so constructed as to prevent any person or thing from being trapped between any part of the hoist or lift and any fixed structure or moving part.

(c) the maximum safe working load shall be plainly marked on every hoist or lift, and no load greater than such load shall be carried thereon.

(d) a hoist authorised and certified for the conveyance of the persons on the platform or cage and a notice stating the maximum number of persons to be carried on such hoist at one time shall be displayed in conspicuous location.

(e)the cage of every hoist or lift used for carrying persons shall be fitted with a gate on each side from which access is afforded to a landing.

(f) every gate referred to in para (b) and para (d) shall be fitted with inter-locking or other efficient device to secure that the gate cannot be opened except when the cage is at the landing and that the cage cannot be moved unless the gate is closed.

(2) The following additional requirements shall apply to hoists and lifts used for carrying persons

(a) where the cage is supported by rope or chain, there shall be at least two ropes or chains separately connected with the cage and balance weight, and each rope or chain with its attachments shall be capable of carrying the whole weight of the cage together with its maximum load.
(b) the guides of hoist platforms offer sufficient resistance to bending and, to bucking, in the case of jamming, by providing a safety catch.
(c) efficient devices shall be provided and maintained capable of supporting the cage together with its maximum load in the event of breakage of the ropes, chains, and attachments.
(d) an efficient automatic device shall be provided and maintained to prevent the cage from over-running.
(e) outdoor hoist towers are erected on adequately firm foundations and are securely braced, guided, and anchored.
(f) electrical equipment of a hoisting engine is effectively earthed.
(g) a hoist is provided with suitable devices to stop a hoisting engine as soon as the platform of such hoist reaches its highest stopping place.
(h) a platform of a hoist is equipped with suitable safety gear which can hold such platform with its maximum load in case its hoisting rope breaks

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(i) a hoisting engine is protected by a suitable cover against weather and falling objects.
(j) a platform of a hoist is capable of supporting such maximum load, that such platform may carry, with a safety factor of at least three;

45. Lifting machines, chains, ropes, lifting tackles and loose gears- under serial no. 9 in the second schedule under clause (f) of sub-section (2) of section 18.

1) All lifting appliances, including their parts and working gear, whether fixed or moveable and any plant or gear used in anchoring or fixing of such appliances, are-
   a) of sound construction, sound material, and of adequate strength to serve the purpose for which these are to be used and all such appliances shall be free from patent defects; and
   b) maintained in good repair and working condition.
2) Every drum or pulley around which the rope of any lifting appliance is carried, shall be of adequate diameter and sound construction in relation to such rope;
3) Any rope which terminates at the winding drum of a lifting appliance shall be securely attached to such drum and at least three dead turns of such rope remain on such drum in every operating position of such lifting appliance;
4) The flange of drum shall project twice the rope diameter beyond the last layer of such rope and if such projection is not available, other measures like anti-slackness guards shall be provided to prevent such rope from coming off such drum;
5) Every lifting appliance is provided with adequate and efficient brakes which-
   a) are capable of preventing fall of a suspended load (including any test load) and of effectively controlling such load while it is being lowered;
   b) act without shock.
   c) have shoes that can be easily removed for running; and
   d) are provided with simple and easily accessible means of adjustment:

   Provided that nothing contained in this clause shall apply to steam winch which can be operated as safely as with brakes as provided in accordance with this clause.

6) Controls of every lifting appliance shall be situated in such manner that the driver of such appliance at his stand or seat has ample room for operating and has an unrestricted view as far as practicable, and that he remains clear of the load and ropes, and that no load passes over him;

7) Test and periodical examination of lifting appliances, loose gears and lifting tackles: The employer shall ensure at any factory that

   (a) all lifting appliances including all parts, loose gears and lifting tackles, whether fixed or moveable, are tested and examined by a competent person before being taken into use for the first time or after it has undergone any alterations or repairs liable to affect its strength or stability and also once at least in every five years, in the manner specified in Schedule I annexed to this para and certificate of the same

shall be maintained in Form 3, Form 4 and Form 5 accordingly attached to this Standard;

(b) all lifting appliances are thoroughly examined by a competent person once at least in every twelve months and where the competent person making such examination forms the opinion that the lifting appliance cannot continue to function safely, he shall forthwith give notice in writing of his opinion to the owner of the lifting appliance.

Explanation: -For the purpose of this rule, thorough examination means a visual examination, supplemented, if necessary, by other means such as hammer test, carried out as carefully as the conditions permit, in order to arrive at a reliable conclusion as to the safety of the parts examined; and, if necessary, for such examination, parts of the lifting appliance and gear, shall be dismantled.

SCHEDULE

MANNER OF TEST AND EXAMINATION BEFORE TAKING LIFTING MACHINE, LIFTING GEAR AND WIRE ROPE INTO USE FOR THE FIRST TIME.

Test Loads:

1. Lifting Machines—Every lifting appliance with its accessory gear, shall be subjected to a test load which shall exceed the safe working load (SWL) as specified in the following table:

TABLE

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

2. Lifting gear and shackle—
   a) Every ring, hook, chain, shackle, swivel, eye-bolt, plate clamp, triangular plate or pulley block (except single sheave block) shall be subjected to a test load which shall not be less than the load as specified in the following table:

TABLE

Safe Working load (in tonnes)	Test load (in tonnes)
Up to 25	2 x safe working load
above 25	(1.22 x safe working load) + 20

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

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

TABLE

Safe Working load (in tonnes)	Test load (in tonnes)
Up to 25	2 x safe working load
25 to 160	(0.9933 x safe working load) + 27
above 160	1.1 x safe working load

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

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

f) In the case of a sling having two legs, the safe working load shall be calculated when the angle between the legs is 90 degrees. In case of multi-legged slings, the safe working load shall be calculated as per National Standards.

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

TABLE

Proposed Safe Working load (intonnes)	Test load (in tonnes)
Up to 10	2 x safe working load
10 to 160	(1.04 x safe working load) + 9.6
above 160	1.1 x safe working load

h) Wire ropes—In the case of wire ropes a sample shall be tested to destruction. The test procedure shall be in accordance with recognised national standards. The safe working load of the rope is to be determined by dividing the load at which the sample broke by a co-efficient of utilisation, determined as specified in the following table:

TABLE

Item		Co-efficient of utilisation
(1)		(2)
(a)	Wire Rope forming part of Sling. Safe working load of the Sling: Safe working load up to and equal to 10 tonnes. Safe working load above 10 tonnes and up to and equal to 160 tonnes.	$\frac{5}{10}$ / (8.85 x SWL) + 1910

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	Safe working load above 160 tonnes.	3
(b)	Wire Rope as integral part of a Lifting Appliance: SWL of the lifting appliance: Safe working load upto and equal to 160 tonnes.	$\frac{10}{(8.85 \times SWL) + 1910}$
	Safe working load above 160 tonnes.	3

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

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

Procedure for testing:

3. Derricks—

a) A derrick shall be tested with its boom at the minimum angle to the horizontal for which the derrick is designed (generally 15 degrees) or at such greater angle as may be agreed. The angle at which the test has been carried out shall be mentioned in the test certificate. The test load shall be applied by hoisting moveable weights. During the test, the boom shall be swung with the test load, as far as practicable, in both directions.

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

c) While test loading of a heavy lift derrick, the competent person responsible for tests using moveable weights shall ascertain from the owner of the vessel or floating platform that the stability of the vessel or platform is adequate for the test.

4. The derricks tested under clause (3) shall not be used in union purchase rig unless:

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

b) the safe working load of that derrick in union purchase rig has also been specified by a competent person in a report in Form V;

c) any limitations or conditions specified in the said report are complied with; and

d) the two hoist ropes are coupled together by a suitable swivel assembly.

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

5. Lifting appliances—
   a) The test load shall be lifted and swung, as far as possible, in both directions. If the jib or boom of the crane has a variable radius, it shall be tested with test loads at the maximum and minimum radii. In case of hydraulic cranes when owing to the limitation of pressure, it is impossible to lift a test load in accordance with table under item (1), it will be sufficient to lift the greatest possible load which shall be more than safe working load.
   b) The test shall be performed at maximum, minimum and intermediate radius points as well as such points in the are of rotation, as the competent person may decide. The test shall consist of hoisting, lowering, breaking and swinging and swinging through all positions and operations normally performed. An additional test shall be made by operating the machinery at maximum working speed with the safe working load suspended.

6. Use of spring or hydraulic balances, etc. for test loading—All tests shall normally be carried on with the help of dead weights. In case of periodical test, replacements or renewal, test load may be applied by means of suitable springs or hydraulic balances. In such case, test load shall be applied with the boom, as far out as practicable, in both directions. The test shall not be taken as satisfactory unless the balance has been certified for accuracy by the competent authority within 2.0 per cent and the pointer of the machine has remained constant at the test load for a period of at least five minutes.

7. Testing machines and dead weights—
   a) A suitable testing machine shall be used for testing of chains, wire ropes and other lifting gears.
   b) Testing machines and balances to be used in test loading, testing, and checking shall not be used unless they have been certified for accuracy at least once in the preceding twelve months by the competent authority
   c) Moveable weights used for the test loading of the lifting appliances having a safe working load not exceeding twenty tonnes shall be checked for accuracy by means of suitable weighing machine of certified accuracy.
8. Thorough examination after testing or test loading After being tested or test loaded, every lifting appliance and associated gear shall be thoroughly examined to see that no part has been damaged or permanently deformed during the test. For this purpose, the lifting appliance or gear shall be dismantled to the extent considered necessary by the competent person.

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8) Automatic safe load indicators:-

(a) The employer shall ensure that in any factory —

(i) every crane, if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise, is attached with a automatic indicator of safe working loads which gives a warning to the operator wherever the load exceeds the safe working load;

(ii) cut-out is provided which automatically arrests the movements of the lifting parts of every crane if the load exceeds the safe working load, wherever possible.

(b) the provisions of sub-clause (i) of clause (a) apply, except where it is not possible to install an automatic safe load indicator, in which case, provision of a table showing the safe working loads at the corresponding inclinations or radii of the jib on the crane shall be considered sufficient.

9) Installation: - The employer shall ensure that in any factory –

(a) fixed lifting appliances are installed.

(i) by competent persons.

(ii) in a manner that such appliances cannot be displaced by the load, vibration, or other influences.

(iii) in a manner that the operator of such appliances is not exposed to danger from loads, ropes, or drums; and

(iv) in a manner that the operator can either see over the zone of operation or communicate with all loading and unloading points by signal, or other communication systems.

(b) adequate clearance is provided between parts or loads of lifting appliances, and-

(i) the fixed objects such as walls and posts; or

(ii) electrical conductors.

(c) the lifting appliances, when exposed to wind loading are given sufficient additional strength, stability and rigidity to withstand such loading safely. (d) no structural alterations or repairs are made on any part of the lifting appliances that affect the safety of such appliances without obtaining the opinion of the competent person to this effect.

10) Winches: - The employer shall ensure that in any factory –

(a)

(i) winches are not used if control levers operate with excessive friction or play.

(ii) double gear winches are not used unless a positive means of locking the gear shift is provided.

(iii) there is no load other than the fall and the hook assembly on the winch while changing gears on a two-gear winch.

(iv) adequate protection is provided to winch operator against abnormal weather.

(v) temporary seats or shelters for winch operators which may pose hazard to the winch operator or any other building workers are not allowed to be used.

(vi) control levers are secured in the neutral position and, whenever possible, the power is shut-off whenever winches are left unattended.

(b) in use of every steam winch-

(i) measures are taken to prevent escaping steam from obscuring any part of the construction site or other workplace or from otherwise hindering or injuring any worker.

(ii) extension control levers which tend to fall of their own weight are counter-balanced.

(iii) winch operators are not permitted to use the winch control extension levers except for

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short handles on wheel type controls and that such levers are of adequate strength, secure and fastened with metal connections at the fulcrum and at the permanent control lever.

11) Identification and marking of safe working load: -

The employer shall ensure that in any factory –

(a) every lifting appliance and loose gear is clearly marked for its safe working load and identification by stamping or other suitable means.

(b)

(i) every derrick (other than derrick crane) is clearly marked for its safe lower working load when such derrick is used either in single purchase with lower block or in union purchases in all possible block positions.

(ii) the lowest angel to the horizontal, to which the derrick may be used, is legibly marked.

(c) every lifting appliance having more than one working load is fitted with effective means to enable the operator to determine safe working load at each point under all conditions of use.

(d) means to ascertain the safe working load for lifting gears under such conditions in which such gears may be used are provided to enable a worker using such gears and such means shall consist of—

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

(ii) either the means specified in sub-clause (i) or notices so exhibited as can be easily read by any concerned employee stating the safe working load for the various sizes of the wire rope slings used in case of wire rope slings

12) Loading of lifting appliances and lifting gears: -

The employer shall ensure that in any factory –

a. no lifting appliance, lifting gear or wire rope is used in an unsafe way and in such a manner as to involve risk to life of building workers, and that they are not loaded beyond their safe working load except for testing purposes under the direction of a competent person in the manner as specified in Schedule I annexed to these rules.
b. no pulley block is used in any factory unless the safe working load and its identification are clearly marked on such block

13) Operator's cab or cabin: - The employer shall ensure that in any factory the operator of every lifting machine in outdoor service is provided with a cab or cabin which—

(i) is made of fire-resistant material;

(ii) has a suitable seat, a footrest and protection from vibration;

(iii) affords the operator an adequate view of the area of operation;

(iv) affords the necessary access to working parts in cab;

(v) affords the operator adequate protection against the weather; (

vi) is adequately ventilated; and

(vii) is provided with a suitable fire extinguisher.

14) Operation of lifting appliances:- The employer shall ensure that in any factory –

a. every crane driver or lifting operator possess adequate skill and training in the operation of the particular lifting appliance;
b. no person under eighteen years of age is in control of any lifting appliance, scaffold

winch, or to give signals to the operator;

c. precaution is taken by the trained operator to prevent lifting appliance from being set in motion;
d. the operation of lifting appliance is governed by signals, in conformity with the relevant national standards;
e. the lifting appliance operator‘s attention is not distracted while he is working;
f. no crane, hoist, winch or other lifting appliance or any part of such crane, hoist, winch or other lifting appliance is, except for testing purposes, loaded beyond the safe working load;
g. during the hoisting operations effective precaution is taken to prevent any person from standing or passing under the load in such operations;
h. operator does not leave lifting appliance unattended while power is on or load is suspended to such appliance;
i. no person rides on a suspended load or on any lifting appliance;
j. every part of a load in course of being hoisted or lowered is adequately suspended and supported to prevent danger;
k. every receptacle used for hoisting bricks, tiles, slates or other material is suitably enclosed as to prevent the fall of any such materials; the hoisting platform is enclosed when loose materials or loaded wheel-barrows, are placed directly on such platform or lowering, such materials or wheel-barrows;
l. no material is raised, lowered or slowed with any lifting appliance in such a way as to cause sudden jerks to such appliance;
m. in hoisting a barrow, any wheel of such barrow is not used as a means of support unless adequate steps are taken to prevent the axle of such wheel from slipping out of its bearings;
n. long objects like planks or girders are provided with a tag line to prevent any possibility of danger while raising or lowering such objects;
o. during the process of landing of material, a building worker is not permitted to lean out into empty space for finding out the loading and unloading of such material;
p. the hosting of loads at places where there is regular flow of traffic is carried out in an enclosed space, or in case such hoisting is impracticable in enclosed space, measures are taken to hold up or divert the traffic during the time of such hoisting;
q. adequate steps are taken to prevent a load, in the course of being hoisted or lowered from coming into contact with any object to avoid any displacement of such load;
b) (s) appliances are provided and used for guiding heavy loads when raising or lowering heavy loads to avoid crushing of hands of building workers during such raising or lowering of loads.

46. **Power press-** under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) The shall apply to all types of power presses including press brakes, except when used for working hot metal.

(2) Starting and stopping mechanism. -The starting and stopping mechanism shall be provided with a safety stop so as to prevent over running of the press or descent of the ram during tool

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setting, etc.

(3) Protection of tool and die. -

(a) Each press shall be provided with a fixed guard with a slip plate on the underside enclosing the front and all sides of the tool.

(b) Each die shall be provided with a fixed guard surrounding its front and sides, and extending to the back in the form of a tunnel through which the pressed article falls to the rear of the press.

(c) The design, construction and mutual position of the guards referred to in (1) and (2) shall be such as to preclude the possibility of the worker's hand or fingers reaching the danger zone.

(d) The machine shall be fed through a small aperture at the bottom of the die guard, but a wider aperture may be permitted for second or subsequent operations if feeding is done through a chute.

(e) Notwithstanding anything contained in sub-paras (1) and (2) an automatic or an inter-locked guard may be used in place of a fixed guard, but where such guards are used they shall be maintained in an efficient working condition and if any guard develops a defect, the power press shall not be operated unless the defect of the guard is removed

(4) Appointment of persons to prepare power presses for use. -

(a) Except as provided in para (3), no person shall set, re-set, adjust or try out the tools on a power press or install or adjust any safety device thereon, being installation or adjustment preparatory to production of die proving, or carry out an inspection and test of any safety device thereon required by para 8 unless he -

i) has attained the age of eighteen; and

ii) has been appointed by the occupier of the factory to carry out those duties in respect of the class or description of power press or the class or description of safety device to which the power press or safety device (as the case may be) belongs; and the name of every such person shall be entered in a register in Form 7 attached to this standard.

(b) The training shall include suitable and sufficient practical instruction in the matter in relation to each type of power press and safety device in respect of which it is proposed to appoint the person being trained.

(5) Examination and testing of power presses and safety devices. -

(a) No power press or safety device shall be taken into use in any factory for the first time in that factory, or in case of a safety device for the first time on any power press, unless it has been thoroughly examined and tested, in the case of a power press, after installation in the factory, or in the case of a safety device, when in position on the power press in connection with which it is to be used.

(b) No power press shall be used unless it has been thoroughly examined and tested by a competent person within the immediately preceding period of twelve months.

(c) No power press shall be used unless every safety device (other than fixed fencing) thereon

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has within the immediately preceding period if six months when in position on that power press, been thoroughly examined and tested by a competent person.

(d) The competent person carrying out an examination and test under the foregoing provisions shall make a report of the examination and test containing the following particulars and every such report shall be kept readily available for inspection:

(i) name of the occupier of the factory;
(ii) address of the factory;
(iii) identification number or mark sufficient to identify the power press or the safety device;
(iv) date on which the power press or the safety device was first taken into use in the factory;
(v) the date of each periodical thorough examination carried out as per requirements of sub-para (2) above;
(vi) particulars of any defects effecting the safety working of the power press or the safety device found at any such thorough examination and steps taken to remedy such defects.

(6) Defects disclosed during a thorough examination and tests. -

(a) Where any defect is disclosed in any power press or in any safety device by any examination and test under para 6 and in the opinion of the competent person carrying out the examination and test, either -

(i) the said defect is a cause of danger to workers and in consequence the power press or safety device (as the case may be) ought not to be used until the said defect has been remedied; or
(ii) the said defect may become a cause of danger to workers and in consequence the power press or safety device (as the case may be) ought not to be used after the expiration of a specified period unless the said defect has been remedied.

such defect shall, as soon as possible after the completion of the examination and test, be notified in writing by the competent person to the occupier of the factory and, in the case of a defect falling within sub-para (ii) of this sub-para such notification shall include the period within which, in the opinion of the competent person, the defect ought to be remedied.

(b) In every case where notification has been given under this standard, a copy of the report made under para 6(d) shall be sent by the competent person to the Inspector cum Facilitator for the area within fourteen days of the completion of the examination and test.

(c) When any such defect is notified to the occupier in accordance with the foregoing provisions of this standard, the power press or safety device (as the case may be) having the said defect shall not be used -

(i) in the case of a defect falling within sub-para (a) (i) until the said defect has been remedied; and
(ii) in the case of defect falling within sub-para (a) (ii), after the expiration of the said

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defect has been remedied.

(d) As soon as is practicable after any defect of which notification has been given under sub-para (a) has been remedied, a record shall be made by or on behalf of the occupier stating the measures by which and the date on which the defect was remedied.

(7) Inspection and test of safety devices. -

(a) No power press shall be used after the setting, resetting or adjustment of the tools thereon unless a person appointed or authorised for the purpose under para (5) has inspected and tested every safety device thereon while it is in position on the said power press :

Provided that an inspection, test and certificate as aforesaid shall not be required where any adjustment of the tools has not caused or resulted in any alteration to or disturbance of any safety device on the power press and if, after the adjustment of the tools, the safety devices remain, in the opinion of such a person as aforesaid, in efficient working order.

(b) Every power press and every safety device thereon while it is in position on the said power press shall be inspected and tested by a trained person every day.

(8) Defects disclosed during an inspection and test. -

(a) Where it appears to any person as a result of any inspection and test carried out by him under para (7) that any necessary safety device is not in position or is not properly in position on a power press or that any safety device which is in position on a power press is not in his opinion suitable, he shall notify the manager forthwith.

(b) Except as provided in sub-para (a) where any defect is disclosed in a safety device by any inspection and test under para8, the person carrying out the inspection and test shall notify the manager forthwith.

(c) Where any defect in a safety device is the subject of a notification in writing under para (6) by virtue of which the use of the safety device may be continued during a specified period without the said defect having been remedied, the requirement in sub-para (b) shall not apply the said defect until the said period has expired.

(9) Identification of power presses and safety devices. - For the purpose of purpose of identification every power press and every safety device provided for the same shall be distinctively and plainly marked.

(10) General Safety Requirements:

(a)Power presses Machines are compliant with National Standards.

(b)Regular maintenance and repair of the machines shall be carried out as per OEM guidelines

(c) safety Critical equipment with respect to power presses e.g. sensors or springs, machine guards shall be provided and ensured functional throughout the operation of the machine.

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(11) Training and instructions to operators. - The operators shall be trained and instructed in the safe method of work before starting work on any power press.

47. Shears, slitters and guillotine machines- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Guillotine and Shears. -

(a) Where practicable, a barrier metal guard of adequate strength shall be provided at the front of the knife, fastened to the machine frame and shall be so fixed as would prevent any part of the operator's body to reach the descending blade from above, below or through the barrier guard or from the side;

Provided that in case of machines used in the paper printing and allied industries, where a fixed barrier metal guard is not suitable on a account of the height and volume of the material being fed, there shall be provided suitable starting devices which require simultaneous action of both the hands of the operator or an automatic device which will remove both the hands of the operator from the danger zone at every descent of the blade.

(b) At the back and of such machines, an inclined guard shall be provided over which the slit pieces would slide and be collected at a safe distance in a manner as would prevent a person at the back from reaching the descending blade.

(c) Power-driven guillotine cutters, except continuous feed trimmers, shall be equipped with -

i) starting devices which require the simultaneous action of both hands to start the cutting motion and of at least one hand on a control during the complete stroke of the knife; or

ii) An automatic guard which will remove the hands of the operator from the danger zone at every descent of the blade, used in con- junction with one-hand starting devices which require two distinct movements of the device to start the cutting motion, and so designed as to return positively to the non-starting position after each complete cycle of the knife.

(d) Where two or more workers are employed at the same time on the same power-driven guillotine cutter equipped with two-hand control, the device shall be so arranged that each worker shall be required to use both hands simultaneously on the safety trip to start the cutting motion, and at least one hand on a control to complete the cut.

(e) Power-driven guillotine cutters, other than continuous trimmer, shall be provided, in addition to the brake or other stopping mechanism, with an emergency device which will prevent the machine from operating in the event of failure of the brake when the starting mechanism is in the non-starting position.

(2) Slitting Machines. -

(a) Circular disc-type knives on machines for cutting metal and leather, paper, rubber, textiles or other non-metallic substances shall, if within reach of operators standing on the floor or working level, be provided with guards enclosing the knife edges at all times as near as practicable to the surface of the material, and which may either-

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i) Automatically adjust themselves to the thickness of the material; or
ii) be fixed or manually adjusted so that the space between the bottom of the guard and the material will not exceed 6 mm at any time.

(b) Portions of blades underneath the tables or benches of slitting machines shall be covered by guards.

(3) Index cutters and Vertical Paper Slotters. - Index cutters, and other machines for cutting strips from the ends of books, and for similar operations, shall be provided with fixed guards, so arranged that the fingers of the operators cannot come between the blades and the tables.

(4) Corner Cutters.- Corner cutters used in the manufacture of paper boxes, shall be equipped with -

(a) suitable guard, fastened to the machines in front of the knives and provided with slots or perforations to afford visibility of the operations; or

(b) other guards equally efficient for the protection of the fingers of the workers.

(5) Band Knives. - Band wheels on band knives, and all portions of the blades except working side between the sliding guide and the table on vertical machines, or between the wheel guards on horizontal machines, shall be completely enclosed with hinged guards of sheet metal not less than 1 mm in thickness or of other material of equal strength.

48. **Centrifugal machines**- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Every part of centrifugal machine shall be -
(a) of good design and construction and of adequate strength;
(b) properly maintained; and
(c) examined thoroughly by a competent person at regular intervals.

(2) Inter-locking guard for drum or basket. -

(a) The cage housing, the rotating drum or basket of every centrifugal machine shall be provided with a strong lid. The design and construction of the cage as well as lid shall be such that no access is possible to the drum or basket when the lid is closed.

(b) Every centrifugal machine shall be provided with an efficient interlocking device that will effectively prevent the lid referred to in sub-para (a) from being opened while the drum or basket is in motion and prevent the drum or basket being set in motion while the lid is in the open position.

(3) Braking arrangement. - Every centrifugal machine shall be provided with an effective braking arrangement capable of bringing the drum or basket to rest within as short a period of time as reasonably practicable after the power is cut off.

(4) Operating speed. - No centrifugal machine shall be operated at a speed in excess of the manufacturer's rating which shall be legibly stamped at easily visible places both on the inside of

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the basket and on the outside of the machine casing.

49. Textile machinery except machinery used in jute mills- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to machinery in factories engaged in the manufacture or processing of textiles other than jute textiles. The standard would not apply to machinery in factories engaged exclusively in the manufacture of synthetic fibres.

(2) General safety requirements.-

a) Every textile machine shall be provided with individual mechanical or electrical means for starting and stopping such machines. Belt shifter on machines driven by belts and shafting shall be provided with a belt shifter lock of an equivalent positive locking device.
b) Stopping and starting handles or other controls shall be of such design and so positioned as to prevent the operator's hand or fingers from striking against any moving part of any other part of the machine.
c) All belts, pulleys, gears, chains, sprocket wheels, and other dangerous moving parts of machinery which either form part of the machinery or are used in association with it, shall be securely guarded.

d) Openers and pickers. -

(i) In all opening or picker machinery, beaters and other dangerous parts shall be securely fenced by suitable guards so as to prevent contact with them. Such guards and doors or covers or openings giving access to any dangerous part of the machinery shall be provided with interlocking arrangement.
(ii) Provided that in the case of doors or covers of openings giving access to any dangerous part, other than beater covers, instead of the interlocking arrangement, such openings may be so fenced by guards which prevent access to any such dangerous part and which is either kept positively locked in position or fixed in such a manner that it cannot be removed without the use of hand tools.

(iii) The feed rolls on all opening and picking machinery shall be covered with a guard designed to prevent the operator from reaching the nip while the machinery is in operation.

(iv) The lap forming rollers shall be fitted with a guard or cover, which shall prevent access to nip at the intake of the lap roller and fluted roller as long as the weighted rack, is down. The guard or cover shall be so locked that it cannot be raised until the machine is stopped, and the machine cannot be started until the cover or guard is closed.

Provided that the foregoing provision shall not apply to the machines equipped with automatic lap forming devices.

Provided further any such machine equipped with an automatic lap-forming device shall

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not be used unless the automatic lap forming device is in efficient working order.

e) Cotton cards. -

(i) All cylinder doors shall be secured by inter-locking arrangement which shall prevent the door being opened until the cylinder has ceased to revolve and shall render it impossible to restart the machine until the door has been closed.

Provided that the latter requirement in respect of the automatic locking device shall not apply while stripping or grinding operations are carried out;

Provided further that stripping or grinding operations shall be carried out only by specially trained adult workers wearing tight fitting clothing whose names have been recorded in the register prescribed in this behalf as required in sub-section (1) of section 22.

(ii) The licker-in shall be guarded so as to prevent access to the dangerous parts.

(iii) Every card shall be equipped with an arrangement that would enable the card cylinder to be driven by power during stripping/grinding operations without having to either shift the main belt to the fast pulley of the machine or to dismantle the interlocking mechanism. Such an arrangement shall be used only for stripping or grinding operations.

(3) Garnett machines. -

(a) Garnett licker-ins shall be enclosed.

(b) Garnet fancy rolls shall be enclosed by guards. These shall be installed in a way that keeps worker rolls reasonably accessible for removal or adjustment.

(c) The underside of the garment shall be guarded by a screen mesh or other form of enclosures to prevent access.

(4) Gill boxes. -

(a) The feed end shall be guarded so as to prevent fingers being caught in the pins of the intersecting fallers.

(b) All nips of in-running rolls shall be guarded by suitable nip guards conforming to the following specifications :-

Any opening which the guard may permit when fitted in position shall be so restricted with respect to the distance of the opening from any nip point through that opening and in any circumstances the maximum width of the opening shall conform to applicable National Standards.

(5) Sliver and ribbon lappers (cotton). - The calendar drums and the lap spool shall be provided with a guard to prevent access to the nip between the in-running rolls.

(6) Speed frames. - Jack box wheels at the head stock shall be guarded and the guard shall have interlocking arrangement.

(7) Spinning mules.- Wheels on spinning mule carriages shall be provided with substantial wheel guards, extending to within 6 mm of the rails.

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(8) Warpers. - Swivelled double-bar gates shall be installed on all warpers operating in excess of 410 meters/min. These gates shall have interlocking arrangement, except for the purpose of inching or jogging:

Provided that the top and bottom bars of the gate shall be at least 1 and 0.5 meters high from the floor or working platform, and the gate shall be located 38 mm from the vertical tangement to the beam head.

(9)Slashers. -

(a) Cylinder dryers. -

(i) All open nips of in-running rolls shall be suitably guarded.

(ii) When slashers are operated by control levers, these levers shall be connected to a horizontal bar or treadle located not more than 170 cm above the floor to control the operation from any point.

(iii) Slashers operated by push button control shall have stop and start buttons located at each end of the machine, and additional buttons located both sides of the machine at the size box and the delivery end. If calendar rolls are used, additional buttons shall be provided at both sides of the machine at points near the nips, except when slashers are equipped with an enclosed dryer.

(b) Enclosed hot air dryer. –

(i) All open nips of the top squeezing rollers shall be suitably guarded.

(ii) When slashers are operated by control levers, these levers shall be connected to a horizontal bar or treadle located not more than 170 cm. above the floor to control the operation from any point.

(iii) Slashers operated by push-button control shall have stop and start buttons located at each end of the machine and additional buttons located on both sides of the machine at the size box and the delivery end. If calendar rolls are used, additional buttons shall be provided at both sides of the machine at points near the nips, except when slashers are equipped with an enclosed dryer as in sub-para (ii).

(10) Looms. -

(a) Each loom shall be equipped with suitable guards designed to minimise the danger from flying shuttles.

(b) Beam weights for tension in beam shall be of such construction so as to prevent it falling during its adjustment.

(11) Valves of kiers, tanks, and other containers. -

Each valve controlling the flow of steam, injurious gases or liquids into a kier or any other tank or container into which a person is likely to enter in connection with a process, operation, maintenance or for any other purpose, shall be provided with a suitable locking arrangement to enable the said person to lock the valve securely in the closed position and retain the key with him before entering the kier, tank or container.

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(12)Shearing machines. - All revolving blades on shearing machines shall be guarded so that the opening between the cloth surface and the bottom of the guard will not exceed 10 mm.

(13) Continuous bleaching range (cotton and rayon). - The nip of all in-running rolls on open-width bleaching machine rolls shall be protected with a guard to prevent the worker from being caught at the nip. The guard shall extend across the entire length of the nip.

(14)Mercerizing range (piece goods). -

(a) A stopping device shall be provided at each end of the machine.
(b) A guard shall be provided at each end of the frame between the in-running chain and the clip opener.
(c) A nip guard shall be provided for the in-running rolls of the mangle and washers.

(15) Tender frames. -
(a) A stopping device shall be provided at each end of the machine.
(b) A guard shall be provided at each end of the machine frame at the in-running chain and clip opener.

(16) Paddlers. - Suitable nip guards conforming to the requirement in para (4) (b) shall be provided to all dangerous in-running rolls.

(17) Centrifugal extractors. -
(a) Each extractor shall be provided with a guard for the basket, and the guard shall have inter-locking arrangement.
(b) Each extractor shall be equipped with a mechanically or electrically operated brake to quickly stop the basket when the power driving the basket is shut off.

(18) Squeezer or wringer extractor, water mangle, starch mangle, back washer (worsted yarn) crabbing machines, and decanting machines. - All in-running rolls shall be guarded with nip guards conforming to the requirements in paragraph (4) (b).

(19) Sanforising and palmer machine. -

(a) Nip guards shall be provided on all accessible in-running rolls.
(b) Access from the sides to the nips of in-running rolls shall be fenced by suitable side guards.
(c) A safety trip rod, cable or wire centre cord shall be provided across the front and back of all palmer cylinders extending the length of the face of the cylinder. It shall operate readily whether pushed or pulled. This safety trip shall be not more than 170 cm. above the level at which the operator stands and shall be readily accessible.

(20) Rope washers. -

(a) Splash guards shall be installed on all rope washers unless the machine is so designed as to prevent the water or liquid from splashing the operator, the floor, or working surface.

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(b) A safety trip rod, cable or wire centre cord shall be provided across the front and back of all rope washers extending the length of the face of the washer. It shall operate readily whether pushed or pulled. This safety trip shall be not more than 170 cm. above the level on which the operator stands and shall be readily accessible.

(21) Laundry washer tumbler or shaker. -

(a) Each drying tumbler, each double cylinder shaker or clothes tumbler and each washing machine shall be equipped with an inter-locking arrangement which will prevent the power operation of the inside cylinder when the outer door on the case or shell is open and which will from being opened without shutting off the power and the cylinder coming to a stop. This should not prevent the movement of the inner cylinder by means of a hand operated mechanism or an inching device.

(b) Each closed barrel shall also be equipped with adequate means for holding open the doors or covers of the inner and outer cylinders or shells while it is being loaded or unloaded.

(22)Printing machine (roller type). -

(a) All in-running rolls shall be guarded by nip guards.
(b) The engraved roller gears and the large crown wheel shall be guarded.

(23) Calendars. - The nip at the in-running side of the rolls shall be provided with a guard extending across the entire length of the nip and arranged to prevent the fingers of the workers from being pulled in between the rolls or between the guard and the rolls, and so constructed that the cloth can be fed into the rolls safely.

(24) Rotary staple cutters. - The cutter shall be protected by a guard to prevent hands reaching the cutting zone.

(25) Plaiting machines. - Access to the trap between the knife and card bar shall be prevented by a guard.

(26) Hand baling machine. - An angle iron handle-stop guard shall be installed at right angle to the frame of the machine. The stop guard shall be so designed and so located that it will prevent the handle from travelling beyond the vertical position should the handle slip from the operator's hand when the pawl has been released from the teeth of the take-up gear.

(27)Flat-work ironer. - Each flat-work or collar ironer shall be equipped with a safety bar or other guard across the entire front of the feed or first pressure rolls so arranged that the striking of the bar or guard by the hand of the operator or other person will stop the machine. The guard shall be such that the operator or other person cannot reach into the rolls without removing the guard. This may be either a vertical guard on all sides or a complete cover. If a vertical guard is used, the distance from the floor or working platform to the top of guard shall be not less than 1.83 meters.

50. Cotton ginning- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of

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section 18

Line Shaft. - The line shaft or second motion in cotton ginning factories, when below floor level, shall be completely enclosed by a continuous wall or unclimbable fencing with only so many openings as are necessary for access to the shaft for removing cotton seed, cleaning and oiling; and such openings shall be provided with gates or doors which shall be kept closed and locked.

51. Woodworking machinery- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) An efficient stopping and starting device shall be provided on every woodworking 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.

(2) A clear space of at least 1 metre shall be provided around all sides of every woodworking machine in motion and shall be kept free from obstruction.

(3) The floor surrounding every woodworking machine shall be maintained in good and level condition, and shall not be allowed to become slippery, and as far as practicable shall be kept free from chips or other loose material.

(4)

(a) No person shall be employed at a woodworking machine unless he has been sufficiently trained to work that class of machine, or unless he works under the adequate supervision of a person who has a thorough knowledge of the working of the machine.

(b) A person who is being trained to work a woodworking machine shall be fully and carefully instructed as to the dangers of the machine and the precautions to be observed to secure safe working of the machine.

(5) Every circular saw shall be fenced as follows :-

(a) behind and in direct line with the saw there shall be riving knife, which shall have a smooth surface, shall be strong, rigid and easily adjustable, and shall also conform to the following conditions :-

(i) the edge of the knife nearer the saw shall form an arc of a circle having a radius of not exceeding the radius of the largest saw used on the bench;

(ii) the knife shall be maintained as close as practicable to the saw, having regard to the nature of work being done at the time, and at the level of the bench table the distance between the front edge of the knife and the teeth of the saw shall not exceed 12 millimetres; and

(iii) for a saw of diameter of less than 60 centimetres, the knife shall extend upwards from the bench table to within 25 millimetres of the top of the saw, and for a saw of diameter 60 centimetres or over shall extend upwards from the bench table to a height of at least 25 centimetres;

(b) The top of the saw shall be covered by a strong and easily adjustable guard, with a flange at the side of the saw farthest from the fence. The guard shall be kept so adjusted that the said flange shall extend below the roots of the teeth of the saw. The guard shall extend from the top of the riving knife to a point as low as practicable at the cutting edge of the

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saw; and

(c) The part of the saw below the bench table shall be protected by two plates of metal or other suitable material, one on each side of the saw; such plates shall not be more than 15 centimetres apart, and shall extend from the axis of the saw outwards to a distance of not less than 5 centimetres beyond the teeth of the saw. Metal plates, if not beaded, shall be of thickness of least 2.5 millimetres, or, if beaded, be of a thickness of at least 1.25-millimeter.

(6) Push sticks. - A push stick or other suitable appliance shall be provided for use at every circular saw and at every vertical spindle moulding machine to enable the work to be done without unnecessary risk.

(7) Band saws.- Every band saw shall be guarded as follows :-
(a) both sides of the bottom pulley shall be completely encased by sheet or expanded metal or other suitable material ;
(b) the front of the top pulley shall be covered with sheet or expanded metal or other suitable material; and
(c) all portions of the blade shall be enclosed or otherwise securely guarded, except the portion of the blade between the bench table and the top guide.

(8) Planing machines. -
a) A planing machine (other than a planing machine, which is mechanically fed,) shall not be used for overhand planing unless it is fitted with a cylindrical cutter block.
b) Every planing machine used for overhand planing shall be provided with a "bridge" guard capable of covering the full length and breadth of the cutting slot in the bench, and so constructed as to be easily adjusted both in a vertical and horizontal direction.
c) The feed roller of every planing machine used for thicknessing, except the combined machine for overhead planing and thicknessing shall be provided with an efficient guard.

(9) Vertical spindle moulding machines. -
a) The cutter of every vertical spindle-moulding machine shall be guarded by the most efficient guard having regard to the nature of the work being performed.
b) The wood being moulded at a vertical spindle moulding machine shall, if practicable, be held in a jig or holder of such construction as to reduce as far as possible the risk of accident to the worker.

(10)Chain mortising machines. - The chain of every chain mortising machine shall be provided with a guard which shall enclose the cutters as far as practicable.

(11) Adjustment and maintenance of guards.- The guards and other appliances required under this schedule shall be -
(a) maintained in an efficient state;
(b) constantly kept in position while the machinery is in motion; and
(c) so adjusted as to enable the work to be done without unnecessary risk.

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52. Band-saws- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Stopping and Starting Device – An efficient stopping and starting device shall be provided on every wood-working machine. The control of this device shall be in such a position as to be readily and conveniently operated by the persons in charge of the machine.

(2) Space around machine – The space surrounding every wood-working machine in motion shall be kept free obstruction.

(3) Floors.- The floor surrounding every wood working machine shall be maintained in good and level condition, and shall not be allowed to become slippery, and as far as practicable shall be kept free from chips or other loose material..

(4) Circular Saw;-Every circular shall be fenced as follows;-

(a) Behind and indirect line with the saw there shall be a riving knife, which shall have a smooth surface, shall be strong, right and easily adjustable, and shall also conform to the following conditions;-

(i) The edge of the knife nearer the saw shall from an arc of a circle having a radius not exceeding the radius of the largest saw used on the bench.

(ii) The knife shall be maintained as close as practicable to the saw, having regard to the nature of the worked being done at the time, and at the level of the bench table the distance between the front of edge of the knife and the teeth of the saw shall not exceed half an inch.

(iii) For a saw of a diameter of less than 24 inches, the knife shall extend upward from the bench table to within one inch of the top of the saw and for a saw of a diameter of 24 inches or over shall extend upwards from the bench table to a height of at least nine inches.

(b) The top of the saw shall be covered by a strong and easily adjustable guard, with a flange at the side of the saw farthest from the fence. The guard shall be kept so adjusted that the said flange shall extend below the roots of the teeth of the saw. The guard shall extend from the top of the riving knife to a point as low as practicable at the cutting edge of the saw.

(c) The part of the saw below the bench table shall be protected by two plates of metal or other suitable martial one on each side of the saw; such plates shall not be more than six inches apart, and shall extend from the axis of the saw outwards to a distance of not less than two inches beyond the teeth of the saw. Metal plates, if not beaded, shall be of thickness of at least 1 /10 inch, or if beaded be of a thickness of at least 1/ 20 inch.

(5) Push Sticks.;- A push stick or other suitable appliance shall be provided for use at every circular saw at every vertical spindle molding machine to enable the work to be done without un-necessary risk..

(6) Band Saws;- Every band saw shall be guarded as follows;-

(a) Both sides of the bottom pulley shall be completely encased by sheet or expanded metal or other suitable martial.

(b) The front of the top pulley shall be covered with sheet or expanded metal or other suitable

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martial

(c) All portions of the blade shall be enclosed or otherwise securely guarded except the portion of the blade between the bench table and the top guide.

(7) Planning Machines;-

(a) A planning machine (other than a planning machine which is mechanically fed _ shall not be used for overhand planning unless it is fitted with a cylindrical cutter block.

(b) Every planning machine used for overhand planning shall be provided with a " bridge" guard capable of covering the length and bread the of cutting slot in the bench and so constructed as to easily adjusted both in a vertical and horizontal direction.

(c) The feed roller of every planning machine used for thickness except the combined machine for overhand planning and thickness, shall be provided with an efficient guard.

(8) Vertical Spindle Moulding machines.-

(a) The cutter of vertical spindle molding machine shall be guarded by most effaced guard having regard to the nature of the worked being performed.

(b) The wood being moulded at a vertical spindle moulding made shall. If practicable be held in a holder of such constructions reduce as far as possible the risk of accident to the worker.

(9) Chain mortising machines;- The chain of every chain mort machine shall be provided with a guard which shall enclose the cutters as practicable.

(10) Adjustment and maintenance of guards;- The guards and off appliances required under this Schedule shall be;-

(a) maintained in an efficient state,

(b) constantly kept in position while the machinery is in motion and

(c) so adjusted as to enable the work to be done without un-recess risk.

53. Rubber mill- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Mills for breaking down, cracking, grating, mixing, refining and warming rubber or rubber compounds shall be so installed that the top of the front roll is not less than 105 centimetres above the floor or working level :

Provided that in existing installations where the top of the front roll is below this height a strong, rigid distance-bar guard shall be fitted across the front of the machine in such position that the operator cannot reach the nip of the rolls.

(2) Rubber mills shall be equipped with -

(a) Hoppers so constructed or guarded that it is impossible for the operators to come into contact in any manner with the nip of the rolls; or

(b) Horizontal safety-trip rods or tight wire cables across both front and rear, which will, when pushed or pulled, operate instantly to disconnect the power and apply the brakes, or to reverse the rolls.

(3) Safety-trip rods or tight wire cables on rubber mills shall extend across the entire length of the face of the rolls and shall be located not more than 175 centimetres above the floor or

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working level.

(4) Safety-trip rods and tight wire cables on all rubber mills shall be examined and tested daily in the presence of the manager or other responsible person and if any defect is disclosed by such examination and test, the mill shall not be used until such defect has been remedied.

54. Forklift- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Equipment:

(a) The design, manufacture, operation, maintenance, safety requirements, testing and examination of forklift trucks shall conform to National Standards.

(b) Electrically driven fork-lift trucks shall be fitted with at least one effective mechanical braking device and mechanically operated current switched off that is activated automatically when the operator leaves the vehicle.

(c) Equipment manufacturer's guidelines shall be strictly adhered to.

(d) Headlights, reverse light and horn, rear view mirror, safe tyres with appropriate air pressure shall be provided and ensured.

(e) Fork-lift trucks shall be fitted with overhead protective guard to protect the operator from falling objects.

(f) Fork-lift trucks or electric cars shall have their gross weight conspicuously marked upon them.

(2) Traffic routes shall be planned, checked, and organised to conform to National Standards.

(3) Operators:

(a) Forklift truck operators shall have valid driving license as per Motor Vehicle Act, 1988 and Rules made thereunder.

(b) The forklift truck operators shall be given training on safety with forklift operations.

(c) Operator protection measures shall be implemented and maintained according to National Standards.

(d) Operators shall be supplied and shall wear the appropriate personal protective equipment during their work.

(4) Precautions during Use:

(a) Fork lift trucks shall not be used to transport workers.

(b) Hand-phones shall not be used while operating a forklift truck.

55. Thermic fluid heaters- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) All heaters shall be of such construction that coils are removable for periodic cleaning, visual

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inspection and hydraulic test.

(2) Suitable arrangements shall be made for cooling the furnace effectively in case of power failure.
(3) Before restarting the furnace, it shall be effectively purged.
(4) Velocity of flow of the thermic fluid shall not be allowed to fall below the minimum recommended by the manufacturers while the heater is in operation.
(5) The thermic fluid shall be circulated in a closed circuit formation with an expansion cum deaerator tank. This tank shall be located outside the shed where the heater is installed.
(6) Every heater shall be provided with a Photo-resistor actuated audio-visual alarm to indicate flame failure and automatic burner cut off.
(7) The stack temperature monitor-cum-controller with audio-visual alarm shall be provided so as to warn the operator in case the outlet temperature exceeds the specified minimum.
(8) Where inspection doors are provided on the furnace they shall be interlocked with the burner itself so that they cannot be opened until burner is shut off and furnace is cooled sufficiently.
(9) All heaters shall be provided with the following safety devises:-
(a) level control in the expansion tank;
(b) temperature control of thermic fluid;
(c) differential pressure switch on the outlet line of the heater tubes; and
(d) temperature control device for the fuel oil supply to the burner.
(10) All devices mentioned in sub-para (9) shall have interlocking arrangements with burner so that in case of any predetermined limits being crossed the supply of fuel and air to burner shall automatically be cut-off.
(11) All safety interlocks when operated shall be indicated on the control panel of the heater by a suitable audio-visual alarm.
(12) Every heater unit shall be provided as a standard accessory an arrangement for sniffing with low pressure steam or nitrogen for putting out the fire.
(13) Electric panel for the heater shall be located near the heater but not so close as to be exposed to spilling or leaking oil.
(14) The heater shall be located in a place segregated from other manufacturing activities.

(15) Explosion vent shall be so installed that release takes place at safe location.
(16) The heater coil shall be subjected to pressure test by competent person once at least in every 12 months. The test pressure shall not be less than twice the operating pressure.
(17) If repairs are carried out to the coil, it shall be tested before taking it into use.
(18) The thermic fluid shall conform to the specifications prescribed by the manufacturers and shall be tested by competent person for suitability at least once in every three months period. Such test shall include test for
acidity, suspended matter, ash contents, viscosity and flash point.
(19) Cleaning of the internal surface of the heater or soot and check up of refractory surface on the inside shall be carried out every month or as often as required depending upon working conditions. The coils shall be removed
and surface of the coils cleaned thoroughly once at least in a period of six months. The burner, nozzles, oil filters and pumps shall be cleaned once a week during the period of use.
(20) A separate register containing the following information shall be maintained :-
(a) weekly checks carried out confirming the effectiveness of the interlock;

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(b) weekly checks confirming that all accessories are in good state of repairs; and

(c) information regarding fuel oil temperature, pressure, thermic fluid inlet/outlet pressure and temperature, fuel gas temperature, recorded at 4 hourly interval,

(21) The heater when in operation shall always be kept in charge of a trained operator.

56. Reaction vessels and kettles- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This standard applies to reaction vessels and kettles, hereinafter referred to as reaction vessels, which normally work at a pressure not above the atmospheric pressure but in which there is likelihood of pressure being created above the atmospheric pressure due to reaction getting out of control or any other circumstance.

(2) In the event of the vessel being heated by electrical means, a suitable thermostatic control device shall be provided to prevent the temperature exceeding the safe limit.

(3) Where steam, is used for heating purposes in a reaction vessel, it shall be supplied through a suitable pressure reducing valve or any other suitable automatic device to prevent the maximum permissible steam pressure being exceeded, unless the pressure of the steam in the supply line itself cannot exceed the said maximum permissible pressure.

(4) A suitable safety valve or rapture disc of adequate size and capacity shall be provided to effectively prevent the pressure being built up in the reaction vessel beyond the safe limit. Effective arrangements shall be made to ensure that the released gases, fumes, vapours, liquids, or dusts, as the case may be, are led away and disposed of through suitable pipes without causing any hazard. Where flammable gases or vapours are likely to be vented out from the vessel, the discharge and shall be provided with a flame arrester.

(5) Every reaction vessel shall be provided with a pressure gauge having the appropriate range.

(6) In addition to the devices as mentioned in the foregoing provisions, means shall be provided for automatically stopping the feed into the vessel as soon as process conditions deviate from the normal limits to an extent which can be considered as dangerous.

(7) Wherever necessary, an effective system for cooling, flooding or blanketing shall be provided, for the purpose of controlling the reaction and process conditions within the safe limits of temperature and pressure.

(8) An automatic auditory and visual warning device shall be provided for clear warning whenever process conditions exceed the present limits. This device, whenever possible, shall be integrated with automatic process correction systems.

(9) A notice pointing out the possible circumstances in which pressures above atmospheric pressure may be built up in the reaction, the dangers involved and the precautions to be taken by the operators shall be displayed at a conspicuous place near the vessel.

57. Ovens and driers- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of

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section 18

(1) This shall apply to ovens and driers, except those used in laboratories or kitchens of any establishment and those, which have a capacity below 325 litres.

(2) Separate electrical connection. - Electrical power supplied to every oven or drier shall be by means of a separate circuit provided with an isolation switch.

(3) Design, construction, examination and testing. -

(a) Every oven or drier shall be properly designed on sound engineering practice and be of good construction, sound materials and adequate strength, free from any patent defects and safe if properly used.

(b) No oven or drier shall be taken into use in a factory for the first time unless a competent person has thoroughly examined all its parts and carried out the tests as are required to establish that the necessary safe systems and controls provided for safety in operation for the processes for which it is to be used and a certificate of such examination and tests signed by that competent person has been obtained and is kept available for inspection.

(c) All parts of an oven or drier which has undergone any alteration or repair which has the effect of modifying any of the design characteristics, shall not be used unless a thorough examination and tests as have been mentioned in sub-para (b) has been carried out by a competent person and a certificate of such examination and tests signed by that competent person has been obtained and is kept available for inspection.

(4) Safety ventilation. -

(a) Every oven or drier shall be provided with a positive and effective safety ventilation system using one or more motor-driven centrifugal fans so as to dilute any mixture of air and any flammable substance that may be formed within the oven or drier and maintain the concentration of the flammable substance in the air at a safe level of dilution.

(b) The safe level of dilution referred to in sub-para (a) shall be so as to achieve a concentration of the concerned flammable substance in air of not more than 25 percent of its lower explosive limit.

Provided that a level of concentration in air upto 50 percent of the lower explosive limit of the concerned flammable substance may be permitted to exist subject to installation and maintenance of an automatic device which -

i) shows continuously the concentration of the flammable substances in air present in the oven or drier at any instant;

ii) sounds an alarm when the concentration of the flammable substance in air in any part of the oven or drier reaches a level of 50 percent of its lower explosive limit; and

iii) shuts down the heating system of the oven or drier automatically when the concentration in air of the flammable substance in any part of the oven or drier reaches a level of 60 percent of its lower explosive limit, is provided to the oven or drier and maintained in efficient working condition.

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(c) No oven or drier shall be operated without its safety ventilation system working in an efficient manner.

(d) No oven or drier shall be operated with a level of dilution less than what is referred to in sub-para (b).

(e) Exhaust ducts of safety ventilation systems shall be so designed and placed that their ducts discharge the mixture of air and flammable substance away from the workrooms and not near windows or doors or other openings from where the mixture could re-enter the workrooms.

(f) The fresh air admitted into the oven or drier by means of the safety ventilation system shall be circulated adequately by means of circulating fan or fans through all parts of the oven or drier so as to ensure that there are no locations where the flammable substance can accumulate in the air or become pocketed to any dangerous degree.

(g) Throttling dampers in any safety ventilation system shall be so designed by cutting away a portion of the damper or otherwise, that the system will handle atleast the minimum ventilation rate required for safety when they are set in their maximum throttling position.

(5) Explosion panels. -

(a) Every oven or drier having an internal total space of not less than half cubic metre shall be provided with suitably designed explosion panels so as to allow release of the pressure of any possible explosion within the oven or drier through explosion vents. The area of openings to be provided by means of such vents together with the area of openings of any access doors which are provided with suitable arrangements for their release in case of an explosion, shall be not less than 2200 square centimetre for every one cubic metre of volume of the oven or drier. The design of the explosion panels and doors as above said shall be such as to secure their complete release under an internal pressure of 0.25 kg per square centimetre.

(b) The explosion releasing panels, shall, as far as practicable, be situated at the roof of the oven or drier or at those portions of the walls where persons do not remain in connection with operation of the oven or drier.

(6) Interlocking arrangements.-

(a) In each oven or drier efficient inter-locking arrangements shall be provided and maintained to ensure that -

(i) all ventilating fans and circulating fans whose failures would adversely effect the ventilation rate or flow pattern, are in operation before any mechanical conveyor that may be provided for feeding the articles or substances to be processed in the oven or drier is put into operation;

(ii) failure of any of the ventilating or circulating fans will automatically stop any conveyor as referred to in sub-para (i) as may be provided, as well as stop the fuel supply by closing the shut off valve and shut off the ignition in the case of gas or oil fired oven, and in the case of electrically heated oven switch off the electrical supply to the heaters;

(iii) the above said mechanical conveyor is set in operation before the above said shut off

valve can be energised; and

(iv) the failure of the above said conveyor will automatically close the above said shut off valve in the case of ovens and driers heated by gas, oil or cut off the electrical heaters in the case of electrically heated ovens or furnaces.

(7) Automatic pre-ventilation.- Every oven or drier heated by oil, gas, steam or electrically shall be provided with an efficient arrangement for automatic pre ventilation consisting of at least 3 volume changes with fresh air by operation of safety ventilation fans and the circulating fans (if used) so as to effect purging of the oven or drier of any mixture of air and a flammable substance before the heating system can be activated and before the conveyor can be placed in position.

(8) Temperature control.- Every oven or drier shall be provided with an automatic arrangement to ensure that the temperature within does not exceed a safe upper present limit to be decided in respect of the particular processing being carried on.

(9) Multistage processes.- Wherever materials are to be processed in ovens or driers in successive operations, suitable arrangement shall be provided to ensure that the operating temperatures necessary for safe operation at each stage are maintained within the design limits.

(10) Combustible substances not to drip on electrical heaters or burners flame.- Effective arrangements shall be provided in every oven or drier to prevent dripping of combustible substances on electric heaters or burner flame used for heating.

(11) Periodical examination, testing and maintenance.-

(a) All parts of every oven and drier shall be properly maintained and thoroughly examined and the various controls as mentioned in this standard and the working of the oven or drier tested at frequent intervals to ensure its safe operation by a responsible person designated by the occupier or manager, who by his experience and knowledge of necessary precautions against risks of explosion, is fit to undertake such work.

(b) A register shall be maintained in which the details of the various tests carried out from time to time under sub-para (a) shall be entered and every entry made shall be signed by the person making the tests.

(12) Polymerising machines.-

(a) Printed fabric shall be thoroughly dried by passing them over drying cans or through hot flue or other equally effective means, before the same is allowed to pass through polymerizing machines.

(b) Infrared ray heaters of polymerizing machines shall be cut off while running the prints.

58. **Industrial robots**- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18.

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(1) Guarding Methods: The following guards shall be provided and maintained;

(a) Interlocked Barrier Guard
This is a physical barrier around a robot work envelope incorporating gates equipped with interlocks. These interlocks are designed so that all automatic operations of the robot and associated machinery will stop when any gate is opened. Restarting the operation require dosing the gate and reactivating a control switch located outside of the barrier.

(b) Fixed Barrier Guard
A fixed barrier guard is a fence that requires tools for removal. Like the interlocked barrier guard, it presents access through, over, under, or around the fence. It provides sufficient clearance for a worker between the guard and any robot reach, including parts held by an end-effector, to perform a specific task under controlled conditions.

(c) Awareness Barrier Device
This is a device such as a low railing or suspended chain that defines a safety perimeter and is intended to prevent inadvertent entry into the work envelope but can be climbed over, crawled under, or stepped around. Such a device is acceptable only in situations where a hazard analysis indicates that the hazard is minimal and interlocked or fixed barrier guards are not feasible. Interlocked or fixed barrier guards provide a positive protection needed to prevent worker exposure to robotic systems hazards.

(d) Presence Sensing Devices
The presence detectors that are most commonly used in robotics safety are pressure mats and light curtains. Floor mats (pressure sensitive mats) and light curtains (similar to arrays of photocells) shall be used to detect a person stepping into a hazardous area near a robot.

(e) Emergency Robot Braking
Dangerous robot movement is arrested by dynamic braking systems rather than simple power cut-off. Such brakes will counteract the effects of robot arm inertia.

(f) Audible and Visible Warning Systems
Audible and visible warning systems shall be provided and maintained to enhance the effectiveness of positive safeguards. The audible and visible signals shall be made to be easily recognizable.

(2) Safety Requirements

(a) The operator, programmer or corrective maintenance worker located and working within the robot work envelope while power is available to moveable elements of the robot system during programming, adjustment, testing, cleaning, inspection, and repair periods shall be protected from hazards and risks.

(b) All measures shall be taken to prevent the robot hazards due to human errors, control errors, unauthorized access, Mechanical hazards, environmental hazards, and hazards with Electric, hydraulic, and pneumatic power sources.

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(c) The main control panel shall be located outside the robot system work envelope in sight of the robot.

(d) Readily accessible emergency stops (palm buttons, pull cords, etc.) shall be located in all zones where needed. The Emergency stops shall override all other controls.

(e) Automatic stop capabilities shall be provided for abnormal robot component speeds and robot traverses beyond the operating envelope.

(f) All control devices shall be clearly marked and labelled as to device purpose. Actuating controls shall be designed to indicate the robot's operating status.

(g) Controls that initiate power or motion shall be constructed and guarded against accidental operation.

(h) Each robot shall be equipped with a separate circuit breaker that can be locked only in the “off” position.

(i) User-prompt displays shall be used to minimize human errors.

(j) Control systems shall be selected and designed so that they prevent a robot from automatically restarting upon restoration of power after electrical power failure. The systems shall also prevent hazardous conditions in case of hydraulic, pneumatic, or vacuum loss or change.

(k) A robot system shall be designed so that it could be moved manually on any of its axes without using the system drive power.

(l) The robot shall be installed in accordance with the manufacturer's guidelines and applicable codes.

(m) Robots shall be compatible with environmental conditions such as temperature, ventilation and humidity inside the factory.
(n) Power to the robot shall conform to the manufacturer's specifications.

(o) The robot shall be secured to prevent vibration movement and tip over.
(p) Installation of Robots shall be carried out such that no additional hazards are created such as pinch points with fixed objects and robot components, or energized conductor contact with robot components.

(q) Signs and markings indicating the zones of movement of the robot shall be displayed

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prominently on the robot itself and, if possible, on floors and walls.

(r) A lock-out and tag-out procedure shall be established and enforced for preventive maintenance or repair operations.

(s) The robot manufacturer's preventive maintenance schedule shall be followed rigorously.

(t) A periodic check of all safety-critical equipment and connections shall be established.

(u) Stored energy devices, such as springs and accumulators, shall be neutralized before robot servicing.

(v) Only programmers shall have access to the work envelope and full control of the robot when it is in the teach mode.

(w) All robot motion initiated from a teach pendant used by a programmer located within the robot work envelope shall be of 10 in/sec (250 mm/sec).

(x) Managers, supervisors, and operators in facilities that use robots shall be trained in the working aspects of robots so that they can set and enforce a robotics safety policy from an informed viewpoint.

(z) A written robotics safety policy that has been explained to all personnel who will be working with robots shall be prepared and issued.

(za) The robots utilized in factories shall be manufactured, installed, and operated as per the applicable National Standards.

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CHAPTER IV- DANGEROUS AND OTHER OPERATIONS

59. Generating petrol gas from petrol - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Prohibition relating to pregnant woman and adolescents: - No pregnant woman or adolescent shall be employed or permitted to work in or shall be allowed to enter any building in which the generation of gas from dangerous petroleum is carried on.

(2) Flame traps: -The plant for generation of gas from Class A petroleum and associated piping and fittings shall be fitted with at least two efficient flame traps so designed and maintained as to prevent a flash back from any burner to the plant. One of these traps shall be fitted as close to the plant as possible. The plant and all pipes and valves shall be installed and maintained free from leaks.
Flash Back Arrestor (Flame Arrestor) manufactured in compliance with National Standard or other stringent standard shall be provided.

(3) Generating building or room.- All plants for generation of petrol gas from Class "A" shall be erected outside the factory building proper in a separate ventilated building having structure is explosion proof.

The fire resistance of an element of structure or combination of elements is determined from one of the following two methods.

(a) Direct application of the results of fire resistance test on an element of structures.
(b) On the basis for calculating the fire resistance of a structural element.

The Fire Test shall be done according to applicable National Standards.

(4)Effective steps shall be taken to prevent petrol from escaping into any drain or sewer.

(5) No person shall smoke or carry matches, fire or naked light or other means of producing a naked light or spark in the generating room or building or in the vicinity thereof and warning notice in Hindi and in the language understood by the majority of the workers shall be posted at entrance and prominent places within 'generating building or room' prohibiting smoking and the carrying of matches, fire or naked light or other means of producing a naked light or spark into such room or building.

(6) No unauthorized person shall have access to any Class A petroleum or to a vessel containing or having actually contained Class petroleum. Precautions shall be taken to prevent unauthorized persons from having access to Class A petroleum.

(7) All electric fitting shall be approved flameproof fittings -manufactured in compliance with National Standard and all electric conductors shall either be enclosed in metal conduits or be lead sheathed.

(8) All doors in the generating room or building shall be fire retardant and constructed to open outwards and no door shall be locked or obstructed or fastened in such a manner that it cannot be easily and immediately opened from the inside while gas is being generated and any person

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is working in the generating room of building. In the building, the emergency door which can open from inside only, shall be provided.

(9) No vessel that has contained petrol shall be repaired in a generating room or building and no repairs to any such vessel shall be undertaken unless live steam has been blown into the vessel and until the interior is thoroughly steamed out or other equally effective steps have been taken to ensure that it has been rendered free from petrol or flammable vapour.

60. Cleaning or smoothing, roughening, etc. of articles, by a jet of sand, metal shot, or grit, or other abrasive propelled by a blast of compressed air or steam - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Sand or any other substance containing free silica shall not be introduced as an abrasive into any blasting apparatus and shall not be used for blasting. No pregnant woman or adolescent shall be employed or permitted to work at any operation of sand blasting.

(2) Precautions in connection with blasting operations.-
(a)Blasting shall not be done except in a blasting enclosure and no work other than blasting and any work immediately incidental thereto and clearing and repairing of the enclosure including the plant and appliances situated therein, shall be kept closed and airtight while blasting is being done therein.

(b) Blasting enclosure shall always be maintained in good condition and effective measures shall be taken to prevent dust escaping from such enclosure, and from apparatus connected therewith, into the air of any room.

(c) There shall be provided and maintained for and in connection with every blasting enclosure, efficient apparatus for separating, so far as practicable, abrasive which has been used for blasting and which is to be used again as an abrasive, from dust or particles of other materials arising from blasting; and no such abrasive shall be introduced into any blasting apparatus and used for blasting until it has been so separated.

(d) There shall be provided and maintained in connection with every blasting enclosure efficient ventilating plant to extract, by exhaust draught effected by mechanical means, dust produced in the enclosure. The dust extracted and removed shall be disposed of by such method and in such manner that it shall not escape into the air of any room; and every other filtering or settling device situated in a room in which persons are employed, other than persons attending to such bag or other filtering or settling device, shall be completely separated from the general air of that room in an enclosure ventilated to the open air.

(e) The ventilating plant provided for the purpose of sub-para (d) shall be kept in continuous operation whenever the blasting enclosure is in use whether or not blasting is actually taking place therein, and in the case of a blasting chamber, it shall be in operation even when any person is inside the chamber for the purpose of cleaning.

(3) Inspection and examination.-

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(a) Every blasting enclosure shall be specially inspected by a responsible person at least once in every week in which it is used for blasting. Every blasting enclosure, the apparatus connected therewith and the ventilating plant shall be thoroughly examined and in the case of ventilating plant, tested by a responsible person at least once in every month.

(b) Particulars of the result of every such inspection, examination or test shall forthwith be entered in a register and shall be available for inspection by any workman employed in or in connection with blasting in the factory. Any defect found on any such inspection, examination or test shall be immediately reported by the person carrying out the inspection, examination or test to the occupier, manager or other appropriate person and without prejudice to the foregoing requirements of this standard, shall be removed without avoidable delay.

(4) Provision of protective helmets, gauntlets and overalls.-

(a) There shall be provided and maintained for the use of all persons who are employed in a blasting chamber, whether in blasting or in any work connected therewith or in cleaning such a chamber, protective helmets of a type approved by a certificate of the Chief Inspector-cum-Facilitator; and every such person shall wear the helmet provided for this use whilst he is in the chamber and shall not remove it until he is outside the chamber.

(b) Each protective helmet shall carry a distinguishing mark indicating the person by whom it is intended to be used and no person shall be allowed or required to wear a helmet not carrying his mark or a helmet which has been worn by another person and has not since been thoroughly disinfected.

(c) Each protective helmet when in use shall be supplied with clean and not unreasonably cold air at a rate of not less 170 litres per minute.

(d) Suitable gauntlets and overalls shall be provided for the use of all persons while performing blasting or assisting at blasting, and every such person shall while so engaged, wear the gauntlet and overall provided.

(5) Precautions in connection with cleaning and other work.-

(a) Where any person is engaged upon cleaning of any blasting apparatus or blasting enclosure or of any apparatus or ventilating plant connected therewith or the surroundings thereof or upon any other work in connection with any blasting apparatus or blasting enclosure or with any apparatus or ventilating plant connected therewith so that he is exposed to the risk of inhaling dust which has arisen from blasting, all practicable measures shall be taken to prevent such inhalation.

(b) In connection with any cleaning operation referred to in para (5) herein, and with

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the removal of dust from filtering or settling devices all practicable measures shall be taken to dispose of the dust in such a manner that it does not enter the air of any room. Vacuum cleaners shall be provided and used wherever practicable for such cleaning operations.

(6) Adequate and suitable storage accommodation for the helmets, gauntlets and overalls required to be provided by para (4) shall be provided outside and conveniently near to every blasting enclosure and such accommodation shall be kept clean. Helmets, gauntlets and overalls when not in actual use shall be kept in this accommodation.

(7) All helmets, gauntlets, overalls and other protective devices or clothing provided and worn for the purposes of this schedule, shall be kept in good condition and so far as is reasonably practicable shall be cleaned on every weekday in which they are used. Where dust arising from the cleaning of such protective clothing or devices is likely to be inhaled, all practicable measures shall be taken to prevent such inhalation. Vacuum cleaners shall, wherever practicable, be used for removing dust from such clothing and compressed air shall not be used for removing dust from any clothing.

(8) Vacuum cleaning plant used for the purpose of this standard shall be properly maintained.

(9) Restrictions in employment of adolescent.

(a) No person under 18 years of age shall be employed in blasting or assisting at blasting or in any blasting chamber or in the cleaning of any blasting apparatus or any blasting enclosure or any apparatus or ventilating plant connected therewith or be employed on maintenance or repair work at such apparatus, enclosure or plant.

(b) No person under 18 years of age shall be employed to work regularly within twenty feet of any blasting enclosure unless the enclosure is in a room and he is outside that room where he is effectively separated from any dust coming from the enclosure.

61. Certain lead processes carried on in printing presses and type foundries- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Exhaust draught.-

(a) None of the following processes shall be carried on except with an efficient exhaust draught unless carried on in such a manner as to prevent free escape of gas, vapour, fumes or dust into any place in which work is carried on, or unless carried on in electrically heated and thermostatically controlled melting pots:-

(i) melting lead material or slugs; and

(ii) heating lead material so that vapour containing lead is given off.

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(b) Such exhaust draught shall be effected by mechanical means and so contrived as to operate on the dust, fume, gas or vapour given off as closely as may be at its point of origin.

(2)No pregnant woman or adolescent shall be employed or permitted to work in any lead process.

(3) Each of the following processes shall be carried on in such a manner and under such conditions as to secure effectual separation from one another and from any other processes :-

(a) melting of lead or any lead material;
(b) casting of lead ingots; and
(c) mechanical composing.

(4) A suitable receptacle with tightly fitting cover shall be provided and used for Dross as it is removed from every melting pot. Such receptacle shall be kept covered while in the workroom near the machine except when the dross is being deposited therein.

(5) Floor of workroom.- The floor of every workroom where lead process is carried on shall be –

(a)made of cement or similar material so as to be smooth and impervious to water;
(b) maintained in sound condition; and
(c) shall be cleansed throughout daily after being thoroughly damped with water at a time when no other work is being carried on at the place.

(6) No food, drink, pan and supari or tobacco shall be consumed or brought by any worker into any workroom in which any lead process is carried on.

(7) Employees shall be given leading indicator safety information and training by their employer. All risks involved in the process shall be informed before work starts. It must include arrangements to deal with accidents, incidents and emergencies such as an uncontrolled release of lead dust or fume etc.

(8) Cautionary notices regarding risks involved in use or handling of lead shall be affixed in prominent places in the factory where they are easily and conveniently read by the persons employed. Notice may also include arrangements to deal with accidents, incidents and emergencies such as an uncontrolled release of lead dust or fume etc.

(9) The occupier shall provide appropriate respiratory protective equipment (RPE), gloves, eye protection, safety footwear to workers handling or working near lead and maintain the protective clothing in good condition at all times to ensure same level of protection as originally designed to give. All protective clothing shall comply the requirements of National Standard.

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62. Manufacture of pottery- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) These provisions shall not apply to a factory in which any of the following articles, but no other pottery, are made :-

(a) unglazed or salt glazed bricks and tiles; and

(b) architectural terra-cotta made from plastic clay and either unglazed or glazed with a leadless glaze only.

(2) The following processes shall not be carried on without the use of an efficient exhaust draught:-

(a) all processes involving the manipulation or use of a dry and unfritted lead compound;

(b) fettling operations of any kind, whether on greenware or biscuit, provided that this shall not apply to the wet fettling, and to the occasional finishing of pottery articles without the aid of mechanical power;

(c) sifting of clay dust or any other material for making tiles or other articles or other articles by pressure, except where -

(i) this is done in an machine so enclosed as to effectually prevent the escape of dust; or

(ii) the material to be shifted is so damp that no dust can be given off;

(d) pressing of tiles from clay dust, an exhaust opening being connected with each press, and pressing from clay dust of articles other than tiles, unless the material is so damp that no dust is given off;

(e) fettling of tiles made from clay dust by pressure, except where the fettling is done wholly on, or with, damp material, and fettling of other articles made from clay dust, unless the material is so damp that no dust is given off;

(f) process of loading and unloading of saggars where handling and manipulation of ground and powdered flint, quartz, aluminia or other materials are involved;

(g) brushing of earthenware biscuit, unless the process is carried on in a room provided with efficient general mechanical ventilation or other ventilation as adequate having regard to all the circumstances of the case;

(h) fettling of biscuit ware which has been fired in powdered flint or quartz except where this is done in machines so enclosed as to effectually prevent the escape of dust;

(i) where cleaning after the application of glaze by dipping or other process;

(j) crushing and dry grinding of materials for pottery bodies and saggars, unless carried on in machines so enclosed as to effectively prevent the escape of dust or is so damp that no dust can be given off;

(k) sieving or manipulation of powdered flint, quartz, clay grog or mixture of these materials unless it is so damp that no dust can be given off;

(l) grinding of tiles on a power driven wheel unless an efficient water spray is used on the wheel;

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(m) lifting and conveying of materials by elevators and conveyors unless they are effectively enclosed and so arranged as to prevent escape of dust into the air in or near to any place in which persons are employed;

(n) preparation or weighing out of flow material, lawning of dry colours, colour dusting and colour blowing;

(o) mould making unless the bins or similar receptacles used for holding plaster of Paris are provided with suitable covers; and

(p) manipulation of calcined material unless the material has been made and remains so wet that no dust is given off.

(3) Each of the following processes shall be carried on in such a manner and under such conditions as to secure effectual separation from one another, and from other wet processes:-

(a) crushing and dry grinding or sieving of materials, fettling, pressing of tiles, drying of clay and greenware, loading and unloading of saggars; and

(b) all processes involving the use of a dry lead compound.

(4) No glaze which is not a leadless glaze or a low solubility glaze shall be used in a factory in which pottery is manufactured.

(5)No persons under the age of eighteen years shall be employed or permitted to work in any of the operations specified in para (2), or at any place where such operations are carriedon.

(6) The potter's wheel shall be provided with screens or so constructed as to prevent clay scrapings being thrown off beyond the wheel.

(7) Control of dust during cleaning-

(a) All practical measures shall be taken by damping or otherwise to prevent dust arising during cleaning of floors.

(b) Damp saw-dust or other suitable material shall be used to render the moist method effective in preventing dust rising into the air during the cleaning process which shall be carried out after work has ceased.

(8) The floors of potter's shops, slip houses, dipping houses and ware cleaning rooms shall be hard, smooth and impervious and shall be thoroughly cleaned daily by an adult male using a moist method.

(9) Protective equipment.-

The occupier shall provide and maintain suitable overalls and hand coverings for all persons employed in process included under para (3).

(a) The occupier shall provide and maintain suitable aprons of a of a waterproof or similar material, which can be sponged daily, for the use of the dippers, dippers assistants, throwers, jolly workers, casters, mould makers and filter press and pug mill workers.

(b) Aprons provided shall be thoroughly cleaned daily by the wearers by sponging or other wet process. All overalls and head coverings shall be washed, cleaned and mended at least once a week, and this washing, cleaning or mending shall be provided for by the

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occupier.

(10) No person shall be allowed to work in emptying sacks of dust materials, weighing out and mixing of dusty materials and charging of ball mills and plungers without wearing a suitable and efficient dust respirator and eye protection.

63. Handling or manipulation of corrosive substances

(1) The floor of every workroom of a factory in which corrosive operation is carried on shall be made of impervious, corrosion and fire resistance material and shall be so constructed as to prevent collection of any corrosive substance. The surface of such flooring shall be smooth and cleaned as often as necessary and maintained in a sound condition.

(2)Protective equipment.-

(a) The occupier shall provide for the use of all persons employed in any corrosive operation suitable protective wear for hands and feet, suitable aprons, face shields, chemical safety goggles, and respirators. The equipment shall be maintained in good order and shall be kept in clean and hygienic condition by suitably treating to get rid of the ill effects of any absorbed chemicals and by disinfecting. The occupier shall also provide suitable protective creams and other preparations wherever necessary.

(b) The Protective equipment and preparations provided shall be used by the persons employed in any corrosive operation.

(3) Where any corrosive operation is carried on, there shall be provided as close to the place of such operation as possible, a source of clean water at a height of 210 centimetres from a pipe of 1.25 centimetres diameter and fitted with a quick acting valve so that in case of injury to the worker by any corrosive substance, the injured part can be thoroughly flooded with water. Whenever necessary, in order to ensure continuous water supply, a storage tank having a minimum length, breadth and height of 210 centimetres, 120 centimetres and 60 centimetres respectively or such dimensions shall provided as the source of clean water.

(4) A cautionary notice in the following format as given herein below and printed in the language which majority of the workers employed understand, shall be displayed prominently close to the place where a corrosive operation is carried out and where it can be easily and conveniently read by the workers. If any worker is illiterate, effective steps shall be taken to explain carefully to him the contents of the notice so displayed. Provision of eye shower and body shower made near where corrosive substances are being used.

CAUTIONARY NOTICE
DANGER

Corrosive substances cause severe burns and vapours thereof may be extremely hazardous. In case of contact, immediately flood the part affected with plenty of water for at least 15 minutes.

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Get Medical Attention Immediately.

(5) Transport.-

(a) Corrosive substances shall not be filled, moved or carried except in containers or through pipes and when they are to be transported in containers, they shall be placed in crates of sound construction and of sufficient strength.

(b) A container with a capacity of 11.5 litres or more of a corrosive substance shall be placed in a receptacle or crate and then carried by more than one person at a height below the waist line unless a suitable rubber wheeled truck is used for the purpose.

(c) Containers for corrosive substances shall be plainly labelled.

(6) Devices for handling corrosive.-

(a) Tilting, lifting of pumping arrangements shall be used for emptying jars, carboys and other containers of corrosives.

(b) Corrosive substance shall not be handled by bare hands but by means of a suitable scoop or other device.

(7)Valves fitted to containers holding a corrosive substance shall be opened with great care. If they do not work freely, they shall not be forced open. They shall be opened by a worker suitably trained for the purpose.

(8) Cleaning tanks, stills, etc.-

(a) In cleaning out or removing residues from stills or other large chambers used for holding any corrosive substance, suitable implements made of wood or other material shall be used to prevent production of arseniuretted hydrogen (arsine).

(b) Whenever it is necessary for the purpose of cleaning or other maintenance work for any worker to enter chamber, tank, vat, pit or other confined space where a corrosive substance had been stored, all possible precautions required for working inside the confined spaceguidelines shall be taken to ensure the worker's safety.

(c) Wherever possible , before repairs are undertaken to any part of equipment in which a corrosive substance was handled, such equipment or part thereof shall be freed of any adhering corrosive substance by adopting suitable methods.

(9) Storage.-

(a) Corrosive substances shall not be stored in the same room with other chemicals, such as turpentine, carbides, metallic powders and combustible materials, the accidental mixing with which may cause a reaction which is either violent or gives rise to toxic fumes and

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gases.

(b) Pumping or filling overhead tanks, receptacles, vats or other containers for storing corrosive substances shall be so arranged that there is no possibility of any corrosive substance overflowing and causing injury to any person.

(c) Every container having a capacity of twenty litres or more and every pipeline, valve, and fitting used for storing or carrying corrosive substances shall be thoroughly examined every year for finding out any defects, and defects so found out shall be removed forthwith. A register shall be maintained of every such examination made and shall be produced before the Inspector-cum-Facilitator whenever required.

(d) Provision of adequate numbers of spill kit shall be ensured.

64. Processing of cashew nut- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all factories in which roasting, scrubbing and shelling of cashew nuts or extracting oil from cashew nuts or cashew nut shells are carried on.

(2) Prohibition of employment of pregnant woman and adolescent.- No pregnant woman or adolescent shall be employed in any of the processes specified in para (1) except in shelling of roasted cashew nuts.

(3) Protective clothing and equipment. - The occupier shall provide and maintain for the use of all persons employed in roasting and scrubbing of cashew nuts or extracting oil form cashew nuts or cashew nut shells.

(a) suitable rubber or washable leather gloves;
(b) suitable type of impervious aprons with sleeves to cover body down to knees and shoulders; and
(c) suitable type footwear to afford protection to feet and legs against cashew nut oil; and for the workers employed in cashew nut shelling, either
(d) a protective ointment containing 10% of shellac, 5% of alcohol, 10% of sodium perborate, 5% of carbitol and 20% talc; or
(e) sufficient quantity of kaolin and coconut oil; and

(4) Every person employed in processes specified in para (1) shall make use of protective clothing and equipment supplied and arrangements shall be made by the occupier to supervise the use, maintenance and cleanliness.

(5) Disposal of shells, ashes, or oil of cashew nut.-

(a) Shells, ashes or oil of cashew nut shall not be stored in any room in which workers are employed and shall be removed at least twice a day to any pit or enclosed place in the case shells and ashes and to closed containers kept in a separate room in the case of oil.

(b) No worker shall be allowed to handle shells or oil of cashew nuts without using the protective clothing or equipment provided under para (3) above.

(6) The floor of every workroom in which processes specified in para 1 are carried on, shall be of a hard material so as to be smooth and impervious and of even surface and shall be cleaned daily, and spillage of any cashew nut oil in any workroom shall be washed with soap and cleaned immediately.

(7) Workers engaged in shelling of cashew nuts shall be provided with adequate seats or work benches which shall be cleaned daily.

(8) No food, drink, pan, supari or tobacco shall be brought or consumed by any worker in any room in which processes specified in para (1) are carried out and no person shall remain in any such room during intervals for meals.

(9) Where smoke or gas is produced in the operation of roasting, provision shall be made for removing the smoke or gas through a chimney of sufficient height and capacity or by such other arrangements as may be necessary to prevent the gas or smoke escaping into the air or any place in which workers are employed.

65. Manufacture or manipulation of manganese and its compounds- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This standard shall apply to every factory in which or in any part of which any manganese process is carried on.

(2) Every manganese process which may give rise to dust, vapour or mist containing manganese, shall be carried on in a totally enclosed system or otherwise effectively isolated from other processes so that other plants and processes and other parts of the factory and persons employed on other processes may not be affected by the same.

(3) process in which any dust, vapour or mist containing manganese is generated, shall be carried out except under an efficient exhaust ventilation which shall be applied as near to the point of generation as practicable.

(4) Personal protective equipment.-

(a) The occupier of the factory shall provide and maintain in good and clean condition suitable overalls and head coverings for all persons employed in any manganese process and such overalls and head coverings shall be worn by the persons while working on a manganese process.

(b) The occupier of the factory shall provide suitable respiratory protective equipment for use by works in emergency to prevent inhalation of dusts, fumes or mists. Sufficient number of complete sets of such equipment shall always be kept near the work place and the same shall be properly maintained and kept always in a condition to be used readily.

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(c) The occupier shall provide and maintain for the use of all persons employed, suitable accommodation for the storage and make adequate arrangements for cleaning and maintenance if personal protective equipment.

(5) No pregnant woman or adolescent shall be employed or permitted to work in any manganese process.

(6) No food , drink, pan and supari or tobacco shall be allowed to be brought into or consumed by any worker in any workroom in which any manganese process is carried on.

(7) A cautionary notice in the following format as given herein below and printed in the language which majority of the workers employed understand, shall be displayed prominently close to the place where manganese and its compounds are being handled and where it can be easily and conveniently read by the workers. If any worker is illiterate, effective steps shall be taken to explain carefully to him the contents of the notice so displayed.

Cautionary notice
Manganese and Manganese Compounds

(a) Dust and mists of manganese and its compounds are toxic when inhaled or when ingested.
(b) Do not consume food or drink near the work place.
(c) Take a good wash before taking meals.
(d) Keep the working area clean.
(e) Use the protective clothing and equipment provided.
(f) When required to work in situations where dusts, fumes or mists are likely to be inhaled, use respiratory protective equipment provided for the purpose.
(g) If you get severe head-aches, prolonged sleeplessness or abnormal sensations on the body, report to the manager who would make arrangements for your examination and treatment.

66. Operations involving high noise and vibration levels - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) HIGH NOISE LEVELS:

(a) This following sub-para shall apply to all operations in any manufacturing process having high noise level.
(b) Protection against noise.-
(i) In every factory, suitable, a suitable engineering control or administrative measures shall be taken to ensure, so far as is reasonably practicable, that no worker is exposed to sound levels exceeding the maximum permissible noise exposure levels specified in Tables (i) and (ii) herein.

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Table 1: Permissible exposure in cases of continuous noise

Total time of exposure (continuous short term exposures) per day, in hours	Sound pressure level in or a number of dBA
8	85
6	87
4	90
3	92
2	95
1 ½	97
1	100
¾	102
½	105
¼	110

Notes:

- No exposure in excess of 110 dBA is permitted.
- For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column 1, the permissible sound pressure level is to be determined by extrapolation on a proportionate basis.

Table 2: Permissible exposure levels of impulsive or impact noise

Peak sound pressure level in dB	Permitted number of impulses or impact per day
140	100
135	315
130	1,000
125	3,160
120	10,000

Notes:

- No exposure in excess of 140 dB peak sound pressure level is permitted.
- For any peak sound pressure level falling in between any figure and the next higher or lower figure as indicated in column 1, the permitted number of impulses or impacts per day is to be determined by extrapolation on a proportionate

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basis.

(ii) For the purposes of this sub para, if the variations in the noise level involve maximum at intervals of one second or less, the noise is to be considered as a continuous one and the criteria given in Table 1 would apply. In other cases, the noise is to be considered as impulsive or impact noise and the criteria given in Table 2 would apply.

(iii) When the daily exposure is composed of two or more periods of noise exposure at different levels their combined effect shall be considered, rather than the individual effect of each. The mixed exposure shall be considered to exceed the limit value if the sum of the fractions

$$\frac{C1}{T1} + \frac{C2}{T2} + \ldots\ldots\ldots\ldots \frac{Cn}{Tn}$$ exceeds unity, -

Where the C1, C2 etc. indicate the total time of actual exposure at a specified noise level and T1, T2, etc. denote the time of exposure of less than 90 dBA may be ignored in the above calculation.

(iv) Where it is not possible to reduce the noise exposure to the levels specified in sub-para (i) by reasonably practicable engineering control or administrative measures, the noise exposure shall be reduced to the greatest extent feasible by such control measures, and each worker so exposed shall be provided with suitable ear protectors as per relevant National Standards so as to reduce the exposure to noise to the levels specified in sub-para (i).

The Occupier shall provide personal hearing protectors to the workers

(a) so as to eliminate the risk to hearing or to reduce the risk to as low a level as is reasonably practicable.

(b) after consultation with the employees concerned or their representative

(c) ensure the hearing protectors is full and properly fitted, periodically checked for the effectiveness, used and maintained in good working order and repair

(v) Where the ear protectors provided in accordance with sub-para (iv) and worn by a worker cannot still attenuate the noise reaching near his ear, as determined by subtracting the attenuation value in dBA of the ear protectors concerned from the measured sound pressure level, to a level permissible under Table (1) or Table (2) as the case may be, the noise exposure period shall be suitably reduced to correspond to the permissible noise exposures specified in sub-para (i).

(vi) (a) In all cases where the prevailing sound levels exceed the permissible levels specified in sub-para (i) there shall be administered an effective hearing conservation programme which shall include among other hearing conservation measures, pre-employment and periodical auditory surveys conducted on workers exposed to noise exceeding the permissible levels, and rehabilitation of such workers either by reducing the exposure to the noise levels or by transferring them to places where noise levels are relatively less or by any other suitable means.

(b) Every worker employed in areas where the noise exceeds the maximum permissible

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exposure levels specified in sub-para (i) shall be subjected to any auditory examination by a Factory Medical Officer within 14 days of his first employment and thereafter, shall be re-examined at least once a every 12 months. Such initial and periodical examinations shall include tests which the Factory Medical Officer may consider appropriate and shall include determination of auditory thresholds for pure tones of 125, 250, 500, 1000, 2000, 4000 and 8000 cycles per second.

(2) HIGH VIBRATION LEVELS:

This shall apply to all operations in a manufacturing part of the process having high undesired vibrations.

(a) Exposure limit values and action values.

(i)For hand-arm vibration—

(a) the daily exposure limit value is 5 m/s2 ;

(b) the daily exposure action value is 2.5 m/s2,

and daily exposure shall be ascertained on the basis set out in the relevant National Standards specified in table 1 below.

(ii) For whole body vibration—

(a) the daily exposure limit value is 1.15 m/s2;

(b) (ii) the daily exposure action value is 0.5 m/s2,

and daily exposure shall be ascertained on the basis set out in the relevant National Standards

Table 1:The Threshold Limit Values (TLVs) for exposure of the hand to vibration in X, Y, or Z direction of axes in the three dimensional system shall be as given below:

Total Daily Exposure Duration (hours)	Maximum value of frequency weighted acceleration (m/s2) in any direction
4 to less than 8 hours	4
2 to less than 4 hours	6
1 to less than 2 hours	8
less than 1hour	12

(b) Assessment of vibration exposure shall be made for each applicable direction (X, Y, Z) since vibration is a vector quantity (magnitude and direction). In each direction, the magnitude of the vibration during normal operation of the power tool, machine or work piece shall be expressed by the root-mean-square (RMS) value of the frequency – weighted component acceleration, in units of meter per second squared (m/s^2)

(c) Assessment of risk to health due to vibration at the workplace.

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(i) An occupier who carries out work which is liable to expose any worker from vibration shall make a suitable and sufficient assessment of the risk created by that work to the health and safety of those and the risk assessment shall identify the control measures that need to be taken.

(ii) The risk assessment shall be reviewed whenever it is felt the changes in the process makes the earlier risk assessment no longer valid.

(d) Engineering control measures.

(i) The occupier shall ensure that risk from the exposure of workers to vibration is either eliminated at source or, where this is not reasonably practicable, reduced to as low a level as is reasonably practicable.

(ii) Where it is not reasonably practicable to eliminate risk at source pursuant to sub-para (i) herein and an exposure action value is likely to be reached or exceeded, the employer shall reduce exposure to as low a level as is reasonably practicable by establishing and implementing a programme of engineering control measures which are appropriate to this type of activity.

(iii) The occupier shall ensure that the workers are provided with the following measures.

(a) work equipment of appropriate ergonomic design which, taking account of the work to be done, produces the least possible vibration;

(b) the provision of auxiliary equipment which reduces the risk of injuries caused by vibration; and install appropriate maintenance programmes for work equipment, the workplace and workplace systems;

(iv) Subject to sub-para (b), the employer shall ensure that his employees are not exposed to vibration above an exposure limit value; and shall take necessary to identify the reasons for the limit being exceeded and take appropriate steps to reduce the exposure to vibration to below limit value.

Provided that where the exposure of an employee to vibration is usually below the exposure action value but varies markedly from time to time and may occasionally exceed the exposure limit value.

further provided that– any exposure to vibration averaged over one week is less than the exposure limit value and there is evidence to show that the risk from the actual pattern of exposure is less than the corresponding risk from constant exposure at the exposure limit value; and that the para (c) risk is reduced to as low a level as is reasonably practicable, considering the special circumstances.

(v) The occupier shall ensure that workers are given periodical training in the use care and maintenance of the Personal Protective Equipment.

(e) Administrative Control Measures.

(i) The occupier shall ensure that as far as reasonably practicable as all necessary control measures are taken to ensure that the unwanted vibrations does not affect the health of the workers employed in the process to which this part of schedule apply.

(ii) The occupier shall provide all workers with information instruction and training to be adopted to limit the exposure limit values and action values as set out in sub-para(a).

(iii) Without prejudice to the generality of sub-para (a) herein, the information, instruction

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and training provided under that sub-para shall include–

(a) the exposure limit values and action values set out in sub-para (a).
(b) safe working practices to minimise exposure to vibration; and
(c) suitable and sufficient information and training for employees, such that work equipment may be used correctly and safely, in order to minimise their exposure to vibration;
(d) limitation of the duration and magnitude of exposure to vibration;
(e) appropriate work schedules with adequate rest periods; and
(f) The information, instruction and training required by sub-para (e) (ii) herein shall be updated to take account of significant changes in the type of work carried out or the working methods used by the employer.

(iv) The Occupier shall display pictorial cautionary notices/warning signs at conspicuous places where there are possibilities of workers being exposed to undesired high vibrations.

(f) No pregnant woman or adolescent or persons with disabilities shall be employed in the process covered by this part of the sub-para.

67. Laboratory safety - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall be applicable to all the laboratories in factory premises.

(2) Chemical Hygiene Plan: Chemical Hygiene plan shall be prepared and shall be readily available to employees, employee representatives. The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(a) The Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;
(b) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;
(c) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;
(d) Provisions shall be made for employee information and training;
(e) Approval procedure for carrying out any hazardous or non-routine operation/ activity;
(f) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee. Chemical Hygiene Officer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least

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annually and update it as necessary; and

(g) Provisions shall be made for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

(i) Establishment of a designated area;
(ii) Use of containment devices such as fume hoods or glove boxes;
(iii) Procedures for safe removal of contaminated waste; and
(iv) Decontamination procedures.

(h) Employers shall ensure that hazardous chemicals are labelled with chemical identity, appropriate hazard warnings, and name and address of the manufacturer, importer or responsible party; maintain MSDSs for hazardous chemicals in the workplace and make them readily accessible to exposed workers; provide training for employees to understand the chemicals hazards and be able to use the information on the labels and MSDSs to know how to protect themselves.

(i) Appropriate measures shall be adopted for disposal of chemicals and the same shall be addressed in the Chemical Hygiene Plan.

(4) Laboratory Arrangement:

(a) Rooms designated for laboratory shall not exceed 100 sq. m in area and if additional space is required, fire separation of 120 mm shall be provided.
(b) Benches shall not be too deep (widely accepted width is 75 cm) and the service line controls shall be placed at the front below the bench top.
(c) Bench shall be kept dry in the vicinity of an experiment involving alkali metals. It shall be ensured that pieces of the metal do not to fall into water or oil baths during addition.
(d) Adequate moving space between lab benches, distance from door to benches to prevent fouling during movement shall be ensured.
(e) Returning equipment not in use to their proper storage place, clear labelling of chemicals, keeping laboratory floor free of obstruction and other good housekeeping practices shall be strictly followed.
(f) Safety carriers shall be used for transporting glass or plastics containers with a capacity of two litres or greater. Incompatible chemical should never be transported together. They shall be transported in suitable separated carriers.
(g) Spills shall be cleaned immediately and thoroughly. The nature of spills shall be ascertained, and spills shall be treated accordingly.
(h) Chemicals wastes shall be disposed of by proper procedures.
(i) Safety information and emergency procedures shall be prominently displayed at all times. Emergency procedures shall be posted in each laboratory.
(j) Gas cylinders shall be safely handled and shall be chained to avoid their fall.

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(k) The reagent shelves shall be easily accessible and shall not be unduly high. The reagent shelves shall be provided with beading (and with centre partitions in the case of double-side shelves) to prevent bottles falling off due to vibrations.

(l) Separate Arrangement shall be provided for doing pressure reactions and other hazardous operation, overnight reactions, chromatography, and work involving large quantities of solvents. These rooms preferably shall be located at the end of the main laboratories.

(m) Each laboratory shall be provided with efficient fume cupboards, sufficiently large to permit complete enclosure of apparatus normally used, and provided with a sink for the washing of apparatus used for handling toxic materials.

(n) For fume cupboard, the exhaust fan shall be able to create a free velocity of 30 metres per minute at normal working height. Cupboards for highly toxic materials require higher face velocities. Hot concentrated perchloric acid shall be handled in separate fume cupboards where its vapour does not contact any organic matter.

(o) Flame-proof electrical fittings shall be provided in the laboratory especially where solvents are handled.

(p) Laboratories shall also be provided with adequate ventilation and efficient exhaust to prevent the build-up of the concentration of toxic vapours in the atmosphere.

(q) In rooms where work with extremely poisonous gases is done, it is advisable to have an air inlet at the bottom (balanced-draught cupboard) so arranged as to sweep everything to the exhaust. It is desirable to have at least one such cupboard in every chemical laboratory.

(r) All pipe lines in the laboratory shall be colour coded as per the applicable National Standards and each room of the laboratory shall be provided with main valves at an easily accessible and prominently visible places so that, in an emergency, all services to a room can be cut-off from one point.

(s) Bench shall be kept dry in the vicinity of an experiment involving alkali metals. Ensure that it is impossible for pieces of the metal to fall into water or oil baths during addition.

(t) Sinks and drains shall be made of chemically resistant materials and the drains shall be properly trapped and vented.

(u) Storage of flammable liquids in laboratories or in any other area shall be not more than 3 litres for every 10 sq.m of area.

(v) Shelf life of laboratory chemicals shall be monitored.

For safety showers, the shower head shall be capable of flowing 20 gallons per minute (gpm) at 30 psi and producing a 20-inch diameter spray pattern at 60 inches above the surface where the user stands. The centre of the spray head pattern shall be at least 16 inches from any wall, door, or obstruction. It is recommended that the shower head be mounted between 82 and 96 inches off the floor, with the valve no higher than 69 inches.

(5) Laboratory Equipment:

(a) All safety equipment shall be properly labelled and maintained in good operating condition and be regularly checked and inspected for correct operation in accordance with the manufacturer's instructions.

(b) Separate containers shall be in place to deposit broken glassware.

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(c) Vacuum flasks and desiccators shall be regularly checked for signs of damage.
(d) Lab Chemicals Refrigerator shall be dedicated, defrosted regularly. Highly volatile/inflammable chemicals shall not be stored indefinitely in the refrigerator, unless suitably modified by removing the bulb and the thermostat outside the refrigerator cabinet. On no account shall any food or drink be kept in laboratory refrigerators.
(e) Precautions with autoclaves, dryers, hot plates, centrifuges shall be taken.

(6) Laboratory Chemicals:
(a) All chemicals shall be regarded as dangerous. A chemical could be explosive, corrosive, flammable or a poison under certain circumstances. Adequate measures shall be in place to minimize the hazards from these chemicals.
(b) Secondary containment shall be provided during storage and transfer of chemicals.
(c) Chemical shall only be used when the drums, sacks, containers or pipelines containing them are clearly labelled and their identity confirmed. In case of doubt, or when a mix-up has actually occurred, inform your supervisor immediately.
(d) Chemicals storage shall always be done after considering their compatibility. Once a place for storing a particular chemical is fixed, it shall not be altered without purpose.
(e) The containers of chemicals that are highly volatile or decompose or are moisture sensitive shall be carefully opened.
(f) Shelf life of laboratory chemicals shall to be monitored periodically.
(g) For peroxide forming chemicals, chemical compatibility shall be verified.
(h) Lab Chemicals shall be separately stored under ventilation and safety monitoring.

(7) Laboratory Operations:
(a) Work in isolation in a laboratory shall be prohibited and a second person shall be within call.
(b) Required Antidotes shall be maintained in addition to first aid arrangements.
(c) Handling or consuming food or drinks shall be avoided in laboratories.
(d) If extraction is carried out in a separating funnel, the pressure shall be released at frequent intervals.
(e) It shall be ensured that the condensing systems are adequate to cope with solvent use.
(f) Dialkyl ethers, tetrahydrofuran, etc, form peroxides in contact with air and sunlight. They shall be stored in dark bottles.
(g) Dry Distillation solvents shall be avoided since these concentrates may contain explosive peroxides.
(h) In order to study the behaviour of new experiments, safety review including any hazards, accident data shall be considered.
(i) Naked flame shall not be used for reactions involving inflammable solvents.
(j) Distillation under reduced pressure shall always be carried out behind adequate shields. Suitable trap shall be used between the sources of vacuum and the apparatus.
(k) Utmost care shall be taken in carrying out sealed tube reactions. When the pressure is likely to develop, a sealed tube shall never be filled up more than one-third of its

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volume. The initial runs shall be done with very small quantities of reactants.

(l) Sealed tubes shall be protected by a steel tube or a wire cage and the temperature shall be raised gradually. These reactions shall be carried out in a separate room behind a safety screen.

(8) Analytical Laboratories:

(a) Adequate measures shall be taken to prevent electrical shocks through contact with components or surfaces bearing high voltage or current.

(b) Burns from hot surfaces shall be avoided.

(c) Permissible levels of strong magnetic fields shall be reviewed while procuring equipment and warning signs shall be posted. Proper warning to be given for persons with implants/ metal objects.

(d) When Cryogenic liquids are handled, precautions shall be taken against exposure and risk of asphyxiation in close area.

(9) Adequate protection shall be provided and constant monitoring of workers for radioactive exposure shall be in place.

68. Building and other construction works in factories- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

The occupational safety and health standards notified under Section 18 of the Code, 2020 pertaining to Building and Other Construction Works are applicable for Building and Other Construction Works in factories.

69. Shipbuilding and ship-repairing- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) General access to vessels in a shipyard.- All main gangways giving general access to a vessel in a shipyard, whether from the ground or from a wharf or quay, and all cross gangways leading from such a main gangway on to the vessel, shall -

(a) be at least 60 centimetres wide;

(b) be securely protected on each side to a height of at least 90 centimetres by strongly constructed upper and lower hand-rails and by a secure toe-board projecting at least 15 centimetres above the floor;

(c) be of good construction, sound material and adequate strength;

(d) be stable and, where ever practicable, of permanent construction;

(e) be kept in position as long as required; and

(f) maintained in good repair.

(2) Access to dry dock.-

(a) Every flight of steps giving access from ground level either to an altar or to the bottom of a dry dock shall be provided throughout on each side with a substantial hand-rail. In the case of an open side, secure fencing to height of at least 90 centimetres shall be provided by means of upper and lower rails, taut ropes or chains, or by other equally safe

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means. For the purposes of this sub-para a flight of steps which is divided into two by a chute for materials, with no space between either side of the chute and the steps, shall be deemed to be one flight of steps.

(b) Such hand-rails and fencing as aforesaid shall be kept in position save when and to the extent to which their absence is necessary for the access of persons, or for the movement of materials or vessels or for traffic or working, or for repair, but hand-rails or fencing removed for any of those purposes shall be kept readily available and shall be replaced as soon as practicable.

(3) Access to vessels in dry dock.-

(a) If a ship is lying in a dry dock for the purpose of undergoing any of the operations, there shall be provided as means of access for the use of workers at such times as they have to pass to, or from, the ship or dry dock -

(i) where reasonably practicable one or more ship's accommodation ladders; or
(ii) one or more soundly constructed gangways or similar constructions.

(b) The means so provided shall be not less than 55 centimeters wide properly secured and fenced throughout on each side to a clear height of 90 centimeters by means of upper and lower rails, taut ropes or chains or by any other safe means, except that in the case of the ship's accommodation ladder, such fencing shall be necessary on one side only provided where the other side is properly protected by the ship's side.

(c) Where at any dry lock, there is a gangway giving access from an alter of the dock to a vessel which is in the dock for the purpose of undergoing any of the altar is unfenced, adequate hand-holds shall be available for any length of the alter which workers commonly use when passing between the gangway and the nearest flight of steps which gives access to ground level.

(4)Access to and from bulwarks.- Where there is a gangway leading on to a bulwark of a vessel there shall be provided -

(a)Wherever practicable, a platform at the in-board end of the gangway with safe means of access therefrom to the docks; or

(b)where such a platform is not practicable, a second gangway or stair way leading from a bulwark on to the dock which are either attached to the first mentioned gangway or placed contiguous to it, in which case means of access, securely protected by fencing, shall be provided from the one to the other.

(5)Access to staging, etc.-

(a)Where outside staging is erected in a shipyard, there shall be provided sufficient ladders giving direct access to the stages having regard to the extent of the staging and to the work to be done.

(b)Where a vessel is under construction or reconstruction and workers are liable to go

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forward or aft or athwartship across or along uncovered deck-beams, or across or along floors, sufficient planks shall be provided on those deck-beams or on these floors for the purpose of access to or from places of work, and sufficient and suitable portable ladders shall be provided so as to give access either from the ground or outer bottom plating to the top of the floor.

(c) Without prejudice to any other provision in this standard requiring a greater width, no foot way or passageway constructed of planks shall be less than 45 centimetres wide.

(6)Ladders.-

(a) Every ladder which affords a means of access, communication or support to a person shall –

(i) be soundly constructed and properly maintained; and

(ii) be of adequate strength for the purpose for which it is used; and

(iii) be securely fixed either -

(a) as near its upper resting place as possible, or
(b) where this is impracticable, at its base, or where such fixing is impracticable a person shall be stationed at the base of the ladder when in use to prevent it from slipping; and

(iv) unless there is other adequate hand-hold, extend to a height of at least 75 centimetres above the place of landing or the highest rung to be reached by the foot of any person working on the ladder, as the case may be, or, if this is impracticable, to the greatest practicable height.

(b) Requirements (iii) and (iv) of the para(a) shall not apply to fixed ladders of a ship or to rope ladders. Effective measures by means of roping off or other similar means shall be taken to prevent the use of fixed ladders of a ship which do not comply with requirements (i) and (ii) of para (a).

(c) Any worker who removes any ladder and sets it up in a new position shall, as regards that ladder, comply with requirements (iii) of para (a).

(d) Rope ladders shall provide foot-hold of a depth including any space behind the ladder of not less than 12 centimetres and, so far as is reasonably practicable, suitable provision shall be made for preventing such ladders from twisting.

(7) Lashing of ladders.-

(a) A fibre rope, or a rope made with strands consisting of wire cores covered with fibre, shall not be used to secure a ladder used for the purpose of the operations.

(b) A wire rope shall not be used to secure any such ladder unless its ends are ferruled, but this provision shall not apply in the case of an end which is so situated or protected that a person using the ladder is not liable to come into contact with it so as to suffer injury.

(8) Material for staging.-

(a) A sufficient supply of sound and substantial material and appliances shall be available

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in a convenient place or places for the construction of staging.

(b) All planks and other materials and appliances intended to be used or re-used for staging shall be carefully examined before being taken into use or re-use in any staging. Every examination required by this sub-para shall be carried out by a person competent for the purpose.

(9) Staging, dry dock altars and shoring sills.-

(a) All staging and every part thereof shall be of good construction, of suitable and sound material and of adequate strength for the purpose for which it is used and shall be properly maintained, and every up-right and thwart shall be kept so fixed, secured or placed in position as to prevent, so far as is reasonably practicable, accidental displacement.

(b) All planks forming stages shall be securely fastened to prevent them from slipping unless they extend 45 centimetres or more beyond the inside edge of the thwart or support on which they rest.

(c) All staging used in connection with the operations shall be inspected before use, and thereafter at regular and frequent intervals, by a responsible person.

(d)All dry dock altars and shoring sills on or from which persons perform work in connection with the operations shall be of sound construction and properly maintained.

(e)All parts of stages, all parts of foot ways or passageways constructed of planks, and all parts of dry dock altars or shoring sills, being parts on or from which persons perform work in connection with the operations, shall so far as is reasonably practicable, be kept clear of all substances likely to make foot-hold or hand-hold insecure.

(10)Upright used for hoisting block.-

(a) If any upright forming part of staging is used as a fixing for a pulley block for hoisting materials -

(i) it shall be properly housed in the ground or shall otherwise be adequately secured so as to prevent it from raising; and

(ii) it shall be suitably protected against damage by the action of the chain or wire or other means of securing the pulley block to the upright.

(b)No upright forming part of staging shall be used as an anchorage for a load pulley block, unless the upright is not likely to be displaced by such use.

(11) Planks supported on the rungs of ladders shall not be used to support stages.

(12) Suspended stages.-

(a) Stages suspended by ropes or chains shall be secured as far as possible so as to prevent them from swinging.

(b) A fibre rope, or a rope made of strands consisting of wire cores covered with fibre, shall not be used for suspending a stage except that fibre ropes may be used in the case of a stage of which the suspension ropes are reeve through blocks.

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(c) Chains, ropes, blocks and other gear used for the suspension of stages shall be of sound material, adequate strength and suitable quality, and in good condition.

(d) Appropriate steps shall be taken to prevent ropes or chains used for supporting a stage from coming into contact with sharp edges of any part of a vessel.

(13) Boatswain's chairs.-

(a) Boatswains' chairs and chains, ropes or other gear used for their suspension shall be of sound material, adequate strength and suitable quality and the chains, ropes or other gear shall be securely attached.

(b) Suitable measures shall be taken to prevent wherever possible the spinning of a boatswain's chair, to prevent the tipping of a boatswain's chair and to prevent any occupant falling therefrom.

(14) All planks forming a rising stage at the bow end of a vessel shall be securely fastened to prevent them from slipping.

(15) All stages shall be of sufficient width as is reasonable in all the circumstances of the case to secure the safety of the persons working thereon.

(16) Stages from which a person is liable to fall more than 2 meters or into water.-

(a) This sub-para applies to stages from which a person is liable to fall a height of more than 2 meters or into water in which there is a risk of drowning.

(b) Every stage to which this sub-para applies -

(i) shall so far as is reasonably practicable be closely boarded, planked or plated;

(ii) shall be so constructed or placed that a person is not liable to fall as aforesaid through a gap in the staging not being a gap necessary and no larger than necessary having regard to the nature of the work being carried on, and

(iii) shall be at least 45 centimetres wide.

(c) Every side of a stage -

(i) if it is not a side immediately adjacent to any part of a vessel, be fenced with a guard-rail or guard-rails to a height of at least 1 metre above the stage, with rail or rails shall be so placed as to prevent so far as practicable the fall of persons from the stage or from any raised standing place on the stage; or

(ii) if it is a side immediately adjacent to any part of a vessel, be placed as near as practicable to that part having regard to the nature of the work being carried on and to the nature of the structure of the vessel.

(d) In the case of stages which are suspended by ropes or chains, and which are used solely for painting, the fencing required by sub-para (c) (i) may be provided by means of taut guard-rope or taut guard-ropes.

(e) No side of stage or, as the case may be, no part of the side of a stage need be fenced in pursuance of para (c) (i) in cases where and as long as, the nature of the work being carried on makes the fencing of that side or, as the case may be, that part impracticable.

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(f)Guard-rails provided in pursuance of sub-para (c) (i) may be removed for the time and to the extent necessary for the access of persons or for the movement of materials, but guard-rails removed for either of these purposes shall be replaced as soon as practicable.

(g)Where it is not reasonably practicable to comply with the provisions of sub-para (c) (i), workers shall be provided with suitable safety belts equipped with life lines which are secured with a minimum amount of slack to a fixed structure.

(17)Fencing of dry docks.-

(a) Fencing shall be provided at or near the edges of a dry dock at ground level, including edges above flights of steps and chutes for materials. The height of such fencing shall at no point be less than 1 metre.

(b)Such fencing as aforesaid shall be kept in position save when and to the extent to which its absence is necessary (whether or not for the purposes of the operations) for the access of persons, or for movement of materials or vessels or for traffic or working, or for repair, but fencing removed for any of these purposes shall be kept readily available and shall be replaced as soon as practicable.

(18) Protection of openings.-

(a)Every side or edge of an opening in a deck or tank top of a vessel, being a side or edge which may be a source of danger to workers shall, except where and while the opening is securely covered or where the side or edge is protected to a height of not less than 75 centimetres by a coaming or other part of the vessel, be provided with fencing to a height of not less than 90 centimetres above the edge or side and such fencing shall be kept in position save when and to the extent to which its absence is necessary (whether or not for the purposes of the operations) for the access of persons, or for the movement of materials, or for traffic or working, or for repair, but fencing removed for any of these purposes shall be kept readily available and shall be replaced as soon as practicable.

(b) Sub-para (a) shall not apply-

(i) to that part of an opening in a deck or tank top which is at the head of a stairway or ladderway intended to be used while the operations are being carried on; or

(ii) to parts of a deck or tank top which are intended to be plated, except such parts where the plating has necessarily to be delayed so that the opening may be used for the purpose of the operations.

(19) Fall of articles from stage.- Where workers are at work outside a vessel on a stage adjacent to part of the structure of the vessel and other workers are at work directly beneath that stage, the planks of the stage shall be in such a position that no article liable to cause injury to the workers can fall between the planks, and the inside plank of the stage shall be placed as near as practicable to the structure of the vessel having regard to the nature of the work being carried on.

(20) Boxes for rivets, etc.-

(a)Boxes or other suitable receptacles for rivets, nuts, bolts and welding rods shall be provided for the use of workers.

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(b)It shall be the duty of the workers to use, so far as practicable, the boxes or other suitable receptacles so provided.

(21) Throwing down materials and articles.-

(a) Subject to the provisions of sub-para (b) of this para, parts of staging, tools and other articles and materials shall not be thrown down from a height where they are liable to cause injury to workers, but shall be properly lowered.

(b)When the work to be done necessarily involves the throwing down from a height of articles or materials, conspicuous notice shall be posted to warn persons from working or passing underneath the place from which the articles or materials may fall, or the work shall be done under the direct supervision of a competent person in authority.

(c) No person shall throw down any articles or materials from a height except in accordance with the requirements of this sub-para.

(22) So far as practicable, steps shall be taken to minimise the risk arising from loose articles or materials being left lying about in any place from which they may fall on workers or persons passing underneath.

(23) Secureness of loads.-

(a)Loads shall be securely suspended or supported whilst being raised or lowered, and all reasonable precautions shall be taken to prevent danger from slipping or displacement.

(b) Where by reason of the nature or position of the operations load is liable, whilst being moved by a lifting machine or lifting tackle, to come into contact with any object so that the object may become displaced, special measures shall be adopted to prevent the danger so far as is reasonably practicable.

(24) Support of lifting machines and lifting tackle.-Every lifting machine and all lifting tackle shall be adequately and suitable supported or suspended having regard to the purpose for which it is used.

(25) Wire ropes with broken wires.- No wire rope shall be used if in any length of ten diameters the total number of visible broken wires exceeds five percent of the total number of wires, or if the rope shows signs of excessive wear or corrosion or other serious defect.

(26) A thimble or loop slice made in any wire rope shall have at least three tucks with a whole strand of the rope and two tucks with one half of the wires cut out of each strand. All tucks shall be against the lay of the rope.

Provided that this para shall not operate to prevent the use of another form of splice which can be shown to be as efficient as the form of splice specified in this para.

(27) Knotted chains, etc.-

(a) No chain or wire rope shall be used when there is a knot tied in any part thereof.

(b) No chain which is shortened or joined to another chain by means of bolts and nuts shall be used:

Provided that this does not exclude the use of a chain bolted or joined to another chain by an approved and properly constructed attachment.

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(28) Precautions against damage to chains and ropes.-
Appropriate steps shall be taken to prevent, so far as practicable, the use of chains or ropes for raising or lowering in circumstances in which they are in or liable to come into contact with sharp edges of plant, materials or loads, or with sharp edges of any part of the vessel on which work is being carried out.

(29) No load shall be left suspended from a lifting appliance other than a self-sustaining, manually operated lifting appliance unless there is a competent person in charge of the appliance while the load is so left.

(30) Where there is reason to believe that a load being lifted or lowered on a lifting appliance weighs more than 20 tonnes its weight shall be ascertained by means of an accurate weighing machine or by the estimation of a person competent for the purpose, and shall be clearly marked on the load:

Provided that this para shall not apply to any load lifted or lowered by a crane which has either a fixed or a derricking jib and which is fitted with an approved type of indicator in good working order which-

(a) indicates clearly to the driver or person operating the crane when the load being carried approaches the safe working load of the crane for the radius of the jib at which the load is carried; and
(b) gives an efficient sound signal when the load moved is in excess of the safe working load of the crane at that radius.
Precautions against asphyxiation,injurious fumes or explosions

(31) Certification for entry into confined spaces likely to contain dangerous fumes.-

(a)effective steps have been taken to prevent any ingress of dangerous fumes;
(b)any sludge or other deposit liable to give off dangerous fumes has been removed and the space contains no other material liable to give off dangerous fumes; and
(c) the space has been adequately ventilated and tested for dangerous fumes and has a supply of air adequate for respiration:

Provided that no account shall be taken for the purposes of sub-para (b) of any deposit or other material liable to give off dangerous fumes in insignificant quantities only.

(32) Precautions against shortage of oxygen.- No person shall enter or remain in any confined space in a vessel, being a confined space in which there is reason to apprehend that the proportion of oxygen in the air is so low as to involve risk of persons being overcome, unless either -
(a) the space has been and remains adequately ventilated and a responsible person has tested it and certified that it is safe for entry without breathing apparatus; or
(b) he is wearing a suitable breathing apparatus and a safety belt securely attached to a rope, the free end of which is held by a person standing outside the confined space.

(33) Rivet fires.-

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(a) Rivet fires shall not be taken into or used in or remain in any confined space on board or in a vessel unless there is adequate ventilation to prevent the accumulation of fumes.

(b) No person employed shall move a rivet fire into any confined space on board or in a vessel unless he has been authorised by his employer to move the fire into that space.

(34) Gas cylinders and acetylene generators.-

(a)No cylinder which contains or has contained oxygen or any flammable gas or vapour at a pressure above atmospheric pressure and no acetylene generating plant, shall be installed or placed within 5 meters of any substantial source of heat (including any boiler or furnace when alight) other than the burner or blow-pipe operated from the cylinder or plant.

(b) No such cylinder and no such plant shall be taken below the weather deck in the case of a vessel undergoing repair, or below the top most completed deck in the case of a vessel under construction, unless it is installed or placed in a part of the vessel which is adequately ventilated to prevent any dangerous concentration of gas or fumes.

(35) Further provision as to acetylene generators.-

(a) The following provisions shall be observed as respects any acetylene generating plant:-

(i) no such plant shall be installed or placed in any confined space unless effective and suitable provision is made for securing and maintaining the adequate ventilation of that space so as to prevent, so far as practicable, any dangerous accumulation of gases

(ii) any person attending or operating any such plant shall have been fully instructed in its working and a copy of the maker's instructions for that type of plant shall be constantly available for his use;

(iii) the charging and cleaning of such plant shall so far as practicable be done during daylight; and

(iv) partly spent calcium carbide shall not be re-charged into an acetylene generator.

(b) No person shall smoke or strike a light or take a naked light or a lamp in or into any acetylene generator house or shed or in or into dangerous proximity to any acetylene generating plant in the open air or on board a vessel:

Provided that this sub-para shall not apply as respects a generator in the open air or on board a vessel which, since it was last charged, has been thoroughly cleaned and freed from any calcium carbide and acetylene gas.

(c) A prominent notice prohibiting smoking, naked lights and lamps shall be exhibited on or near every acetylene generating plant whilst it is charged or is being charged or is being cleaned.

(36) Construction of plant for cutting, welding or heating metal.-

(a) Pipes or hoses for the supply of oxygen or any flammable gas or vapour to any apparatus for cutting, welding or heating metal shall be of good construction and sound material and be properly maintained.

(b) Such pipes or hoses shall be securely attached to the apparatus and other connections by means of suitable clips or other equally effective appliances.

(c) Efficient reducing and regulating valves for reducing the pressure of the gases shall be

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provided and maintained in connection with all cylinders containing oxygen or any flammable gas or vapour at a pressure above atmospheric pressure while the gases or vapours from such cylinders are being used in any process of cutting, welding or heating metal.

(d) Where acetylene gas is used for cutting, welding or heating metal-
(i) a properly constructed and efficient back pressure valve and flame arrester shall be provided and maintained in the acetylene supply pipe between each burner or blow-pipe and the acetylene generator, cylinder or container from which it is supplied, and shall be placed as near as practicable to the burner or blow-pipe, except that these requirements shall not apply where an acetylene cylinder serves only one burner or blow-pipe; and

(ii) any hydraulic valve provided in pursuance of the preceding sub-para shall be inspected on each day by every person who uses the burner or blow-pipe on that day and it shall be the duty of every worker who used the burner or blow-pipe to inspect the hydraulic valve accordingly.

(e) The operating valves of burners or blow-pipes to which oxygen or any flammable gas or vapours is supplied for the purpose of cutting, welding or heating metal shall be so constructed, or the operating mechanism shall be so protected, that the valves cannot be opened accidentally.

(37) Precautions after use of apparatus for cutting, welding or heating metal.-
(a) In the case of apparatus on board a vessel and used for cutting, welding, or heating metal with the aid of oxygen or any flammable gas or vapour supplied at a pressure above atmospheric pressure, the precautions specified in the following sub-paras shall be taken when such cease for the day or for a substantial period and the apparatus is to be left on board, but need not be taken when such use is discontinued merely during short interruptions of work. The requirements in sub-paras (a) and (d) shall not apply during a meal interval, provided that a responsible person is placed in charge of the plant and equipment referred to therein.
(b) Supply valves of cylinders, generators and gas mains shall be securely closed and the valve key shall be kept in the custody of a responsible person.
(c) Movable pipes or hoses used for conveying oxygen or flammable gas or vapour and the welding and cutting torches shall, in the case of a vessel undergoing construction, be brought to the top most completed deck, or in the case of a vessel undergoing repair, to a weather deck or in the either case to some other place of safety which is adequately ventilated to prevent any dangerous concentration of gas or fumes:

Provided that where, owing to the nature of the work, it is impracticable to comply with the foregoing requirements of this sub-para, the pipes or hoses shall be disconnected from cylinders, generators or gas mains, as the case may be.
(d) When the cylinders or acetylene generating plane have been taken below deck as permitted by sub-para(b) of para (34) such cylinders or acetylene generating plant shall be brought to a weather deck or, in the case of a vessel undergoing construction, to the top most completed deck.

(38) Naked lights and hot work oil-carrying vessels.-
(a) Subject to the provisions of sub-para (b) of this para and to the provisions of para (46),

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and without prejudice to the provisions of para (44) and (45), no naked light, fire or lamp-

(i) shall be permitted to be applied to, or to be in, or any hot work permitted to be carried out in any part of a tanker, unless since oil was last carried in that tanker, a naked lights certificate has been obtained and is in force in respect of those parts of the tanker for which, in the opinion of a competent analyst, a naked light certificate is necessary:

Provided that a naked light, fire or lamp of a kind specified in writing by a competent analyst may be applied to, or be in, or any hot work of a type specified by him carried on, any part of the tanker so specified;

(ii) shall be permitted -

(aa) to be in any oil tanker on board or in a vessel in which oil-tank the oil last carried was oil having a flash point of less than 23 degrees centigrade or was liquid butane, nor any hot work permitted to be carried out in any such oil tank or vessel, unless a naked light certificate has previously been obtained on the same day and is in force in respect of that oil tank and of any oil tank, compartment or space adjacent thereto;

(bb) to be applied to the outer surface of any oil-tank on board or in a vessel in which oil-tank the oil last carried was such oil as aforesaid nor any work of such a nature which is likely to produce sufficient heat capable of igniting flammable gases or vapours permitted to be carried out on the outer surface of such oil-tank or vessel, unless a naked light certificate has previously been obtained on the same day and is in force in respect of that oil-tank;

(cc) to be applied to the outer surface of, or to be in, any compartment or space adjacent to an oil-tank on board or in a vessel in which oil-tank the oil last carried was such oil as aforesaid, nor any hot work permitted to be carried out in such compartment or space as aforesaid, nor any work of such nature which is likely to produce sufficient heat capable of igniting flammable gases or vapours, permitted to be carried out on the outer surface of such compartment or space, unless a naked light certificate has previously been obtained on the same day and is in force in respect of that compartment or space:

Provided that where in any such case referred to in paras (aa) (bb) or (cc) of this sub-para a competent analyst has certified that daily naked light certificate are unnecessary or are necessary only to a specified extent, such a daily certificate need not be obtained or, as the case may be, need only be obtained to the specified extent;

(iii) shall be permitted to be applied to the outer surface, or to be in, any oil-tank on board or in a vessel nor any hot work permitted to be carried out in any such oil-tank or vessel, nor any work of such nature which is likely to produce sufficient heat capable of igniting flammable gases or vapours, permitted to be carried out on the outer surface of the oil tank or vessel, unless, since oil was last carried in that oil-tank, a naked light certificate has been obtained and is in force in respect of that oil-tank;

(iv) shall be permitted to be applied to the outer surface of, or to be in, any compartment or space adjacent to an oil-tank on board or in a vessel nor any hot-work permitted to be

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carried out in any such compartment or space, nor any work of such nature which is likely to produce sufficient heat capable of igniting flammable gases or vapours, permitted to be carried out on the outer surface of any such compartment or space, unless, since oil was last carried as cargo in that oil-tank, a naked light certificate has been obtained and is in force in respect of that compartment or space.

(b) Not withstanding anything in sub-para (a) of this para, heated rivets may be permitted in any place without naked light certificate being in force in respect of that place if expressly so authorised by a competent analyst who certifies that after adequate and suitable testing, he is satisfied having regard to all the circumstances of the case, including the likelihood or otherwise of the atmosphere becoming flammable, that the place is sufficiently free from flammable vapour; but such heated rivets shall, where practicable, be passed through tubes.

(c) No person shall introduce, have or apply naked light, fire or lamp into, in or to any place where they are prohibited by this sub-para.

(d) No person shall carry out hot work or any work of such nature which is likely to produce sufficient heat capable of igniting flammable gases or vapours, in any place or any surface where they are prohibited by this sub-para.

(e) In this sub-para the expression 'competent analyst' means an analyst who is competent to give a naked light certificate.

(39)Entering oil-tanks.-

(a) No person (other than an analyst entering with a view to issuing a certificate of entry) shall, unless he is wearing a breathing apparatus of a type approved for the purpose of this sub-para, enter or remain in an oil-tank on board or in a vessel unless, since the oil-tank last contained oil, a certificate of entry has been obtained and is in force in respect of the tank.

(b) Without prejudice to para (a) of this para, no person (other than an analyst entering as aforesaid) shall be allowed or required to enter or remain in an oil-tank on board or in a vessel in which oil-tank the oil last carried was oil having a flash point of less than 23 degrees centigrade unless, since the oil-tank last contained oil, an analyst has certified that the atmosphere is sufficiently free from flammable mixture.

(c) The provisions of this sub-para are without prejudice to the requirements of para (32).

(40) Duration of certificates.- Any naked light certificate or certificate of entry may be issued subject to a condition that it shall not remain in force after a time specified in the certificate.

(41) Posting of certificates.- Every occupier for whom a naked light certificate or a certificate of entry is obtained shall ensure that the certificate or a duplicate thereof is posted as soon as may be and remains posted in a position where it may conveniently read by all persons concerned.

(42) Maintaining safe atmosphere.-

(a) When conditions in an oil-tank in respect of which a naked light certificate has been

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issued, are such that there is a possibility of oil vapour being released from residues or other sources, test shall be carried out by a competent analyst at such intervals as may be required so as to ensure that the conditions in the tank are maintained safe.

(b)Whenever hot work is carried on or a naked light, fire or lamp is allowed to be, on the weather deck over spaces, in respect of which a naked light certificate has not been issued, all covers of manholes and openings on deck and all valves (except those which are connected to high vent pipes) connecting the weather deck with the said spaces, shall be closed.

(c) A record of all the tests carried out for the purpose of paras (32), (38) and (39) shall be maintained in a register which should furnish the date, time, location and results of the tests.

(43) Cleaning of oil-tanks.-

(a)Subject to the provisions of para (46), before a test for flammable vapour is carried out with a view to the issue of a naked light certificate for the purposes of para (38) in respect of a an oil-tank on board or in a vessel, that oil-tank shall, since oil was last introduced into the tank, be cleaned and ventilated in accordance with sub-para (b) of this para.

(b)The said cleaning and ventilation shall be carried out by the following methods:-

(i) the oil-tank shall be treated in such manner and for such periods as will ensure the vaporisation of all volatile oil;

(ii)all residual oil and any sludge or other deposit in the oil-tank shall be removed therefrom; and

(iii)after the oil-tank has been so cleaned,-

(aa) all covers of manholes and other openings therein shall be removed and it shall be thoroughly ventilated by mechanical or other efficient means with a view to the removal of all oil vapour; and then

(bb)the interior surfaces, if any deposit remains thereon, shall be washed or scraped down.

(44) Invalidation of certificates.-

(a) If during the course of work in, or to the outer surface of, any part of a tanker or aircraft carrier, any pipe or tank joint is opened or broken or any other event occurs so that there is a risk of oil vapour entering or arising in that part of the tanker or aircraft carrier, that work shall be suspended and thereafter any certificate of entry previously issued in respect of any oil-tank in that part and any naked light certificate previously issued in respect of that part shall be no longer in force.

(b) If (in case of a vessel other than a tanker or aircraft carrier) during the course of work in any oil-tank or in any compartment or space adjacent thereto, any pipe or tank joint is opened or broken or any other event occurs so that there is a risk of oil vapour entering or arising in the oil-tank or in any compartment or space adjacent thereto that work shall be suspended and thereafter any certificate of entry previously issued in respect of the oil-tank or any compartment or space adjacent thereto shall be no longer in force.

(45) Provisions as to work in other compartments or space.-

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(a) Without prejudice to the other provisions of this standard, if the presence of oil in such quantity and in such position as to be likely to give rise to fire or explosion is detected in any part of a vessel, being a part to which this sub-para applies and in which repairs of the following kind are to be or are being undertaken, that is to say, repairs involving the use of a naked light, fire or lamp (other than a safety lamp of a type approved for the purpose of para (38), or involving hot work, such repairs shall not be started or continued until a naked light certificate has been issued or, as the case may, reissued in respect of that part of the vessel.

(b) This sub-para shall apply to bilges, shaft tunnels, pump rooms, and to compartments and spaces other than those to which sub-para (a) (iv) of para (38) applies.

(46) Earthing.- Electrical energy other than that generated by an independent generating unit on board shall not be taken for use, or used in, or in connection with any of the operations unless that body of the ship is securely earthed in such a manner as to ensure an immediate and safe discharge of energy to the earth. A ship or vessel shall not be considered as securely earthed for the purpose of this para only on account of it being partly submerged in water.

(47) Arc welding.-

(a)Electric are welding shall not be carried on in connection with any of the operations unless separate and fully insulated welding return conductor or conductors as the case may be, of adequate electrical capacity are provided for return of the current to the transformer or generator of the welding set.

(b)The return end of the source of the welding current shall not be earthed.

(c) All work on which welding is carried on shall be securely earthed independently to an earth electrode by means of a conductor or conductors as the case may be, of adequate capacity, unless all such work are connected to any structure of the ship or vessel in such a manner as to ensure adequate connection to earth as aforesaid.

(48) Electrical energy shall be cut off from all portable electric tools and manual electrode holders within any tank, compartment or space referred to in paras (32) and (38) or in any other confined space during all times when such tools or holders are not in operations:

Provided that for determining whether any such portable electric tool or electrode holder is not in operation, no account shall be taken of brief interruptions of work occurring during normal working.

Provided further that energy may not be cut off from any such equipment if a responsible person is left in charge of it in such tank, compartment or space concerned.

Provided further that cutting of all electrical energy by operation of any switch or control provided on the portable tool or electrodes itself should not be taken as fulfilling the requirement of this para.

Miscellaneous safety provisions

(49) Lighting.- All parts of a vessel and all other places where the operations are being carried

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on, and all approaches to such parts and to places to which a worker may be required to proceed in the course of his employment, shall be sufficiently and suitably lighted. In provided such lighting, due regard shall be given to avoidance of glare and formation of shadows, to the safety of the vessel and cargo, of the navigation of other vessels, and to any local statutory requirements as to the lighting of the harbour or dock.

(50) Work in boilers, etc.-

(a) No work shall be permitted in any boiler, boiler-furnace or boiler-flue until it has been sufficiently cooled to make work safe for the workers.

(b) Before any worker enters any steam boiler which is one of a range of two or more steam boilers-

(i) all inlets through which steam or hot water might otherwise enter the boiler from any other part of the range shall be disconnected from that part; or

(ii) all valves or taps controlling such entry shall be closed and securely locked.

(c) While workers remain in any steam boiler to which sub-para (b) of this para applies all such inlets shall remain disconnected or all such valves or taps as are therein referred to shall remain closed and securely locked.

(d) No worker shall be allowed or required to enter or remain in, and no person shall enter or remain, in any steam boiler to which sub-para (b) applies unless the provisions of that sub-para are being complied with.

(51) The hatch beams of any hatch in use for the operations shall, if not removed, be adequately secured to prevent their displacement.

(52) Bolts which have been jumped-up and re-screwed shall not be used for securing plates on the sides of vessels, and no worker shall use such bolts for this purpose.

(53) Work in or on life boats.-

(a) Before workers are permitted to work in or on any life boat, either stowed or in suspended position, precautions shall be taken to prevent the boat from falling due to accidental tripping of the releasing gear or movement of the davits, and capsizing of the boat if in the chocks.

(b) Workers shall not be permitted to remain in life boats while the life boats are being hoisted into final stowed position.

(54) Prohibition of employment of Adolescent in certain processes. - No Adolescent shall be employed in –

(a) the application of asbestos by means of a spray;

(b) the breaking down for removal of asbestos lagging;

(c) the cleaning of sacks or other containers which have contained asbestos;

(d) the cutting of material containing asbestos by means of portable power-driven saws; or

(e) the scaling, scurfing or cleaning of boilers, combustion chambers or smoke box, where his work exposes him to dust of such a character and to such an extent as to be likely to be injurious or offensive to persons employed in such work.

(55) Lead processes. -

(a) Lead paint shall not be applied in the form of a spray in the interior painting of any

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part of a ship or vessel.

(b)Wherever lead sheating work is carried on for making cold storage chambers in the ships, efficient exhaust draughts with portable extractors shall be provided to remove the lead fumes from the confined spaces.

(56) Safety supervision. - In the case of every shipyard other than a dry dock available for hire, being a shipyard where the number of workers regularly or from time to time exceeds five hundred, a person experienced in the work of such yards shall be appointed and employed exclusively to exercise general supervision of the observance of these standards and to promote the safe conduct of the work generally.

70. Curing, canning or other processing of fish, prawn, shrimp and others aquatic fauna - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all factories or parts of factories involved in the curing, canning or any other processing of fish, prawn , Shrimp and others aquatic fauna

(2) Specific Personal protective equipment –

(a) Suitable protective clothing shall be provided for the use of workers when entering the cold storage chamber, and when attending to processes which are wet and likely to drench the clothes worn.

(b) The occupier shall provide for the use of all persons employed in or entering the cold storage chamber, an adequate supply of protective equipment against low temperature, including gloves, overalls and protective footwear's, of types approved in writing by the Inspector-cum-Facilitator;

(c) an adequate supply of protective footwear of a type approved in writing by the Inspector-cum-Facilitator for the use of all persons employed in wet processes involving standing on wet floor or handling of wet articles, or washing of articles.

(d) Arrangement shall be made for the proper and efficient cleaning of all such protective clothing, Adequate soap, free of cost, shall be made available for this purpose.

(e) The occupier shall provide and maintain for the use of persons employed suitable accommodation for keeping the clothing not worn during working hours, and for the drying of wet clothing. The accommodation so provided shall be placed under the charge of a responsible person.

(f) No person shall wear a protective clothing or protective footwear worn by another person.

71. Compression of oxygen and hydrogen-produced by the electrolysis of water- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) The room in which electrolyser plant is installed shall be separate from the plant for storing and compressing the Oxygen and Hydrogen and also the electric generator room.

(2) The purity of Oxygen and Hydrogen shall be tested by a competent person at least once in every shift at the following points:-

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(a) in the electrolysis room
(b) at the gas holder in-let and
(c) at the suction end of the compressor.

The purity figures shall be entered in the register and signed by the persons carrying out such tests.

Provided, however, that if the electrolyser plant is fitted with automatic recorder of purity of Oxygen and Hydrogen with alarm lights, it shall be sufficient if the purity of the gases are tested at the suction end of the compressor only.

(3) The Oxygen and Hydrogen gases shall not be compressed if their purity as determined under para (2) above falls below 98 per cent at any time.
(4) The bell of any gas holder shall not be permitted to go within 30 cms. of its lowest position when empty and a limit switch shall be fitted to the gas holder in such a manner as to switch off the compressor motor when this limit is reached.
(5) There shall be at least two gas holders for each kind of gas compressed and the gas holders for same gas shall be provided with suitable arrangements to ensure that no gas holder is connected to the compressor and to electrolyser at the same time, and only one gas holder is connected to the compressor line at any one time.
(6) The water and caustic soda used for making lye shall be chemically pure within pharmaceutical limits.
(7) Electrical connections at the electrolyser cells and at the electric generator terminals shall be so constructed as to preclude the possibility of wrong connections leading to the reversal of polarity and in addition an automatic device shall be provided to cut off power in the event of reversal of polarity owing to wrong connections either at the switch board or at the electric generator terminals.
(8) Oxygen and Hydrogen pipes shall be painted with distinguishing colours and in the event of leakage in the joints of the hydrogen gas pipe, the pipe after reconnection shall be purged of all air before drawing in hydrogen gas.
(9) All electrical wiring and apparatus in the electrolyser room shall be of flame-proof construction or enclosed in flame-proof fittings and no naked light or flame shall be allowed to be taken either in the electrolyser room or where compression and filling of gases is carried on and such warning notices shall be exhibited in prominent places.
(10) No part of the electrolyser plant and the gas holders and compressor shall he subjected to welding, brazing, soldering or cutting until steps have been taken to remove any explosive substance from that part and render the part safe for such operations and after the completion of such operations no explosive substance shall be allowed to enter that part until the metal has cooled sufficiently to prevent risk of explosion.
(11) No work of operation, repair or maintenance shall be undertaken except under the direct supervision of a person who, by his training, experience and knowledge of the necessary precautions against risk of explosion is competent to supervise such work. No electric generator after erection or repairs shall be switched on to the electrolysers unless the same is certifiedby the competent persons under whose direct supervision erection or repairs are carried on to be in a safe condition and the terminals have been checked for the

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polarity as required by para(7).

(12) Every part of the electrolyser plant and the gas holders and compressor shall have a regular schedule of overhaul and checking and every defect noticed shall be rectified forthwith.

72. Handling and processing coir fibre- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all factories or part of factories in which any of the following operations involving coir fibre are carried out.

(a) hammering

(b) harvesting

(c) defibering/decortication

(d) spinning/curling

(e) bleaching

(f) dyeing

(g) spooling and bailing

(h) PVC tufting

(i) Weaving

(j) Shearing

(k) Rubber backing

(1) Latex backing

(m) Stenciling

(n) Flocking

(2) Declaration of operations as dangerous: Harvesting, defibring, bleaching, dyeing, Tufting, rubber backing, shearing, stencilling, flocking and latex backing of coir are declared to be dangerous operations when carried out in any factory.

(3) Prohibition of Employment of pregnant woman and adolescent:

(a)No adolescentshall be employed or permitted to work in any operation specified in para(1).

(b) No pregnant woman shall be employed or permitted to work in any operation specified in para(2).

(4) Storage and Handling of dangerous of chemicals: Whenever any dangerous chemical is handled, stored or used, all necessary steps shall be taken to prevent inhalation, ingestion or absorption of this chemical by workers while engaged in operations specified in para(1).

(5) Suitable seating arrangements shall be provided for the workers engaged in manual

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defibering and manual hammering operations.

(6) Bleaching and dyeing operation shall be carried out separately away from other operations. Effective arrangements shall be made to prevent escape of fumes in the work environment.

(7) Escape of dust and fumes: Suitable and adequate arrangements shall be made for preventing escape of dust and fumes in work environment.

(8) a) No food or drink shall be brought into any room in which any of the operations specified in para(1) is carried on.

(b) No food or drink shall be consumed in any room in which any of the operations specified in para (1) is carried on.

(9) The floor of every room in which any of the operations specified in para (1) is carried on shall be:

(a) of cement or similar material so as to be smooth and impervious.

(b) maintained in sound condition; and

(c)provided with suitable and adequate arrangements for drainage.

73. Handling and processing of cotton- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all factories or part of factories in which any of the following processes are carried on:

(a) Opening of cotton bale

(b) Carding

(c) Combing of cotton

(d) Spinning of cotton yam

(e) Cleaning of waste cotton

(2) Exhaust Draught Examination and Test:

(a) An efficient exhaust draught shall be provided and maintained by the occupier for the following processes and machines to trap cotton dust or fluff at the source of origin and those in air:

(i) bale breaking and mixing of cotton

(ii) blow room machinery, cards, combing, spinning, winding machines:

(iii) machines used for processing waste cotton; and

(iv) any other process in which cotton dust is given off into the work environment.

(b) All equipment for extraction of cotton dust or fluff shall be examined and tested by competent person at least once in every six months and any defects disclosed by such examination and tests, shall be rectified. A register about such examination and test shall be maintained by the occupier.

(3) Protective appliances: The occupier shall make arrangements for:

(a) supply of a suitable personal protective appliances to all workers likely to be

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exposed to cotton fluff or dust.

(b) supply of these appliances on individual basis

(c) maintaining these appliances in working condition by cleaning and replacement;

(d) storage of these appliances in hygienic condition;

(e) education of workers to use appliances and

(f) proper supervision to ensure whether the workers are using these appliances in working process

(4) The occupier of the factory shall ensure that:-

(a) cotton dust in the ambient air of the workroom or any other place where cotton is processed or handled shall not exceed concentration 0.2 mg./m

(b) environment in those areas shall be regularly monitored and results shall be made available to the Chief Inspector cum Facilitator on demand.

(5) Without prejudice to the other methods as stated above for prevention of above referred disease, the Occupier shall adopt such other control measures like adoption of vacuum stripping of cards instead of brush stripping cleaning of the workroom by vacuum cleaners instead of brooms, etc.,

74. Fireworks manufactories and match factories- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) The provisions of this standard shall apply to all manufactories and processes incidental thereto carried on in any Fire Works Manufactory or a match works.

(2) Buildings

(a) The building of any fireworks manufactory or match factory shall conform to the National Standards and the height of such buildings shall at no time be less than 3 meters;

(b) No building inside a fireworks manufactory shall have a first floor at any time:

(c) In Match works, provided with a first floor, there shall be 2 staircases leading from the first floor to the ground floor irrespective of the number of persons employed in the first floor and one of the staircases shall be of masonry construction or of non inflammable materials;

(d) All doors shall open outwards and all the doorways shall be kept free from obstructions;

(e) All doors of workrooms shall not be less than 1.2 meters in width or less than 2meters in height;

(f) The floors of all work rooms including mixing sheds shall be completely covered by a rubber sheet having a smooth surface and having a thickness of at least 3 mm. If the floor cannot be covered by a single rubber sheet, more than one rubber sheet may be used, so that each sheet is overlapped by the other at least 150 mm; and

(g) Mixing sheds in a fireworks manufactory shall be at a distance of 18 meters away from all other sheds if the quantity of chemical stored, handled or used in the mixing shed is less than 50 kilograms and be separated by baffle walls opposite to each exitof the mixing shed:

Provided that the distance shall be at least 21 meters, if the quantity of chemical stored,

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handled or used in the mixing shed exceeds 50 kilograms.

(3) Electrical Equipment

(a) If at any time, use of electricity is allowed in the factory, all leads, etc., shall be in conduits with flame-proof junctions;

(b) Electrical supply shall never be through a lamp even with a non-conducting handle.

(4) Protective clothing

(a) Under no circumstances clothes made of artificial fiber like terelene, etc., be allowed inside the factory;

(b) All workers shall be supplied with asbestos aprons especially to cover the chest, gonads and thighs

(c) Breathing apparatus shall be used in mixing sheds to avoid workers inhaling poisonous fumes in the event of an untoward reaction.

(d) In mixing sheds where aluminium and magnesium powders arc used "anti-stat" footwear

to combat static electricity shall be supplied.

(e) All protective equipment shall be maintained in an efficient condition and also shall be maintained in a clean and hygienic condition.

(5) Match Factories

In match factories --

(a) the residue of the head composition shall not in any way be mixed with the residue of the friction composition ;

(b) the rooms comprising the two mixing departments, namely, (a) head composition and (b) friction composition shall be entirely separated from each other and the drains from these two departments shall be kept entirely separate;

(c) rubbish containing the residues of the head composition and friction composition shall be kept and burnt separately;

(d) department in which completed matches (matches with heads on) are stored shall be separated from all other departments by means of fire-proof walls and doors providing adequate means of escape in case of fire :

(e) Splints, veneers and other materials in excess of the quantity required for the day's manufacture shall be kept in separate rooms of the factory where no manufacturing process is carried on. No manufactured material shall be stored anywhere in the factory compound for more than five days after the manufacture except in the storage godowns:

(f) Provided that nothing contained in this standard shall apply to splints and veneers in cases stored in peeling and box making departments;

(g) Store room for matches shall be entirely separated by fire-proof walls from the buildings used for manufacture

(h) The racks in the dipped splints room shall have sides top and the rear part provided with non-inflammable materials.

(i) The process of packing shall be done in an area away from the place of manufacture; and

(j) No child or adolescent shall be employed or permitted to work in any process directly

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connected with the manufacturing process up to final production of match sticks.

(6) Precautions to be taken in connection with manufacture of fuses used in crackers, etc

(a) Bundles of fuses shall be handled by carrying and not dragging them on the floor;

(b) Drying of fuses after wrapping shall be carried out on platforms away tram workrooms ;

(c) Cutting shall be done by experienced workers employed only for this purpose and under proper supervision ;

(d) Cutting shall be done on a large masonry platform covered with at a tarpaulin and kept free from grit and pebbles;

(e) Cutting shall be done on a raised platform so that workers can work standing. Cutting shall be done by placing the fuse on wooden sleepers kept over blocks of wood. Brick shall not be used beneath the wooden reapers; and

(f) Workers, while on dangerous operations, shall not wear clothing sewn with ferrous or steel buttons, buckles or attachments. They shall not carry on their persons, iron knives, keys, etc.

(7) Restriction of Employment of pregnant woman and children: Pregnant woman workers and adolescents shall not be employed on operation where chemicals arc mixed and where fuses are cut. Children shall not be employed or permitted to work in the manufacturing process or any work or operation or process connected there with or incidental thereto in fireworks manufactory.

(8) General

(a) No person other than a factory worker and/or an inspecting officer or others connected with the manufacturing process shall be allowed to enter the working area;

(b) Cardboard containers and trays without steel nails shall be used for storage and dayto-day working purposes.

(c) During the manufacture of fuses only brass or non-ferrous knives shall be used and drying of fines shall be away from all workrooms.

(d) Door mats shall be provided outside the workroom and near all drying platforms and where fuses are cut for the workers to clean their feet.

(e) At no time, mixing materials shall exceed the quantity that is required for the manufacture of mixing for half an hour operation only.

(f) For filling up chemicals in the inner tubs of crackers, only aluminium or plastic rings shall be used and not galvanized iron rings.

(g) Buckets, containers, hoops, locks, nails, screws, bolts, nuts, knives, scissors, hinges latches etc. made up of iron shall not be used within the factory premises.

(h) Wooden racks without iron nails shall be used for drying paper cap sheets, in a morcess factories.

(i) Wooden racks used for drying paper cap sheets shall be provided with asbestos or other fire resistant sheets on the three sides leaving the front side open.

(j) Dried paper cap sheets shall be carried in wooden trays with four compartments (partitions) each compartment (partition) carrying a single sheet.

(k) Each manufacturing shed of fireworks shall have at least two doors facing each other. The doors provided to the work sheds of adjacent rows shall not face each other.

(l) Not more than four persons shall be employed or allowed at any one time in anyone building in which explosive is being manufactured.

(m) Copper plates shall be fixed on the baffle wall of the chemical mixing shed and

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chemical filling shed; and the workers before entering those sheds, shall place their hands on the copper plates in order to discharge the electrostatic charges from their body and to protect them from any untoward fire or explosion.

(n) Workers aged above 55 years shall be employed only in non-explosive areas.

(o) No person, aged 50 years and above shall be employed in Fireworks Manufactory unless his eyesight including colour vision and his hearing capacity are examined and declared fit by a qualified ophthalmologist and ENT specialist, respectively, to work whether with or without use of corrective appliances. Such examinations shall be made at least once in every two years. Record of examination or re-examination carried out shall be produced on demand to Inspector-cum-Facilitators at the time inspection.

(p) Work benches and tables shall be provided for mixing and filling operations.

(q) Blast walls shall be provided around the drying platform at a distance of 2 meters away from the drying platform. The height of the blast wall shall be at least one foot more than that of the height of the drying platform.

(r) In every Fireworks Factory, there shall be appointed a Supervisor with minimum qualification of B.Sc. (Chemistry) or Diploma in Chemical Engineering or its equivalent. He shall be fully conversant with the process of manufacture of fireworks and the associated hazards. These Supervisors shall undergo special training of fireworks safety as approved by the Chief Inspector-cum-Facilitator of Factories. Number of Supervisors shall be at the rate of 1 for every 50 workers. Manufacture of fireworks shall be carried out under the supervision of such Supervisors.

(s) Factories which make fancy crackers shall have,

(i) separate colour pellet machine shed;

(ii) separate colour pellet drying shed ; and

(iii) separate transit rock for storing colour pellets.

(t) Not more than one manufacturing activity at any one item of crackers shall be allowed or required to be done in any workings shed at a time.

(u) The workers involved in mixing and filling operations shall have an education Qualification of at least Higher Secondary Course.

(v) The drying platform meant for Rockets and Fire Works of flying nature shall be provided with a temporary roof of a strong aluminium mesh cover resting on the baffle wails, for protection from direct sun light.

(w) There shall be provided at least two burning pits in every factory and each burning pit shall be at a minimum distance of 62 meters away from the workings shed.

(x) The collected waste shall be disposed in the burning pit after the working hours of the factory on the same day in the presence of the Foreman by a trained worker.

(y) Wind direction indicator shall be provided in each factory.

(z) No electronic appliances such as mobile phones, transistors etc., shall be allowed in the premises, where fireworks are manufactured, handled, stored or used.

(aa) The mixed chemicals shall be used on the same day. No mixed chemical (fireworks)composition, dry or wet shall be kept in the factory at the close of any working day. Such residual composition shall be safely destroyed at the close of the day.

(ab)No manufacturing activity shall be carried on in Fireworks factory between 6.00pm. and 6.00 am.

(9) Display of notices

The following notices in the local language understood by the majority of workers shall be

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displayed at a conspicuous place in the factory.
(a) Smoking is strictly prohibited.
(b) No one shall carry matches or other igniting materials into the factory.
(c) No workers shall be in a work room or a rawhide no work has been assigned to him.
(d) If anything untoward happens in any shed all workers shall dash to the gates which serve as out gates of the factory and in no circumstances be curious to see what has happened in the affected shed.
(e) Any spillage of materials shall be cleaned without any delay.
(f) Wearing of clothes made of artificial fiber like terrene, etc., is prohibited. clothing's sewn with ferrous or steel buttons or buckles or attachment should not be worn.
(g) Foot wears with iron nails should not be used-(It) Workers should not carry with themselves iron knives and iron keys, etc.

75. Manufacture of bangles and other articles from cinematograph film and toxic and inflammable solvents- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply in respect of all factories or any part thereof in which the process of manufacture of bangles and other articles from cinematograph film or from toxic and inflammable substances or from both (hereinafter referred to as the said manufacturing process) is carried on.
(2) Prohibition relating to employment of pregnant woman and adolescent
(3) No pregnant woman or adolescent shall be employed or permitted to work in any room in which any of the said manufacturing process is carried out or in any room in which toxic or inflammable substances or both are stored or treated.
(4) Protective clothing. Protective, clothing shall be provided and maintained in good repair for all workers employed in the factory and such clothing shall be worn by the workers concerned. The protective clothing shall consist of a suitable apron and head- coverings provided in that behalf. The head-coverings so provided shall be washed daily.
(5) Drying of cinematograph film. :-
  (a) Drying of cinematograph film shall not be done except under such conditions as will prevent the cinematograph film from coming into contract or proximity with any source of heat or heated to surface in such a manner as would render the cinematograph film liable to be ignited or decomposed.
  (b) Loose unwound cinematograph film shall be enclosed during drying in such a manner that a person in a room will be protected as far as practicable from an outburst of flame.
  (c) The temperature in any part of a drying enclosure for loosed unwound cinematograph film other than a safety acetate film shall not at any time exceeding 100° F. A thermometer shall be kept available in every room in which such drying is done.
  (d) Boiling of raw films either alone or in conjunction with other chemicals or heating of bangles and other articles made of films shall be carried out in an open space.
  (e) A sufficient number of buckets filled with water shall be provided near the places where bangles are subjected to heat treatment.
(7) Storage of raw materials. :-
  (a) Each roll or package of cinematograph film used in any of the said manufacturing process, shall except when required to be exposed for the purposes of the work carried

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on, be kept in separate box, properly closed and constructed of metal or other approved metal.

(b) All cinematograph film not being actually used or manipulated shall be kept in a room or chamber. Toxic and inflammable solvents stock shall be stored in approved place or containers.

(8) Disposal of waste films.:-

(a) All waste and scrap of cinematograph films shall be collected at frequent intervals during each day and be placed in strong metal receptacles fitted with self-closing lids and clearly marked with words "Film Waste".

(b) No material liable to ignite spontaneously nor anything likely to ignite or decompose cinematograph film shall be placed in the receptacle.

(c) At the end of each day's work waste and scrap film shall be either transferred to a storeroom or removed from the premises.

(d) Waste films and shavings shall be destroyed by burning in an open place under controlled conditions. They shall be allowed- to be thrown or scattered in or about the premises of the factory.

(9) Prohibition for smoking.

(a) No person shall be allowed to smoke in any room in which cinematograph film is manipulated, used or stored.

(b) No open fire or any smoking materials or matches nor anything likely to ignite or decompose cinematograph film shall be allowed in any store room or in any room, in which cinematograph film or toxic inflammable solvents or both are stored manipulated or used.

(10)All electrical installation and fittings shall be of flame-proof type.

(11)The floor of every workroom in which any of the said manufacturing process are carried on shall be:-

(a) of cement or similar material so as to be smooth arid impervious to water;

(b) maintained in sound conditions;

(c) kept free from materials, plant or other obstruction not required for, or produced in the process carried on in the room;

(d) cleaned daily after being thoroughly sprayed with water at a time when no other work is being carried on in the room.

(12) No food, drink, pan and supari or tobacco shall be consumed or brought by any worker into any workroom in which any of the said manufacturing processes is carried on.

(13) Adequate means of escape in case of fire shall be provided in every room in which cinematograph film is manipulated, used or stored and the means of escape shall not be deemed adequate unless:-

(a) at least two separate exists are provided from every such room and two safe ways of escape from the building are available for all persons employed in the factory, and

(b) all doors and windows provided in connection with the means of escape are constructed to open outwards readily.

(14) Cautionary notices:-

(a) Cautionary notices explaining the dangers to which workers are exposed due to any of the said manufacturing processes being carried shall be affixed in prominent positions in the factory where they may be easily and conveniently read by the persons employed.

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(b) The said notice shall be printed in the languages understood by the majority of worker employed in the factory.

(c) If any person employed in the factory is illiterate, effective steps shall be taken to explain carefully to such illiterate person the contents of the notices.

76. Manufacture of articles from refractory materials including refractory bricks - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to the following processes:-

(a) handling, moving, breaking, crushing, grinding or sieving of any refractory materials containing not less than 25 per cent total silica for the purpose of manufacture:-

(i) of articles used in the construction of furnaces and flues, of crucibles, and

(ii) of compositions or other materials used in the preparation of moulds in which metals are cast; or

(b) any process in the manufacture of refractory bricks as hereinafter defines:

Provided that, nothing in this standard shall apply:-

(i) to handling, moving, mixing or sieving of natural sand, or

(ii) to the manipulation of rotten rock in the preparation of moulds used in metal foundries:

Provided further that, if the Chief Inspector of Factories is satisfied in respect of any factory or part thereof that owing to the special conditions of work or otherwise, any of the provisions of this Schedule can be suspended or relaxed without any danger to the health of the person employed therein, he may by an order in writing grant such suspension or relaxation for such period and no such conditions as he may think fit. Any such order may be revoked at any time.

(2) No refractory material shall be broken in pieces by manual labour unless is carried out in the open air:-

Provided that, where it is not practicable to carry out this process in open air. the process shall be carried out under an efficient exhaust draught.

(3) No refractory material, unless it is so wet that dust will not be produced, shall be crushed or ground in a stone crushing or a grinding machine unless such machine is provided with :-

(a) an efficient exhaust draught and efficient dust collecting appliances; or

(b) an efficient water or steam spray:

Provided that, every grinding machine wherein any refractory material is ground in dry state, shall be, totally enclosed and connected to a mechanical exhaust system so as to prevent effectively any escape or dust outside the casing of the machine by maintaining a pressure below the atmospheric pressure within the casing of the machine.

Provided further that, all processes of crushing and grinding shall be effectively isolated from other processes.

(4) All chutes, conveyors, elevators, screens, selves and mixers used for manipulating refractory material shall, unless the material is so wet that dust will not be produced, be enclosed and be provided with efficient exhaust draught.

(5) No refractory material so dry as to produce dust shall:-

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(a) be loaded into any wagon or other receptacle for transport, unless it has been placed in suitable dust-proof container so damped as to preclude dust; or

(b) be unloaded from any wagon or other receptacle for transport unless it has been so damped as to preclude dust or unless the work is done under an efficient exhaust draught;

(c) be shovelled or racked or otherwise manipulated by means of hand tools in any manufacturing process, unless it has been so damped as to preclude or unless the work is done under an efficient exhaust draught :

Provided that, sub-para (b) shall not apply to refractory material in the form of rock or pebbles before it is manipulated in any manufacturing process.

(6) (a) The floors of all places where refractory bricks are dried, other than the floors of tunnels, ovens or chamber dries not normally entered by persons employed shall, after each lot of refractory bricks has been removed, be carefully cleaned of all debris and the part, being cleaned shall be kept damped while the cleaning is being done.

(b) There shall be provided in every such place a constant supply of water laid on under adequate pressure with sufficient connections and flexible branch pipe and sprinkler to enable water to be supplied directly to every part of the floor.

(7) No drying stoves in which refractory bricks are backed by fires before being placed in the kilns shall be used.

(8) The surface of every floor or place where persons are liable to pass shall be cleaned of debris of refractory material once at least during each daily period of employment or where shifts are worked, once during each shift. Such debris, unless it is immediately required for use in the process, shall be effectively damped and either be placed in covered receptacles, or be otherwise stored in such manner as to prevent the escape of dust into the air or near to any place where any person is employed.

(9) Where plates are used, whether portable or forming part of the floor, on which refractory bricks are dried, such plates shall be freed from adherent material only by a wet method or by such other method as will prevent the escape of dust into the air.

(10) The dust or powder of refractory materials shall not be used for sprinkling the moulds in refractory brick making:

Provided that, nothing in this para shall be deemed to prevent the use of natural sand for the purpose of sprinkling the moulds.

(11) No worker shall be allowed to work on any dusty process or at any place where dust of any refractory materials is present in the atmosphere:

Provided that, in any emergency a worker may be allowed to work at such process or place if he wears a suitable and efficient dust mask or breathing apparatus.

77. Graphite powdering- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all factories or parts of factories in which the grinding and sieving of graphite and the processes incidental thereto are carried on.

(2) No pregnant woman, child or adolescent shall be employed in any factory upon any of the operations specified in para (1) above.

(3) Exhaust draught

Provisions shall be made for removing the dust produced in any of the operations

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specified in para (1) above by means of an efficient exhaust draught so contrived as to operate on the dust as closely to the point of origin as possible:

Provided that where the provision of an exhaust draught is not reasonably practicable the Inspector-cum- Facilitator may require

(a) respirators of a type approved by him to be provided and maintained in a clean and efficient condition by the occupier and worn by every person working under such conditions ;and

(b) the damping of floors, apparatus and material to prevent the raising of dust.

(4) Floor and work benches

(a) The floor of every room in which any persons employed up on any of the operations specified in para (1) above shall be of cement or other impervious material.

(b) The top of every work-bench in every such room shall be of impervious material.

(c) The said floors and work-benches shall be kept dean and in good condition.

(d) The Inspector–cum–Facilitator may, by order in writing, require the said floor sand work--benches to be kept wet in such manner as he may deem suitable, in order to reduce dust

(5) No food, drink, pan and supari or tobacco hall be brought into, or consumed, in any room in which any person is employed upon any of the operations specified in para (1) above.

(6) Adequate protective clothing such as over-alls in a clean condition shall be provided by the occupier to every person employed upon any of the operations specified in para (1) above.

78. Dyeing stenciling and painting of mats, mattings and carpets in coir and fibre- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all coir factories in which stenciling or painting of mats or maittings or carpets is carried on, and to all coir and fibre factories in which dyeing of yarn (other than cotton yarn) and fibre is carried on.

(2) No pregnant woman or adolescent shall be employed or permitted to work in any of the operations specified in para(1).

(3) No food or drink shall be brought into or consumed in, in any room in which any of the operations specified in para(1) is carried on.

(4) The floor of every room in which any of the operations specified in para (1) is carried onShall be

(a)of cement or similar material so as to be smooth and impervious to water;

(b) maintained in sound condition; and

(c) provided with suitable and adequate arrangement for drainage.

79. Cellulose spraying-under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all factories or parts of factories in which the spraying of cellulose ester paints, or lacquers is carried on.

(2) No adolescent shall be employed in any factory on the operation specified in para (1) above.

(3) An efficient exhaust draught shall be provided by mechanical means for the process

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Specified in para (1).The draught Shall operate on the vapour given off in the processes near as may be at the point of origin so as to prevent it (as far as practicable under the atmospheric conditions usually prevailing) from escaping into the air of any place in which work is carried on. The draught shall be maintained working for a period of at least five minutes after the cessation of the operation.

(4) Arrangement shall, as far as practicable, be made so as to render it unnecessary for the person operating the spray to be in a position between a ventilating outfit and the article being sprayed.

80. Chemical works - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to all manufacture and processes incidental thereto carried on in chemical works involving, utilising, handling, storing, processing, blending and other related operations pertaining to chemicals listed under item no. 71 of the Second Schedule and Standard no. 32 of the Code.

(2) Housekeeping.-

(a) Any spillage of materials shall be cleaned up before further processing.

(b) Floors, platforms, stairways, passages and gangways shall be free of any obstructions.

(c) There shall be provided easy means of access to all parts of the parts of the plant to facilitate cleaning.

(3) No chemicals or solvents or empty containers containing chemicals or solvents shall be permitted to be used by workers for any purpose other than in the processes for which they are supplied.

(4) No food, drink, tobacco, pan or any edible item shall be stored or heated or consumed on or near any part of the plant or equipment.

(5) Cautionary Notices and Instructions.-

(a) Cautionary notices in a language understood by the majority of workers shall be prominently displayed in all hazardous areas drawing the attention of all workers about the hazards to health, hazards involving fire and explosion and any other hazard such as consequences of testing of material or substances used in the process or using any contaminated container for drinking or eating, to which the workers' attention shall be drawn for ensuring their safety and health.

(b) In addition to the above cautionary notice, arrangement shall be made to instruct and educate all the workers including illiterate workers about the hazards in the process including the specific hazards to which they may be exposed to, in the normal course of their work. Such instructions and education should also deal with the hazards

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involved in unauthorised and unsafe practices including the properties of substances used in the process under normal conditions as well as abnormal conditions and the precautions to be observed against each and every hazard. Further, an undertaking from the workers shall be obtained within 1 month of their employment and for old workers employed, within one month of coming into operation of the code, to the effect that they have read the contents of the cautionary notices and instructions, understood them and would abide by them. The training and instructions to all workers and all supervisory personnel shall include the significance of different types of symbols and colours used on the labels stuck or painted on the various types of containers and pipe lines.

(6) Evaluation and provision of safeguards before the commencement of process.-

(a) Before commencing any process or any experimental work, or any new manufacturing process, the occupier shall take all possible steps to ascertain definitely all the hazards involved both from the actual operations and the chemical reactions including the dangerous chemical reactions. The properties of the raw materials used, the final products to be made and any by-products derived during manufacture, shall be carefully studied and provisions shall be made for dealing with any hazards including effects on workers, which may occur during manufacture.

(b) The design, construction, installation, operation, maintenance and disposal of the buildings, plant and facilities shall take into consideration effective safeguards against all the safety and health hazards so evaluated.

(7) Authorised entry.- Authorised persons only shall be permitted to enter any section of the factory or plant where any dangerous operations or processes are being carried on or where dangerous chemical reactions are taking place or where hazardous chemicals are stored.

(8) Examination of instruments and safety devices.-

(a) All instruments and safety devices used in the process shall be tested before taking into use and after carrying out any repair to them and examined once in a month, by a competent person. Records of such tests and examinations shall be maintained in a register.

(b) All instruments and safety devices used in the process shall be operated daily or as often as it is necessary, to ensure its effective and efficient working at all times.

(9) Electrical installations.- All electrical installations used in the process shall be of an appropriate type to ensure safety against the hazard prevalent in that area such as suitability against dust, dampness, corrosion, flammability and explosivity etc. and shall confirm to the relevant National Standards governing their construction and use for that

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area.

(10) Handling and storage of chemicals.-

(a) The containers for handling and storage of chemicals shall be of adequate strength taking into consideration the hazardous nature of the contents. They shall also be provided with adequate labelling and colour coding arrangements to enable identification of the containers and their contents indicating the hazards and safe handling methods and shall conform to the respective National standards. The instructions given in the label shall be strictly adhered to. Damaged containers shall be handled only under supervision of a knowledgeable and responsible person and spillage shall be rendered innocuous in a safe manner using appropriate means.

(b) The arrangements for the storage of chemicals including charging of chemicals in reaction vessels and containers shall be such as to prevent any risk of fire or explosion or formation of toxic concentration of substances above the limits specified.

(c) Without prejudice to the generality of the requirements in sub- para (b) above, the arrangements shall have suitable ventilation facilities and shall enable the maintenance of safe levels in vessels and containers. Such arrangements shall also take into consideration, the type of flooring and the capacity of flooring and the compatibility requirements of substances with other chemicals stored nearby.

(d) (i) Storage of chemicals and intermediate products, which are highly unstable or reactive or explosive shall be limited to the quantities required for two months use.

(ii)Whenever the quantities laid down in the sub-para (i) above are to be exceeded, the permission of the Chief Inspector-cum-Facilitator shall be obtained.

(e) Standby arrangements equal to the biggest container shall always be available to transfer the toxic substances quickly into the standby storage facility if any defect develops in any of the container resulting in the release of toxic substances.

(f) Any storage facility constructed using non-metallic material such as Fibreglass Reinforced Plastics (FRP), all glass vessels etc., shall have adequate strength to withstand the stress, if any, exerted by the contents and shall be properly anchored. Working platforms, access ladders, pipelines etc used in such storage facility shall not have any support on the structure of the storage facility and shall be independently supported.

(11) Facility for isolation.- The plant and equipment shall be so constructed and maintained as to enable quick isolation of plant or part of plant or equipment, with appropriate indication. One copy of the layout plan indicating the isolation facilities shall always be available with the security personnel, the maintenance and the health and safety personnel and these isolation facilities shall be checked for its effectiveness once in a month.

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(12) Personal protective equipment.-

(a) All workers exposed to the hazards in the processes covered by this standard shall be provided with appropriate and approved type of personal protective equipment. Such equipment shall be in a clean, sterile and hygienic condition before issue.

(b) The occupier shall arrange to inform, educate and supervise all the workers in the use of personal protective equipment while carrying out the job.

(13) Suitable and effective alarm systems giving audible and visible indications shall be installed at the control room as well as in all strategic locations where process control arrangements are available so as to enable corrective action to be taken before the operational parameters exceed the predetermined safe levels or lead to conditions conducive for an outbreak of fire or explosion to occur. Such alarm systems shall be checked daily and tested every month at least once to ensure its performance efficiency at all times.

(14) Control of escape of substances into the work atmosphere.-

(a) Effective arrangements such as, enclosure, or by pass, or efficient exhaust draught, maintenance of negative pressure etc., shall be provided in all plants, containers, vessels, sewers, drains, flues, ducts, culverts, and buried pipes and equipment, to control the escape and spread or substances which are likely to give rise to fire or explosion or toxic hazards during normal working and in the event of accident or emergency.

(b)In the event of the failure of the arrangements for control resulting in the escape of substances in the work atmosphere immediate steps shall be taken to control the process in such a manner, that further escape is brought down to the safe level.

c) The substances that would have escaped into the work atmosphere before taking immediate steps as required in sub-para (b), shall be rendered innocuous by diluting with air or water or any other suitable agent or by suitably treating the substances.

(15) Suitable provision, such as automatic and or remote control arrangements, shall be made for controlling the effects of `dangerous chemical reactions'. In the event of failure of control arrangements automatic flooding or blanketing or other effective arrangements shall come into operation.

(16) Testing, examination and repair of plant and equipment.-

(a) All parts of plant, equipment and machinery used in the process which in the likely event of their failure may give rise to an emergent situation shall be tested by a competent person before commencing process and retested at an interval of two years or after carrying out repairs to it. The competent person shall identify the parts of the plant, equipment and machinery required to be tested as aforesaid and evolve a

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suitable testing procedures. In carrying out the test mentioned above in respect of pressure vessels or reaction vessels the following precautions shall be observed, namely -

(i) before the test is carried out, each vessel shall be thoroughly cleaned and examined externally, and as far as practicable, internally also for surface defects, corrosion and foreign matters. During the process of cleaning and removal of sludge, if any, all due precautions shall be taken against fire or explosion, if such sludge is of pyropheric nature or contains spontaneously combustible chemicals;

(ii) as soon as the test is completed, the vessel shall be thoroughly dried internally and shall be clearly stamped with the marks and figures indicating the person by whom testing has been done, and the date of test; and

(iii) any vessel which fails to pass the test or which for any other reason is found to be unsafe for use shall be destroyed or rendered unusable.

(b) All parts of plant, equipment, machinery which in the likely event of failure may give rise to an emergent situation shall be examined once in a month by the responsible person.

(c) records of testing and examination referred to in paras (a) and (b) shall be maintained as long as that part of the plant, equipment and machinery are in use.

(d) All repair work including alteration, modification and addition to be carried out to the plant, equipment and machinery shall be done under the supervision of a responsible person who shall evolve a procedure to ensure safety and health of persons doing the work. When repairs or modification is done on pipelines, and joints are required to be welded, butt welding of joints shall be preferred. Wherever necessary, the responsible person shall regulate the aforesaid work through a 'Permit to work system'.

(17) Staging.-

(a) All staging that is erected for the purpose of maintenance work or repair work or for work connected with entry into confined spaces and used in the processes, shall be stable, rigid and constructed out of substantial material of adequate strength. Such staging shall conform to the respective National Standard specifications.

(b) Staging shall not be erected over any closed or open vessel unless the vessel is so constructed and ventilated to prevent exposure of persons working on the stages.

(c) All the staging constructed for the purpose of this para shall have appropriate access which are safe and shall be fitted with proper hand rails to a height of one metre and toe board.

(18) Entry into or work in confined spaces.-

(a)The occupier of every factory to which the provisions of this apply, shall ensure the observance of the following precautions before permitting any person to enter or work inside the confined spaces -

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(i) identify all confined spaces and the nature of hazards that are encountered in such spaces, normally or abnormally, and arrange to develop the most appropriate safeguards for ensuring the safety and health of persons entering into or working inside, the confined spaces;

(ii) regulate the entry or work inside the confined spaces through a `permit to work system' which should include the safeguards so developed as required under sub-para (i);

(iii) before testing the confined space for entry into or work, the place shall be rendered safe by washing or cleaning with neutralizing agents; or purging with steam or inert gases and making adequate forced ventilation arrangements or such measure which will render the confined space safe;

(iv) shall arrange to carry out such tests as are necessary for the purpose by a competent person and ensure that the confined space is safe for the persons to enter or work. Such testing shall be carried out as often as is necessary during the course of work to ensure its continued safety;

(v) shall arrange to educate and train the personnel who would be required to work in confined spaces about the hazards involved in the work. He shall also keep in readiness the appropriate and approved personal protective equipment including arrangements for, rescue resurrection and first aid, and shall arrange supervision of the work at all times by a responsible and knowledgeable person.

(b) The manager shall maintain a log of all entry into or work in, confined spaces and such record shall contain the details of persons assigned for the work, the location of the work and such other details that would have a bearing on the log book so maintained shall be retained as long as the concerned workers are in service.

(19) Maintenance work etc.-

(a) All the work connected with the maintenance of plants and equipment including cleaning of empty containers which have held hazardous substances used in the processes covered in this Schedule, shall be carried out under `permit to work system' employing trained personnel and under the supervision of responsible person, having knowledge of the hazards and precautions required to deal with them.

(b) Maintenance work shall be carried out in such a manner that there is no risk to persons in the vicinity or to persons who pass by. If necessary, the place of such work shall be cordoned off or the presence of unconnected persons effectively controlled.

(20) Permit to work system.- The permit to work system shall inter-alia include the observance of the following precautions while carrying out any specified work to be subjected to the permit to work system-

(a) all work subject to the permit to work system shall be carried out under the supervision of a knowledgeable and responsible person;

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(b) all parts of plant or machinery or equipment on which permit to work system is carried out, shall remain isolated from other parts throughout the period of permit to work and the place of work including the parts of plant, machinery shall be rendered safe by cleaning, purging, washing, etc.;

(c) all work subject to the permit to work system shall have predetermined work procedures which integrate safety with the work. Such procedures shall be reviewed whenever any change occurs in material or equipment so that continued safety is ensured;

(d) persons who are assigned to carry out the permit to work system shall be physically fir in all respects taking into consideration the demands and nature, of the work before entering into the confined space. Such person shall be adequately informed about the correct work procedures as well as the precautions to be observed while carrying out the permit to work system;

(e) adequate rescue arrangements wherever considered necessary and adequate first aid, rescue and resurrection arrangements shall be available in good working condition near the place of work while carrying out the permit to work system, for use in emergency;

(f) appropriate and approved personal protective equipment shall be used while carrying out the `permit to work system';

(g) after completion of work subject to the `permit to work system' the person responsible shall remove all the equipment and tools and restore to the original condition so as to prevent any danger while carrying out regular process.

(21) Safety of sampling personnel.- The occupier shall ensure the safety of persons assigned for collecting samples by instructing them on the safe procedures. Such personnel shall be provided with proper and approved personal protective equipment, if required.

(22) Procedures for meeting emergencies.-

(a) The occupier of every factory carrying out the works, shall arrange to identify all types of possible emergencies that could occur in the processes during the course of work or while carrying out maintenance work or repair work. The emergencies so identified shall be reviewed every year.

(b) The occupier shall formulate a detailed plan to meet all such identified emergencies including arrangements for summoning outside help for rescue and fire fighting arrangements for making available urgent medical facilities.

(d) The occupier shall arrange to install distinctive and recognisable warning

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arrangements to caution all persons inside the plant as well as the neighbouring community, if necessary, to enable evacuation of persons and to enable the observance of emergency procedures by the persons who are assigned emergency duties. All concerned shall be well informed about the warning arrangements and their meaning. The arrangements shall be checked for its effectiveness every month.

(e) Alternate power supply arrangements shall be made and interlocked with the normal power supply system so as to ensure constant supply of power to the facilities and equipment meant for compliance .

(f) The occupier shall arrange to suspend the further process work in a place where emergency is established and shall forthwith evacuate all persons in that area except workers who have been assigned emergency duties.

(h) All emergency procedures shall be rehearsed every three months and deficiencies, if any, in the achievement of the objectives shall suitably be corrected.

(i) The occupier shall arrange to have ten percent of the workers trained in the use of First Aid Fire Fighting appliances and in the rendering of specific hazards of the particular process.

(j) The occupier shall furnish immediately on request the specific chemical identity of the hazardous substance to the treating physician where the information is needed to administer proper emergency or first-aid treatment to exposed persons.

(23) Danger due to effluents.-

(a) Adequate precautions shall be taken to prevent the mixing of effluents from different processes and operations which may cause dangerous or poisonous gases to be evolved.

(b) Effluents which contain or give rise in the presence of other effluents to poisonous gases shall be provided with independent drainage systems to ensure that they may be trapped and rendered safe.

Fire and Explosion Risks

(24) Sources of ignition including lighting installation.-

(a) No internal combustion engine and no electric motor or other electrical equipment, and fittings and fixtures capable of generating sparks or otherwise causing combustion or any other source of ignition or any naked light shall be installed or permitted to be in the process area where there could be fire and explosion hazards.

(b) All hot exhaust pipes shall be installed outside a building and other hot pipes or hot surface or surfaces likely to become hot shall be suitably protected.

(c) The classification of work areas in terms of its hazard potential and the selection of electrical equipment or other equipment that could constitute a source of ignition shall be in accordance with the respective National Standard.

(d) Where a flammable atmosphere may be prevalent or could occur, the soles of

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footwear worn by workers shall have no metal on them, and the wheels of trucks or conveyors shall be conductive type.

(e) All tools and appliances used for work in this area shall be of non-sparking type.

(f) Smoking in process areas where there are risks of fire and explosion shall be prohibited, and warning notices in the language understood by majority of workers shall be posted in the factory prohibiting smoking into specified areas.

(25) Static Electricity.-

(a) All machinery and plant, particularly, pipe lines and belt drives, on which static charge is likely to accumulate, shall be effectively earthed. Receptacles for flammable liquids shall have metallic connections to the earthed supply tanks to prevent static sparking. Where necessary, humidity shall be regulated.

(b) Mobile tanker wagons shall be earthed during filling and discharge, and precautions shall be taken to ensure that earthing is effective before such filling or discharge take place.

(26) Lightening protection arrangement shall be fitted where necessary, and shall be maintained.

(27) Process heating.- The method of providing heat for a process likely to result in fire and explosion shall be as safe as possible and where the use of naked flame is necessary, the plant shall be so constructed as to prevent any escaping flammable gas, vapour, or dust coming into contact with the flame, or exhaust gases, or other sources likely to cause ignition. Wherever possible, the heating arrangement shall be automatically controlled at a pre-determined temperature below the danger temperature.

(28) Leakage of flammable liquids.-

(a) Provision shall be made to confine by means of bund walls, dykes, sumps etc. possible leakages from storage vessels containing flammable liquids.

(b) Waste material in contact with flammable substances shall be disposed off suitably under the supervision of knowledgeable and responsible person.

(c) Adequate and suitable fire-fighting appliances shall be installed in the vicinity of such vessels.

(29) Every still and every closed vessel which gas is evolved or into which gas is passed, and in which the pressure is liable to rise above the atmospheric pressure, shall have attached to it a pressure gauge, and a proper safety valve, rupture disk or other equally efficient means to relieve the pressure. These appliances shall be maintained in good condition.

(30) Installation of pipe line etc.- All pipelines carrying flammable or explosive substances shall be protected from mechanical damage and shall be examined by a responsible person once a week to detect any deterioration or defects, or accumulation of flammable or explosive substances, and record kept of any defects found and repairs made.

Risks of Toxic Substances

(31) Leakage.-

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(a) All plants shall be so designed and constructed as to prevent the escape of toxic substance. Where necessary, separate buildings, rooms, or protective structures shall be used for the dangerous stages of the process and buildings shall be so designed as to localise any escape of toxic substances.

(b) Catch pits, bund walls, dykes, or other suitable safeguards shall be provided to restrict the serious effects of such leakages. Catch pits shall be placed below joints in pipelines where there is danger involved to maintenance and other workers from such leakage.

(32) Drainage.- Adequate drainage shall be provided and shall lead to collection tanks specifically provided for this purpose wherein deleterious material shall be neutralised, treated or otherwise rendered safe before it is discharged into public drains or sewers.

(33) Covering of vessels.-

(a) Every fixed vessel or structure containing any toxic substance and not so covered as to eliminate all reasonable risk of accidental contact of any portion of the body of a worker, shall be so constructed as to avoid physical contact.

(b) Such vessel shall, unless its edge is at least 90 centimetres above the adjoining ground or platform, be securely fenced to a height of at least 90 centimetres above such adjoining ground or platform.

(c) Where such vessels adjoin and the space between them, clear of any surrounding brick or other work is either less than 45centimetres in width or is 45 or more centimetres in width, but is not securely fenced on both sides to a height of at least 90 centimetres, secure barriers shall be so placed as to prevent passage between them :

Provided that sub-para (b) of this para shall not apply to -

(i) saturators used in the manufacture of sulphate of ammonia; and

(ii) that part of the sides of brine evaporating pans which require raking, drawing or filling.

(34) Continuous exhaust arrangement.-

(a) Any process evolving toxic vapour, gas, fume and substance shall have efficient continuous exhaust draught. Such arrangement shall be interlocked in the process control wherever possible.

(b) In the event of failure of continuous exhaust arrangement means shall be provided to automatically stop the process.

(35) Work Bench.- All the work benches used in the processes involving the manipulation of toxic substances, shall be graded properly and shall be made of smooth impervious surface which shall be washed daily after the completion of work.

(36) Waste disposal.-

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(a) There shall be provided a suitable receptacle made of non-absorbable material with a tightly fitting cover for depositing waste material soiled with toxic substances and the contents of such receptacle shall be destroyed by burning or using other suitable methods under the supervision of a responsible person.

(b) During the course of manufacture, whenever any batch or intermediate products having toxicity is rejected on considerations of quality, sufficient precautions shall be taken to render them innocuous or otherwise treat them or inactivate them, before disposal.

(c) The empty containers of toxic substances shall be cleaned thoroughly before disposal under the supervision of a responsible person.

Special Provisions

(37) Special precautions for Nitro or Amino Processes.-

(a) Unless the crystallised intro or amino substances or any of its liquor is broken or agitated in a completely enclosed process so as not to give rise to dust or fume, such process shall be carried on under an efficient exhaust draught or by adopting any other suitable means in such a manner as to prevent the escape of dust or fume in the working atmosphere.

(b) No part of the plant or equipment or implements which was in contact with nitro or amino compounds shall be repaired, or handled unless they have been emptied and thoroughly cleaned and decontaminated.

(c) Filling of containers with nitro or amino compounds shall be done only by using a suitable scoop to avoid physical contact and the drying of the containers in the stove shall be done in such a manner that the hot and contaminated air from the stove is not drawn into the work room.

(d) Processes involving the steaming into or around any vessel containing nitro or amino compounds or its raw materials shall be carried out in such a manner that the steam or vapour is effectively prevented to be blown back into the working atmosphere.

(e) Suitable antidotes such as methylene blue injections shall always be available at designated places of work for use during emergency involving the poisoning with nitro or amino compounds.

(38) Special precautions for `chrome processes'.-

(a) Grinding and sieving of raw materials in chrome processes shall be carried on in such a manner and under such condition as to secure effective separation from any other processes and under an efficient exhaust draught.

(b) There shall be washing facilities located very near to places where wet chrome processes such as leaching, acidification, sulphate settling, evaporation, crystallisation, centrifugation or packing are carried out, to enable quick washing of affected parts of body with running water.

(c) Weekly inspection of hand and feet of all persons employed in chrome process shall

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be done by a qualified nurse and record of such inspections shall be maintained.

(d) There shall be always available at designated places of work suitable ointment such as glycerine, vaseline, etc. and water proof plaster in a separate box readily accessible to the workers so as to protect against perforation of nasal septum.

(39) Special precautions for processes carried out in all glass vessels.-

(a) Processes and chemical reactions such as manufacture of vinyl chloride, benzyl chloride etc. which are required to be carried out in all glass vessels shall have suitable means like substantial wire mesh covering to protect persons working nearby in the event of breakage of glass vessel.

(b) Any spillage or emission of vapour from the all glass vessel due to breakage, shall be immediately inactivated or rendered innocuous by suitable means such as dilution with water or suitable solvents so as to avoid the risks of fire or explosion or health hazards.

(40) Special precautions for processes involving chlorate manufacture.-

(a) Crystallisation, grinding or packing of chlorate shall not be done in a place used for any other purpose and such places shall have hard, smooth and impervious surface made of non-combustible material. The place shall be thoroughly cleaned daily.

(b) The personal protective equipment likes overall, etc. provided for the chlorate workers shall not be taken from the place of work and they shall be thoroughly cleaned daily.

(c) Adequate quantity of water shall be available near the place of chlorate process for use during fire emergency.

(d) Wooden vessels shall not be used for the crystallisation of chlorate or to contain crystallised ground chlorate.

(41) Special precautions in the use of plant and equipment made from reinforced plastics.-

(a) All plant and equipment shall conform to appropriate National Standard.

(b) Care shall be taken during storage, transport, handling and installation of plant and equipment to avoid accidental damage.

(c) All plant and equipment shall be installed in such a way as to ensure that loads are distributed as intended in design or as per the recommendations of the manufacture.

(d) All pipe work shall be supported so that total loads local to the branches on the vessel or tank do not exceed their design values.

(e) Plant and equipment during their use shall not be subjected to over filling or over loading beyond rated capacity.

81. Tank farm - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall applicable to above ground conical roof, floating roof and floating roof inside

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conical tank farms, dome roof tanks, bullets and spheres.

(2) Construction of tanks

(a) The tank farms shall be set on a flat, smooth and solid surface and built as per national standards.

(b) Tanks shall be painted and shall have corrosion protection as per national standards.

(c) Aboveground Storage Tanks and underground piping shall be tested annually for corrosion protection tests

(d) Tanks shall be inspected for any defects once in every month and records of inspections maintained.

(e) Each compartment and interstice shall have an independent emergency vent through a spark arrestor, if applicable.

(f) Spheres and tanks shall be internally and externally inspected as per national standards.

(3) Dykes

(a) Dyke facility shall be based on the compatibility of chemicals only and incompatible chemicals stored with separate dyke arrangement.

(b) Tank dyke shall be capable of containing 110% volume of largest storage tank.

(c) Tank yards and dyke areas shall be kept free from debris, kept clean and orderly.

(d) Pumps shall be located outside the dyke conforming to hazardous area classification as per the national standards.

(e) Storage of other materials inside the dyke area shall not be permitted.

(4) Spill and Overfill Prevention:

(a) Visual and audible warning signals shall be provided.

(b) While filling the tank high level Visual-Audible signal and high shut-off equipment shall be provided.

(c) Clearly identified and easily accessible Emergency Shut-Off switch shall be provided

(d) Hoses connected to unloading tankers for flammable liquids shall have an emergency breakaway connection.

(5) Pipelines:

(a) Pipelines shall be protected from impact,vibrationand expansion/contraction.

(b) Pipelines shall be provided with corrosion protection.

(c) Underground pipelines carrying flammable liquids shall be provided with leak detection requirements.

(d) All filling valves connected to flammable liquids pipelines shall be locked, labeled and colour coded as per the national standards.

(e) Pipelines carrying flammable liquids, gases and two-phase substances shall be continually bonded/grounded for static electricity discharge purpose.

(f) Earthing/bonding shall be tested periodically as per the national standards.

(6) Operational safety

(a) Drain valves shall remain closed and shall be opened when required only.

(b) Vents shall always remain open while loading and unloading.

(c) Vent valve shall be checked at periodical intervals for corrosion and rusting.

(d) Static electricity shall be grounded from the Transport vehicles carrying flammable liquids.

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(e) Earth Pits shall be maintained in conformance with the National Standards and their resistance values shall be measured and recorded.

(f) Loading and unloading shall be done in accordance with standard operating procedures and the SOP displayed in English and local language.

82. Cryogenic liquids- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply for industries using Cryogenic liquids having boiling point below- 150°C namely, liquid oxygen, nitrogen, helium and hydrogen.

(2) General Safety Precautions

(a) The worker shall stand clear of boiling and splashing liquid and its issuing cold gas.

(b) Charging a warm container, filling containers, or inserting objects into the liquid shall be performed slowly.

(c) Any unprotected part of the body shall never be allowed to touch uninsulated pipes or vessels containing liquefied atmospheric gases;

(d) Protective Clothing –

(i) Eyes shall be protected with full face shield or safety goggles.

(ii) Eyewash stations and safety showers shall be made available nearby,

(iii) Cryogenic/ leather gloves shall be worn when handling anything that is or may have been in contact with liquid.

(iv) Gloves shall be loose fit so that they may be readily removed

(v) Cryogenic overalls or similar type clothing with long sleeves and without pockets or turn- ups shall be worn.

(vi) Trousers shall be worn outside boots or shoes, particularly gum boots.

(vii) In emergency situations, self-contained breathing apparatus (SCBA) shall be used in tanks and confine spaces.

(viii) Fog clouds shall not be used to define the leak area and shall not be entered by anyone. Gas detectors shall be used to identify leaks

(ix) It shall be ensured that fog clouds do not interfere with vehicle traffic or safety escape routes.

(3) Equipment to Handle Cryogenic Liquids

(a) Cryogenic liquid shall be stored in Dewar's, Cryogenic liquid cylinders or cryogenic tanks.

(b) Cryogenic containers shall be made from materials able to withstand the rapid changes and extreme differences in temperature encountered in working with these liquids.

(c) Containers shall be open or protected by a vent or other safety device which permits the escape of vapours.

(d) Where a special vented stopper or venting tube is used, the vent shall be checked at regular intervals and records maintained.

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(e) Smaller containers of liquid shall never be plugged; they shall be covered when not in use
(f) Large storage containers not open to the atmosphere shall be provided with pressure-relieving devices.
(g) Small containers shall not generally be stored in the open where they may come in contact with rain or moisture.
(h) Containers shall be clearly identified so that only the correct contents may be filled or withdrawn.
(i) A filling funnel shall be used whenever liquid is poured into a small container. The top of the funnel shall be partly covered to reduce splashing.
(j) When it is not safe or convenient to tilt the container, a discharge tube shall be used to remove liquid. A discharge tube shall always be used to remove liquid from large 50 or 100 litres containers.

(k) Equipment or piping for cryogenic liquids shall be installed in consultation with thoroughly trained persons in low temperature work. The materials used shall be those specifically recommended for use at extremely low temperatures.
(l) Vessels shall never be rolled, dragged, or dropped, or permitted to strike each other.
(m) Containers shall be kept vertical.
(n) Sudden mechanical shocks shall be avoided.

(4) Special Precautions for Handling Liquid Oxygen
(a) All assemblies and components, including piping, which will be in contact with liquid oxygen, shall be thoroughly degreased.
(b) Only pressure gauges marked 'Oxygen - Use No Oil ' are to be used
(c) Naked lights, lighted cigarettes, sparks or any combustible material, such as oil, grease, rags, or other flammable materials shall not be permitted to come into contact with or be in the vicinity of liquid oxygen.
(d) 'NO SMOKING' signs shall be conspicuously displayed in all areas where liquid oxygen is stored.
(e) Organic material or flammable substance of any kind shall not bepermitted to come in contact with liquid oxygen.
(f) If liquid oxygen spills on asphalt or other surfaces contaminated with combustibles, workers shall not walk on or roll equipment over the spill area.
(g) Sources of ignition shall be kept away for 30 minutes after all frost or fog has disappeared.
(h) Any clothing that has been splashed or soaked with liquid oxygen or exposed to high oxygen concentrations shall be removed immediately and aired for at least an hour.

(5) Special Precautions for Handling Liquid Nitrogen
(a) Waste nitrogen shall not be disposed of in a confined area or a place where some- one else may enter.
(b) Liquid nitrogen shall not be exposed to the air,
(c) Before entering any large liquid nitrogen storage tank, it shall be ensured that all pipes to the tank are blanked or closed off.
(d) The tank shall be purged with air.
(e) Air quality shall be checked regularly with gas detectors before entering the tank.
(f) If for any reason, the supply of fresh air in the tank is doubtful, appropriate breathing

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apparatus confirming to applicable national standards shall be used.

(g) An observer shall be stationed outside to check on the worker while he is working inside the tank

(h) Ventilating equipment shall be provided to rapidly change the air in tanks at all times when workers are working inside them.

(6) Special Precautions for Handling Liquid Helium

(a) liquid helium shall be stored and handled under positive pressure or in closed systems to prevent the infiltration and solidification of air or other gases.

(b) To prevent the possible ignition of grease, oil or other combustible materials which could come into -contact with the air-condensing surface, such areas shall be cleaned to oxygen free condition.

(c) Pressure-relief devices for liquid helium containers and equipment shall *be* adequately sized to release the rapidly expanding helium gas safely in case of heat influx through insulation failure or other modes.

(d) Entrance of any gas except pure, dry helium into a helium-cooled vessel shall be prevented.

(e) If a small vessel contains only pure helium gas, it shall be filled directly with liquid helium without concern of contamination.

(f) if the vessel is first pre-cooled with liquid nitrogen, all nitrogen shall be removed first by purging the nitrogen-cold container with pure, dry helium gas-before being filled with liquid helium.

(g) Liquid Helium shall be stored in either Duplex Dewar or Gas-Cooled Shielded Dewar.

(h) A safety adapter shall be fitted to the neck of the vessel.

(i) The vessel for transporting shall always be fitted with adequate relief devices.

(j) Before transport, it shall be ensured that the vents are free from blockage and that the relief devices are in working order.

(k) If the container is of the type which requires liquid nitrogen shielding, it shall be ensured that the liquid nitrogen reservoir is full.

(l) Proper filling and transfer tube equipment shall be used.

(m) A brass or copper rod shall be kept available for freeing any solid gas blockage.

(n) Employees handling liquid helium shall be trained and familiar with cryogenic liquid handling techniques

(o) To reduce thermal oscillations, tubing leading from the liquid shall be vacuum insulated,

(7) Special Precautions for Handling Liquid Hydrogen

(a) All metal parts of equipment and piping, which contain hydrogen, shall be grounded.

(b) Non metallic parts shall be Anti-static.

(c) Nylons or other synthetic clothing and combing hair shall be avoided in areas where hydrogen is handled.

(d) All workers shall be grounded before they handle Dewar.

(e) All personnel shall wear conducting shoes.

(f) Spark-proof tools shall be used.

(g) Any potential sources of ignition shall be removed.

(h) In the working area, the allocation of space shall be generous, with a high sloping roof or ceiling, allowing free escape for the light buoyant hydrogen at the highest point.

(i) Natural draught principle by using doors with levers at the bottom and an open roof

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ridge shall be provided during warm weather to increase ventilation,

(j) In extreme winter steam radiators shall be provided for upward convection to assist the buoyancy flow of contaminated air.

(8) Internal Transportation and Storage:

The following safety measures shall be ensured:

(a) Allow the evaporated gas to escape freely and in such a way that air is not permitted to diffuse back into the container.
(b) Keep the mouth of Dewar connected to a suitable vent line and to use a simple non-return Bunsen valve.
(c) Check daily whether the neck-tube is clear by carefully lowering a stout copper tube fitted with a collar.
(d) Alternatively, the obstruction shall be dispersed by means of a jet of warm hydrogen introduced by means of a suitable tube.
(e) Super-insulated vessels shall carry separate liquid and vent lines, which shall be valved off.
(f) The vents shall be fitted with a relief valve and bursting disc to give adequate protection.
(g) liquid hydrogen containers shall be stored out doors when not in service and smaller vessels shall be protected from the weather.
(h) Hydrogen sensors shall be installed at various places for remote detection
(i) The venting of spent hydrogen is associated with hazard and shall be done very carefully.
(j) All vessels shall be connected to a vent pipe which discharges hydrogen at a high point away from ignition sources.
(k) A flame trap or water seal shall be employed at the discharge point.

(i) Liquid hydrogen containers shall be stored away from the liquefaction plant.
(ii) The storage area shall be protected from any source of fire or ignition, and there shall not be any combustible matter in the area.
(iii) Overflows shall be avoided during filling or transferring liquid hydrogen by use of suitable devices. All the associated gadgets shall be flushed with liquid nitrogen and checked for absence of oxygen in the system.
(iv) The transport van shall be designed to have -explosion-proof sides, and suited for the purpose with due regard to fire and explosions risks, static charge and hydrogen gas leakage.
(v) The container Dewar shall be thoroughly insulated and checked for leakage before transport.
(vi) The vent gases shall be released gradually in a naturally ventilated atmosphere through a long vent tube over the roof. ··
(vii) The vent design shall be made on the basis of available gas for disposal and location. The vent line design shall consider the dependence of lower limits of flammability on the size of vent piping.

PPE Matrix

Activity	Hazard	Prescribed PPE's

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Handling Cryogenic Liquids, storage and transportation	Cryogenic liquid splash in Eyes	Face Shield, chemical splash goggles.
	Contact of hands to cryogenic tanks and pipe line	Cryogenic Gloves
	Splash of cryogenic liquids	Cryogenic overalls and hoods
	Contact of feet with cryogenic liquids	Gum boots with anti static soles
	Low air quality while working in tanks	Self contained breathing apparatus

83. Lead acid battery manufacturing- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This standard applies to industries that manufacture lead acid battery, VRLA (valve regulated lead acid battery), Sealed Maintenance Free (SMF) battery.

(2) Lead-Acid Batteries

(a) Lead Oxide Production and Paste Mixing

(i) Access control shall be ensured so that only authorized persons are present near the furnace/lead pot.

(ii) Adequate precautions shall be taken to control and contain hot metal overflow from furnace

(iii) Heat radiation and metal spill hazard due to molten lead overflow shall be controlled with barricading.

(iv) Threshold Limit Value (TLV) or Permissible exposure limit (PEL) for inorganic lead dust in the work environment shall be maintained to relevant National Standards.

(v) Appropriate Dust Collection systems shall be implemented.

(vi) Acid spillage hazard shall be prevented by following Chemical safety precautions to dilute the spill /barricade the area and follow proper storage of chemicals, maintain MSDS and never use combustible or reactive materials to clean up or absorb spills.

(vii) Contaminated clothing shall be discarded in a manner which limits further exposure and machine washed before reuse .

(viii) Place shall be provided, separate from the meal room for the storage of overalls or working suits. The latter shall be cleaned at frequent intervals and immediately, if contamination is established.

(ix) Separate Arrangements shall be made for the temporary storage of materials

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required in the process, and also for the stacking of finished products.

(b) Curing, cutting, and brushing

Dust Collection systems shall be provided during cutting and brushing.

(c) Assembling the Elements

(i) Fume extraction system shall be available during welding of plastic lid.

(ii) Material lifting and handling procedures shall be followed to lift heavy batteries in accordance with relevant national standards.

(d) Acid Filling and Charge formation

(i) Acid spill or splash hazard shall be prevented by following Safety Precautions.

(ii) The availability and healthy condition of eye wash fountains, emergency safety showers and emergency kits for acid spill as per national standards shall be ensured.

(iii) Spill control kits shall be used. Combustible or reactive materials shall not be used to clean up or absorb spills.

(iv) Sulphuric acid for concentration 93% to 99%, shall be stored in mild steel tanks, drums and glass carboys. For concentration below 93 percent, it shall be stored in glass carboys, earthenware jars or other suitable containers lined with acid-resistant materials.

(v) Storage tank leakage hazard is prevented by regular thickness monitoring of tanks and adherence to maintenance procedures and chemical safety precautions.

(vi) Pressure builds up due to hydrogen gas shall be relieved through safety vents.

(vii) Hydrogen gas detectors shall be installed, and concentration of hydrogen gas reviewed periodically.

(viii) Antidote for lead poisoning shall be available in case of accidental exposure and or ingestion of lead.

(3) PPE MATRIX

SN	Activity	Prescribed PPE's
1	Lead Oxide Production	Heat resistant hand gloves, Fire retardant clothing, safety shoes with heat resistant soles, Respiratory protective devices
2	Curing, cutting, and brushing	Cut resistant Gloves, Safety Goggles, Respiratory Protective devices

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3	Assembly of elements	Safety shoes with steel toe, Cut Resistant Gloves
4	Acid Filling and Charge Formation	Chemical splash Goggles, Chemical suits, Respiratory protection devices, Nitrile gloves, Shoes with nitrile/rubber soles

84. Lead acid battery charging- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

The following controls shall be ensure in every lead acid battery charging area.

(a) Battery charging area shall be located away from manufacturing and storage areas
(b) Battery shall be monitored for change in temperature in real time.
(c) Power Cut-off switches shall be within easy reach of the worker to switch off power in case temperature of battery rises abnormally
(d) Charging apparatus shall be protected against mechanical and electrical damage.
(e) The workers shall be trained to perform the charging and discharge cycles.
(f) Batteries shall be kept clean and dry and a clear space shall be kept between batteries on charge
(g) When working around banks of batteries and it becomes necessary to temporarily cover the batteries, as much air space as possible shall be maintained between the temporary cover and the batteries.
(h) The area of work shall be kept clear of obstacles
(i) Electrolyte, and distilled water shall be stored in designated containers and labelled.
(j) The floor and wall of the charging area shall be acid-resistant
(k) Battery stands / Trays shall be of acid-resistant construction or protected from the accumulation of acid
(l) Adequate ventilation according to national standards shall be maintained to prevent the accumulation of dangerous gases
(m) All electrical fittings shall be of flame\explosion proof type
(n) Emergency shower and eyewash shall be available
(o) Workers shall work without,rings, watches and dangling jewelry which can cause an electrical shock
(p) Insulated/non-conducting tools shall be used
(q) Sources of ignition shall be prevented
(r) Smoke detectors and Hydrogen gas detectors shall be installed.
(s) No Smoking' sign shall be displayed at the entrance of the area.
(t) Personal Protective Equipment:

S.No	Activity	Prescribed PPE's
1	Battery Charging Area	Heat resistant gloves, face shield. Slip resistant shoes with steel toe.

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85. Manufacture of lithium-ion battery- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Applicability: Industries that manufacture lithium Ion Battery

(2) Lithium Ion Battery:

(a) Testing and grading

(i) Workers shall protect their hands from heat and electricity using appropriate gloves , while grading the batteries.

(ii) Appropriate protection from electrical shocks shall be taken while working on transformers.

(iii) Workers shall be protected from oil spills while working near the transformer by keeping the area clean and free from oil spill.

(iv) Absorbent material shall be used to clean oil fills. Safe disposal of absorbent material shall be ensured.

(v) Workers shall be protected from slips and trips while working near the transformers

(b) Assembly of cells.

(i) Worker shall be protected from excessive heat and electrical shock during spot welding.

(ii) Eyes shall be protected from high speed particles and harmful light radiations during spot welding.

(c) Assembly of Battery Management System(BMS)

Workers shall be protected from heat and solder fumes while soldering the BMS to the battery.

(i) Soft Packing

(ii) Worker shall be protected from heat while using hot air guns to shrink wrap the batteries in soft packing

(iii) Packing in Casing

(iv) Correct material lifting and handling procedures shall be followed to lift heavy batteries.

(v) Battery Cyclers

(vi) Battery cycler monitors shall be monitored for change in temperature in real time. Power Cut off switches shall be within easy reach of the worker so that he switches off power in case temperature of battery rises abnormally and may cause an explosion .

(vii)Handling Lithium

(a) Contact of lithium with moisture and water shall be prevented to avoid violent reactions and Flash fires

(b) Any contact of lithium with skin or eyes shall be prevented

(c) Glove shall be removed without touching glove's outer surface to avoid skin contact.

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(d) Formation of dust and aerosols shall be prevented
(e) Breathing vapours, mist or gas , shall be prevented by appropriate respiratory protection devices .
(f) In case of fire dry sand, dry chemical or alcohol-resistant foam shall be for extinction.
(g) Storage of lithium shall be done away from sources of Ignition
(h) No smoking sign shall be displayed near the storage.

(viii) PPE Matrix

S.No	Activity	Hazard	Prescribed PPE's
1	Testing and grading	Injury to hand Oil spills,	Heat resistant hand gloves, electrical hand gloves, slip resistant safety shoes.
	Assembly of cells	Injury to hands from heat and electricity Damage to eyes from Flying particles and harmful light radiations	Heat resistant hand gloves, electrical hand gloves, Safety goggles ,welding goggles, Flame retardant clothing
	Assembly of BMS	Injury to hands from heat, respiratory hazards from solder fumes	Heat resistant hand gloves. respiratory protective device, Flame retardant clothing
	Soft Packing	Injury to hands from heat	Heat resistant hand gloves.
	Packing and Casing	Injury to toe due to heavy objects falling on it	Safety shoes with steel toe.
	Battery Cyclers	Injury due to battery explosion	Heat resistant gloves, face shield.

86. Manufacture of chromic acid or manufacture or recovery of the bichromate of sodium, potassium, or ammonium- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) Prohibition relating to pregnant woman and adolescent. :-

No pregnant woman or adolescent shall be employed or permitted to work or any chrome process.

(2) Efficient exhaust draught:-

The following chrome processes shall not be carried on without the use of an efficient exhaust-draught, namely:-

(a) grinding;
(b) sieving;
(c) batch mixing;

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(d) concentration.

(3) Separation of certain processes:-

The following chrome processes namely:-

(a) grinding of raw materials, and

(b) sieving of raw materials.

shall be carried on in such manner and under such conditions as to secure effectual separation from any processes.

(4) Flooring:-

The floor of every work room shall be -

(a) of cement or similar other material so as shall be smooth and impervious to water and provided with suitable gradient and drainage;

(b) Maintained in sound condition and cleaned daily.

(5) Fencing of vessels:-

Every fixed vessel, whether pot, pan, vat or other structure, containing any dangerous material, and not so covered as to eliminate all reasonable risk of accidental immersion of any portion of the body of a person employed shall be fenced as follows :-

(a) Each such vessel shall, unless its edge is at least 91.4 centimeters the adjoining ground or platform be securely fenced to a height of at least 91.4 centimeters above such adjoining ground or platform;

(b) No plank or gang-way shall be placed across or inside any such vessel unless such plant or gang-way is:-

(i) at least 45.7 centimeters wide; and

(ii) securely fenced on both sides, either by upper and lower rails to a height of 91centimeters or by other equally efficient means;

(c) If any two such vessels are near each other and the space between them clear of any surrounding brick-work or other work, is either

(i) less than 45.7 centimeters in width, or

(ii) is 45.7 or more centimeters in width, but is not securely fenced on both sides to a height of at least 91.4 centimeters secure barriers shall be placed so as to prevent any passage between them.

(6) Cautionary notice: -

A cautionary notice shall be printed in English and the language of the majority of the workers and the same shall be affixed in a prominent place in the factory where it can be easily and conveniently read by the workers.

87. Effluent treatment plant (ETP), sewage treatment plant (STP) and waste water treatment plant (WWTP)- under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

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(1) This shall apply to every factory or in any part of which Effluent Treatment Plant (ETP), Sewage Treatment Plant (STP) and Waste Water Treatment Plant (WWTP) operations and connected works are carried on.

(2) General Safety and Health Requirements:

(a) The workers shall be trained on safety and health aspects and adequate instruction are provided before performing any works. The hazards and safety precautions shall be displayed in English and local language.

(b) Unauthorised entry shall be prevented by providing fencing to the entire periphery and exclusive entry and exit gates maintained under and Lock and Key arrangement.

(c) Periodic inspection shall be made by qualified maintenance personnel, and a certification record maintained. The certification record shall include the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, for the equipment inspected. The operator shall be instructed to report any equipment defects to his supervisor and the use of the equipment shall be discontinued until safety repairs have been completed.

(d) The locations which are below ground level and have stair case entry for access to routine maintenance, inspection, testing, sampling and repairs shall be provided with safe access.

(e) Control systems shall be implemented to control liquid levels and flow rates through the works from exceeding permissible levels to prevent inundation.

(f) Pipeline colour coding shall be ensured as per National Standard and a board displaying colour code provided and maintained.

(g) A work permit shall be issued and followed up while entering confined space to protect the workers from safety and health hazards arising out of confined space entry.

(h) Routine maintenance, inspections, repairs and testing operations shall ensure that the energized equipment is de-energized or shut down, locked out and tagged by implementing Lock out Tag out (LOTO) System.

(i) Emergency equipment shall be provided while storing or handling flammable, explosive and toxic chemicals. The emergency equipment includes first aid supplies, emergency phone numbers, eye wash and shower facilities, fire extinguishers, spill-cleanup supplies and personal protective equipment, all of which shall be readily available.

(j) Appropriate control measures shall be implemented to prevent formation and accumulation of hazardous gases such as Sulfur Dioxide, Hydrogen Sulphide, Carbon Monoxide, Methane etc.

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(k) Chemicals shall be properly labelled and stored according to information specified on the MSDS.

88. **Industrial major accident hazard-** under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to any factory in which a hazardous chemical, which satisfies any of the criteria laid down in Part I of Schedule II or is listed in Column (2) in Part II of that Schedule II, is or shall be involved.

(2) An occupier of any factory in terms of sub-para (1) shall arrange to obtain or develop information in the form of Material Safety Data Sheet. The information shall be made accessible to workers upon request for reference.

(3)The occupier while obtaining or developing a safety data sheet in respect of a hazardous chemical handled by him shall ensure that the information is recorded accurately and reflects the scientific evidence used in making the hazard determination. In case, any significant information regarding hazard of a chemical is available, it shall be added to the safety data sheet as soon as practicable:

(4)Every container of a hazardous chemical shall be clearly labelled or marked to identify, -
(a)the contents of the container ;
(b)the name and address of the manufacturer or importer of the hazardous chemical; and
(c)the physical, chemical and toxicological data of the hazardous chemical.

(5)In case where it is impracticable to label a chemical in view of the size of the container or the nature of the package, provision shall be made for other effective means like tagging or accompanying documents.

(6) Preparation of on–site emergency plans by the occupier

(a) The occupier shall prepare, keep up-to-date and furnish to the Inspector-cum-facilitator or Chief Inspector-cum-facilitator an on-site emergency plan containing details and detailing how major accidents will be dealt with on the site on which the industrial activity or isolated storage is carried on and that plan shall include the name of the person who is responsible for safety on the site and the names of those who are authorized to take action in accordance with the plan in case of an emergency.

(b) The occupier shall ensure that the emergency plan prepared in accordance with sub-para (a) takes into account any modification made in the industrial activity or isolated storage and that every person on the site who is concerned with the plan is formed of the relevant provisions.

(c) The occupier shall prepare emergency plan required under sub-para (a) before the commencement of any factory

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(d) The occupier shall ensure that a mock drill of the on-site emergency is conducted at least once in every six months.

(e) A detailed report of a mock drill conducted under sub-para (d) shall be made immediately available to the Inspector-cum-facilitator or the Chief Inspector-cum-facilitator.

(7) Information shall be given to persons liable shall be affected by a major accident

(a)The occupier shall take appropriate steps to inform persons outside the site who are likely shall be in an area which shall be affected by a major accident about -

(i) the nature of the major accident hazard; and

(ii) the safety measures and the ‘dos and ‘don’ts which shall be adopted in the event of a major accident.

(b) The occupier shall take the steps required under sub-para (a) to inform persons about and industrial activity or isolated storage before that activity is commenced, except that in respect of an existing industrial activity or isolated storage, the occupier shall comply with the requirements of sub-para (a) within 90 days of coming into operation of these standards.

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CHAPTER V – HAZARDOUS PROCESSES

89. **Ferrous metallurgical industries -** under serial no. 1 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all factories wherein manufacturing and processes incidental thereto carried on with any of ferrous, alloys of ferrous and combination of ferrous metals.

(2) Occupational Health and Safety

Occupational health and safety issues specific to the ferrous and non - ferrous metallurgical industries shall be addressed and appropriate and adequate safe guards in preventing and controlling them shall be implemented.

(a) **Physical Hazards**

Potential physical hazards related to handling of large and heavy raw materials, intermediate products and finished product; heavy mechanical transport; grinding and cutting activities rolling processes; and work at heights shall be prevented by implementing appropriate and adequate measures conforming to National Standards.

(b) **Heavy Loads**

Lifting and moving heavy loads at elevated heights using hydraulic platforms and cranes shall be carried out in a safe manner and the following measures shall be taken to prevent and control potential worker injury;

(i) Appropriate design and layout of facilities to avoid crossover of different activities and processes;
(ii) Specifications of the lifting crane shall be used shall match with the material being handled (maximum lifted load, dimensions)
(iii) Material and product handling shall remain within restricted zones under appropriate supervision.
(iv) Lifting and movement of hot coils, shall be done in such a manner that there are no fumes generated from these coils that shall obstruct the vision of the Electric Overhead Travelling (EOT) crane operators.
(v) Number of EOT cranes shall be accessed in a manner that the coils, slabs etc. are uniformly distributed and not handled by a single EOT Crane.
(vi) EOT crane that handles hot slabs in the slab yard for movement of slabs shall be fitted with tooth arrangement.
(vii) The tyres used in the mobile hydra near hot surfaces such as scrap removal, slag removal, etc. shall be designed in a manner that it does not cause sparks due to friction.
(viii) Sufficient cooling arrangement in scrap yards and slag yards were movement of mobile hydra takes place, shall be provided, so that heat

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build-up is avoided.

(c) **Grinding and Cutting / Rolling**

The following measures shall be taken to prevent and control injuries related to grinding and cutting activities, and use of scrap:

(i) Provide grids around stands and shields where rolled material could accidentally come off rolling guides;

(ii) Provide rails along transfer plate with interlocked gates that open only when machine is not in use.

(d) **Hot Liquid and Molten metal**

Appropriate and adequate prevention and control, measures shall be implemented to protect workers from getting exposed to high temperatures and direct infrared (IR) radiation. The following measures shall be taken for prevention and control of exposure to heat, hot liquids / materials and molten metal:

(i) Shield the surfaces where close to prevent contact with hot equipment or splashing from hot materials is expected

(ii) Implement safety buffer zones to separate areas where hot materials and items are handled or temporarily stored.

(iii) Rail guards around those areas shall be provided, with interlocked gates to control access to these areas during operations;

(iv) Use appropriate PPE such as aluminized jackets, heat resistant gloves, leg guard, insulated gloves and shoes, goggles to protect against IR and ultraviolet radiation, and clothing to protect against heat radiation and liquid steel splashes;

(v) Job rotation to reduce fatigue and heat stress due to exposure from high temperatures needs to consider.

(vi) Runners where possible shall be covered to avoid direct exposure to hot metal.

(vii) Drop Gates with sirens and signal arrangement shall be provided in the ladle loco movement area to avoid persons crossing the area where movement of hot ladles takes place.

(viii) The entire locomotive movement area shall be barricaded to avoid untoward incidents.

(ix) Movement of ladle carrying molten metal shall be carried out by EOT cranes in the designated pathways.

(e) **Radiation**

(i) Gamma ray testing shall be carried out in a controlled, restricted area using a

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shielded collimator. No other activities shall be undertaken in the testing area;

(ii) All incoming scrap shall be tested for radioactivity prior to use as feedstock material;

(iii) Regular maintenance and repair shall be conducted on testing equipment, including protective shields.

(f) **Entrapment**

Risk of entrapment in storage areas and in particular during maintenance operations shall be prevented by implementing adequate safe guards. Measures to prevent burials shall include the following:

(i) Ensure proper containment wall for mineral heaps;

(ii) Ensure distance between heaps and transit way in conformance with applicable National Standards;

(iii) Develop and adopt specific safety procedures for working inside hoppers (e.g. verification systems / procedures to stop refilling belt and to close refilling hole);

(iv) Linear heat sensing cables shall be provided for coal/inflammable material carrying conveyor.

(v) Adequate machine guarding for nip points of conveyors/rotating parts shall be provided.

(vi) Pull cords with hooter shall be provided at appropriate length of conveyor.

(vii) 'Lock Out and Tag Out' (LOTO) shall be implemented and followed.

(viii) Before starting up the conveyor, siren shall be sounded for warning.

(ix) Loose clothing shall not be permitted to avoid trapping.

(x) Continuous monitoring of conveyor shall be carried out for safety of workers.

(xi) Counter weight used in conveyor system shall be properly guarded.

(3) Protective equipment

(a) The occupier shall provide and maintain suitable protective equipment specified for the protection of workers.

(b) suitable gloves for hand protection, leg protection or a provision of suitable heat-resistance or other protection for the hands for the workers engaged in handling any hot material likely to cause damage of the hands by burn, scald or scar, or in handling pig iron, rough castings or other articles likely to cause damage to the hands by cut or abrasion;

(c) Approved respirators for workers carrying out any operations creating a heavy dust concentration which cannot be dispelled quickly and effectively by the existing ventilation arrangements.

(d) No respirator provided for the purpose of sub-para (c) has been worn by a person shall be worn by another person if it has not since been thoroughly cleaned and disinfected.

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(e) Persons who for any of their time:-

(i) work at a spout of or attend, to a cupola or furnace in such circumstances that material there from any come into contact with the body, being material at such a temperature that its contact with the body shall cause a burn; or

(ii) are engaged in, or in assistant with, the pouring of molten metal, or

(iii) carry by hand or move by manual power any ladle or mould containing molten metal; or

(iv) are engaged in knocking out operations involving material at such a temperature that its contact with the body shall cause a burn; shall be provided with suitable footwear and gainters which worn by them prevent, so far as reasonably practicable, risk of burns to his feet and ankles.

(f) Where appropriate, suitable screens shall be provided for protection against flying materials (including splashes of molten metal and sparks and chips thrown off in the course of any process).

(g) The occupier shall provide and maintain suitable accommodation for the storage and make adequate arrangements for cleaning and maintaining of the protective equipment and they shall be maintained free from any defect.

(h) Arrangement shall be made for the proper and efficient cleaning of all such personal protective equipment.

(4) Disposal of dross and skimming

(a) Dross and skimmings removed from molten metal or taken from a furnace shall be placed forthwith in suitable receptacles.

(b) Water accumulation in disposal pots or area shall be avoided.

(5) Disposal of waste

Appropriate measures shall be taken for the disposal of all types of waste products from shell moulding (including waste) burnt sands soon as reasonably practicable after the castings have been knocked out.

(6) Material and equipment left out of doors

All material and equipment left out of doors (including material and equipment so left only temporarily or occasionally) shall be so arranged and placed as to avoid unnecessary risk. There shall be safe means of access to all such material and equipment and, so far as reasonably practicable, such access shall be by roadways or pathways shall have a firm and even surface and shall, so far as reasonably practicable be kept free from obstruction.

(7) Process and Equipment Safety Precautions

(a) **Coke ovens**

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(i) The Ovens shall be designed and located in such a manner that the operators have full control and access to the equipment and its accessories such as pusher cars, charging cars, etc.

(ii) In case of recovery type ovens, the by product area shall be located in a safe place away from administrative buildings.

(iii) The equipment used for the separation of by-products (tar, acids, gases, etc.) shall be inherently safe and as per OEM instructions.

(iv) Safety precautions relating to Coal Handling Unit conforming to the appropriate National Standards shall be implemented.

(b) **By - product plants –**

(i) **Gas Condensation Plants** –

(a) Regular inspection to observe flange / gland leakage before change over and rectify the same with safety protocol.

(b) Regular inspection of Coke Oven Gas (COG) lines to detect leakage if any.

(c) On line CO monitor shall be installed in the U-Seal andportable CO monitors shall be used to detect Gas leakage.

(d) Regular check of Oxygen% in Coke Oven Gas and take appropriate action in case O_2>0.8%.(1%)

(e) Wind sock shall be provided.

(f) Periodic inspection of seal pots shall be carried out internally daily and externally once in a month.

(g) Nitrogen purging shall be carried out before start of maintenance of gas lines.

(ii) **Acid Recovery Plants –**

(a) Ensure use of proper PVC coated PPEs while handling such chemicals.

(b) Emergency eye wash and safety showers shall be provided.

(c) Regular checking and inspection of glands, flanges and pipelines where acids are transported.

(d) Ensure safety of persons loading and unloading of chemicals.

(e) Ensure earthing of tankers used for storing benzol.

(f) Continuity of jumpers in pipelines.

(g) Provision to isolation and LOTO arrangement for acid pipelines.

(iii) **Coke Dry Cooling Plants –**

(a) Wherever the explosive gas is used in the CDCP, the following precautions are shall be followed –

(i) Percentage of oxygen content shall not exceed to 1 %.

(ii) Percentage of hydrogen content shall not exceed to 4 %.

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(iii) Percentage of Carbon mono oxide shall not exceed to 8%.
(iv) Availability of Nitrogen shall be ensured.
(v) Proper functioning of nitrogen valves and bleeder valves shall be ensured.
(vi) Explosion flaps located in the circulating gas path shall be in proper cleaned condition and shall be inspected time to time.
(vii) Proper functioning of air breather valve at pre-chamber shall be ensured.
(viii) Fixed CO monitors shall be installed in Cold Coke Discharge area and Rotary Seal Valve area.

(b) Safety precautions relating to Coke Dry Cooling Plants conforming to the appropriate National Standards shall be implemented.

(iv) **Gas Holders:**

(a) Gas holder shall be fitted with Interlock system to ensure automatic stoppage of gas leakage from the holder.
(b) Dispersion analysis of the gas shall be carried out to decide the location of Holders
(c) Fire Water monitors shall be provided all around the Gas holder.
(d) The area shall be fenced to prevent unauthorized entry.
(e) Wind sock shall be provided.
(f) Gas monitors with audio and visual alarms shall be provided
(g) Sufficient warning signages shall be provided.

(c) **Agglomeration Unit**

(i) **General Safety-**

(a) Rotary drums used in the formation of pellets shall be equipped with safety devices such as arrangement for LOTO, etc. and as per OEM guidelines.
(b) Furnaces used in pellet units and sintering units shall be installed with fixed gas detectors.
(c) In case of any control room present near these furnaces, proper precautions shall be taken for the safeguards of the persons working in these control rooms.
(d) Ensure the Electrostatic Precipitators are properly handled and maintained to avoid any dust emission.

(ii) **Charging Bins / Hoppers –**

(a) Protective cover/grill at the storage bin top shall be provided.
(b) Dislocation stopper at the bin top shall be provided.
(c) Ensure auto hooter blowing whenever shuttle shifting command is given.

(iii) **Furnaces –**

(a) Provision of online gas detector on the ignition furnace shall be ensured.

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(b) Heat insulation shall be provided at places where the temperature of the sinter machine is high.

(c) Ensure periodic maintenance of furnace is done as per the Standard Operating Procedure.

(iv) **Sinter/Pellet Breaker –**

Proper safety precautions shall be taken shall be safe from hazards such as Rotating Machinery, Handling Hot Sinter, Electrical Drives, Fine Hot Dust, Noise etc.

(v) **Electrostatic Precipitators (ESP)–**

(a) Precautions like access control, use of dust mask, shall be ensured.

(b) LOTO and earthing shall be ensured.

(d) **Blast Furnace**

(i) Fixed gas detectors shall be installed in the vicinity of the blast furnaces.

(ii) Periodic maintenance of tuyere, nozzles, heaters, charging cars, etc. shall be carried out.

(iii) Tap holes, wherever man movement/approach is present, they shall be made safe.

(iv) Runners wherever possible shall be in closed condition.

(v) Regular inspection of Mud Gun shall be followed in the Cast House.

(vi) No employee shall be permitted in working on stove platform area when stove status is changed from isolation mode to heating mode.

(vii) In the gas cleaning plant, the water level in the U-Seal shall be maintained and checked continuously.

(viii) In the Cast House area, it is necessary to ensure timely closing of Tap Holes.

(ix) Trial of rocking runner shall be taken before the entire ladle is full.

(x) Care shall be taken to avoid accumulation of water near any hot metal handling area.

(xi) Slag pit shall always be in dry condition to prevent blast/explosion.

(xii) Controlled access shall be permitted in the Cast House Floor.

(xiii) MSDS of toxic gases/substances produced/used shall be displayed at conspicuous places.

(e) **Directly Reduced Iron (DRI) or Sponge Iron**

(i) Dust extraction or suppression system shall be provided

(ii) Adequate ventilation in covered spaces for DRI shall be provided

(iii) Passivation in closed vessels before discharging to open atmosphere

(iv) Online Carbon Monoxide (CO) gas monitoring shall be provided

(v) Periodic thermography of refractory line duct shall be provided

(vi) Inert purging shall be ensured before opening any equipment or pipeline and

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carrying out any maintenance activity.

(vii) Colour coding with labelling of pipelines in conformance with relevant National standards and flow direction shall be provided.

(viii) Flue gas online oxygen detectors shall be provided.

(ix) Periodic monitoring of temperature shall be carried out.

(f) **Torpedo Ladle / Ladle / Ladle Car**

(i) During movement of ladle, tapping hot metal to and from the ladle, man movement shall not be entertained. Siren arrangement shall be provided in the shop floor to ensure the same.

(ii) Periodic maintenance of Ladle shall be ensured as defined by the process owner.

(iii) Ladle repair shop shall be made available in the vicinity to ensure immediate maintenance of damaged ladles.

(iv) During transfer of hot metal from torpedo to ladle, level sensors for free board measurement system shall be in place.

(v) During transfer of hot metal from torpedo ladles to hot metal ladles, ensure proper positioning of torpedo and the operator visibility shall be ensured.

(vi) Precautions shall be taken to avoid contact of water or moisture in hot metal while transfer of hot metal.

(vii) Water accumulation shall not be permitted inside ladles.

(viii) Periodic maintenance of track (for torpedo) shall be ensured.

(ix) No combustible material shall be stored near the track area.

(x) Regular inspection of ladle refractory shall be done.

(g) **Hot Metal Pre-Treatment**

(i) Periodical clearing of de-dusting hoods shall be done.

(ii) Corrosion of pipes shall be monitored periodically and if there is a leakage of water, the ladle shall not be moved till the water is drained out.

(h) **Steel Shop Furnace**

(i) Separate identification shall be provided for lancing oxygen lines.

(ii) Furnace parameter reading such as temperature, pressure shall be continuously monitored.

(iii) Suitable refractory material shall be used to line the furnace.

(iv) During charging the material shall be dry and free from combustible materials and liquids.

(v) When charging a furnace use only dry charge material.

(vi) Remote charging to eliminate charging of wet materials.

(vii) Pre-heating the charge and tools prevent shall be done.

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(viii) The manufactures instructions shall be followed for storing alloying materials and pre heating tools minimize moisture accumulation, reducing the risk of splashing.

(ix) Ingots added to a molten pool shall be pre heated, or introduced using a remote charging system.

(x) The earth leak detector system shall be provided with coreless induction furnaces (except removable crucible furnaces) and power supply units for safe melting and holding operations.

(8) Oxygen Blowing in Basic Oxygen Furnace

There are chances of water leakages from lance tip, thereby causing a blast inside the vessel. To avoid this, the following safety precautions are suggested –

(a) Condition monitoring and testing of weld in Blow tip fixing and method.

(b) Blow stop interlocking due to differential water flow in lance shall be made mandatory and water diversion bypass line shall be available

(c) Additional Blow stop interlocking such as outlet water temperature high, outlet water flow low and differential temperature high shall be provided.

(d) Lance positioning and facilitating converter tilt shall be defined as standard procedures

(e) Arrest the water leakage, ensure that water isn't entrapped in hot metal. Do not tilt furnace till water evaporation is ensured.

(9) Caster/ Billet Caster and Mills/ Bar Mill

(a) Cross over facility shall be provided at designated locations in the mill floor.

(b) Continuous gas monitoring devices shall be installed in the gas lines.

(c) U – Seal shall be protected with the desired water columns to avoid leakage of gases.

(d) For stopping of flow of material into/from Tundish, provision shall be made. Alternate arrangement shall be provided in case the first once fails.

(e) Alternative arrangement for controlling Movement of Turret shall be provided

(f) Alternative arrangement for water circulation shall be provided for water cooled panels having contact with the liquid steel.

(g) Standard operating procedure shall be defined and followed for cobble removal from Mill or run-out table.

(h) Customized lifting tackles shall be preferred in place of regular slings and chains to handle heavy loads.

(i) Restricted entry shall be allowed in casting floor area.

(10) Reheating/Soaking Furnace

(a) All the gas line shall be isolated from circuit by "U" seal and isolation valve

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(Goggle valve) and also filled up water in water seal and ensure overflow of water to drain.

(b) Blanking of gas line shall be done before removal of valves or flanges.

(c) Use Portable and /Online "CO"/multi gas monitors with audio/visual alarm to detect gas leakage.

(d) Purge the gas pipe line with nitrogen in small segments by opening the bleeder valve, prior to any maintenance activity in the gas lines.

(e) Control the draft (negative pressure) in the furnace so that flame shall not come out.

(f) Gas flow and air to gas ratio shall be maintained for complete combustion and quality of flame and prevention of CO into stack.

(g) During firing of furnace, it shall be ensured by suitable provision that all burners are flamed to prevent explosion from accumulation of fuel (BFG/COG/Mixed) gas.

(11) Coilers -

(a) Heat resistant jackets shall be provided for persons working in the coilers during the time of cobbling etc.

(b) Ensure down coilers are protected with guards to avoid misplacement of coils during cobbling activity.

(c) Availability of EOT cranes at all times to remove run away coils shall be ensured.

(d) Trips and interlock system of the down coiler linked to the DCS system shall be provided.

(12) Storage yard and its accessories such as Stackers, Reclaimers, Conveyors etc.

(a) Raw material handling storage yard and coke and coal storage yards shall be provided with sprinkler arrangements.

(b) Conveyors shall be fitted with Linear Heat Sensing devices to sense fire even in case of remote locations. (already included in entrapment)

(c) Junction Boxes shall ensure all mandatory precautions as mentioned in the Conveyor Safety and Machine Guarding guidelines.

(d) Periodic checking of the Stackers and Reclaimers shall be ensured.

(e) Ensure the safety of the persons/ operators of the stackers and reclaimers wherever such persons are working in remote locations away from the plant process. CCTV cameras can be installed in such location.

(f) Magnetic separator shall be provided to pick up ferrous particle.

(13) Smelting

Proper protective clothing and equipment, including safety glasses, face shield head and body protection and foot and hand protection shall be used when working near molten aluminium as it is with ferrous metals.

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(14) Pyrometallurgy and Hydrometallurgy process

(a) Appropriate control measures shall be taken to reduce exposure to dust and other such hazards.

(b) Ensure dilution and local exhaust ventilation (LEV).

(c) Skin and eye protection and LEV shall be used in smelting operations.

(d) Proper goggles and face shields shall be worn.

(e) Hearing protectors shall be worn.

(f) A hearing conservation program including audiometric testing and training shall be instituted.

(g) Appropriate electrical maintenance with lockout/tagout procedure along with insulated gloves, clothing and tools; and ground fault circuit interrupters shall be provided.

90. **Non-ferrous metallurgical industries -** under serial no. 2 in the first schedule under clause (za) of sub-section (1) of section 2

(1) Provisions of this standard shall apply to all factories wherein manufacturing and processes incidental thereto carried on with any of non-ferrous, alloys of non- ferrous and combination of non-ferrous metals namely zinc, lead, copper, manganese and aluminium.

(2) NON-FERROUS METAL

(a) **ALUMINIUM METALLURGICAL INDUSTRIES.**

(i) **Alumina Refinery**

(a) **Bauxite handling, storage and crushing**

Safety precautions like barricading and pull cords systems shall be provided to prevent physical hazards during conveyor operation.

(b) **Red Area**

(Bauxite grinding, digestion, desilication, red mud settling and security filtration of operation)

(i) During some manual operations, operation control procedure shall be followed with use of appropriate PPE.

(ii) In the security filters the gaskets shall be replaced annually to prevent ruptures due to high pressure.

(iii) Eye wash, safety showers and safety specialised goggles shall be provided and used.

(c) **White Area**

(Seed filtration, hydrate precipitation, classification and calcination)

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(i) Since caustic soda is one of the raw material the similar hazards mentioned above is applicable.
(ii) Appropriate barricading / insulation has shall be provided.
(iii) Ear muffs shall be ensured for the working personnel in the blower room.
(iv) During alumina loading into the wagons appropriate platform and barricading shall be done.

(ii) **Aluminium Smelting**

(a) **Carbon Anode Making**

(i) Temperature of the liquid pitch storage tanks and smelters shall be maintained by hot thermic fluid which flows through closed circuit. Pitch fumes emitted during melting shall be vented out through chimney for dispersion.
(ii) Cleaning of pitch storage tanks, Sludge cleaning in anode cooling decantation tank shall be treated as Confined space and the standards laid down under section 18 of the code pertaining to confined spaces shall be fully adhered to.
(iii) LOTO and permit to work system shall be followed during maintenance work.
(iv) The permissible limits of exposure of chemicals and toxic substances shall be ensured in fume treatment centre and other dedusting system.
(v) Heavy Fuel Oil metallic braided hoses in bake ovens shall be inspected once in three months and the damaged hoses replaced immediately.
(vi) Fail-safe dampers for emergency evacuation of fumes in case power failure or breakdown shall be provided.
(vii) Face shields and breathing nose masks shall be provided to protect the workmen against the fumes generated during induction furnace operation.
(viii) Appropriate dehydration prevention control measures shall be implemented.
(ix) Ladle preheating up to minimum 150 deg C shall be ensured before casting so as to prevent the presence of moisture.
(x) The travel path of the anode movement at height shall be protected on both sides and at the permitted crossings, hazard communication and audible and visible sirens or warnings shall be ensured.

(b) **Alumina Reduction**

(i) No moisture shall be permitted to remain inside the ladle.
(ii) During tapping, the person concerned for putting the gasket at the pouring spout of the ladle shall not stand in front of the pouring spout and also shall maintain a safe distance.

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(iii) Pot tending machine (PTM) the following safety measures shall be enured:

(a) Only authorized persons drive a PTM.

(b) PTM not shall be operated when red/warning light is glowing inside cabin or when a tag is hanging on the pendant.

(c) Blow horn before using the PTM to ensure no one is working with the PTM.

(d) Do not climb PTM cabin on pot superstructure. Use the ladder/staircase provided.

(e) Do not push any standing PTM nearby.

(f) If any PTM comes close to other PTM without any indication intimate the shift/section in-charge.

(g) Ensure no water/moisture inside sow mould/skimming bowl before pouring molten bath/hot skimmed materials.

(h) Any abnormal sound observed from any part of PTM is shall be brought to the notice of shift/section in-charge immediately.

(i) Ensure there is no pot equipment above pot super structure which shall dash with PTM Hopper Trolley /Two bucket shovel /alumina spout etc.

(j) Ensure the central passage bumpers are not in down condition and the lifting beam is in position before crossing the central passage.

(k) In case of any sparking observed near collector shoes, stop the PTM and inform the concerned shift/section in-charge immediately for maintenance of the same.

(l) Ensure no person is nearby during clapping the hot TBS at the time of anode changing.

(m) Never operate the cross travel and up-down movement of main hoist simultaneously.

(c) **Aluminium Casting**

(i) The following safety precautions shall be implemented in ladle skimming

(a) No Water in the laddle spout

(b) No spillage of metal from the laddle

(c) In the laddle skimming station, skimming tool shall be dry

(d) Metal transport trolley (MTT) shall be entered when green signal is given.

(e) At a time only one MTT shall be allowed in to the ECL Bay

(f) No Vehicle movement during metal handling.

(ii) The following safety precautions shall be implemented in ladle pouring:

(a) Pouring hoist shall be engaged properly before pouring

(b) Pouring trough shall be free from water/moisture

(c) Wait for the signal from ground crew

(d) Keep distance between Ladle spout and the Furnace pouring trough

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(e) Any dross piece blocking pouring shall be cleaned
(f) While pouring last laddle maximum care shall be taken for furnace metal level
(g) While pouring in Direct Casting preheated of mould shall be ensured
(h) Keep the optimum distance between Laddle Spout and Sow mould, so that spillage shall be Minimum
(i) Do not use mobile phone while pouring hot metal

(iii) The following safety precautions shall be implemented in furnace skimming:
(a) Furnaces are Skimmed to remove dross
(b) Ensure Skimming tool shall be free from Moisture
(c) Skimming tool shall be fitted properly
(d) Furnace tending vehicle shall be free from oil leakage
(e) Skimming bowl shall be free from water/Moisture
(f) Skimming bowl shall be properly placed
(g) After skimming hot dross shall be shifted to dross Cooler for metal separation.

(iv) The following safety precautions shall be implemented in Ingot casting Machine
(a) Furnace Spout packing shall be checked for leakage
(b) Launder shall be pre heated
(c) By pass sow mould shall be preheated
(d) After preheating keep the LPG burner in a designated place
(e) Mould coating with oil lubricant shall be done
(f) Casting wheel and mould shall be preheated
(g) Keep distance while removing oversize/undersize ingot
(h) Ensure use of hand gloves in Layer andStrapping Station
(i) Timely remove the ingot stack from Stack Conveyer using Forklift.

(v) The following safety precautions shall be implemented in Wire Rod Casting
(a) Furnace Spout packing shall be checked
(b) Launder shall be pre heated.
(c) Ceramic foam filter shall be preheated.
(d) By pass sow mould shall be preheated.
(e) Preheating Large Tundish, Small Tundish and Ceramic down spout shall be done.
(f) After preheating keep the LPG burner in a designated place.
(g) Face shield shall be used while casting.
(h) While operating the casting panel wait the signal from caster.

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(i) Keep away when there is a bar crack.
(j) While bar cutting one hook of EOT crane shall be used to remove the bar.
(k) Keep away from Rolling Mill, some times rod shall come out after last stand.
(l) Keep away while there is looping in coiler, if required Emergency shall be pressed.
(m) Ensure Safety gate for Coiler shall be open while strapping.
(n) Don't go under hot aluminium bar.

(vi) The following safety precautions shall be implemented in Billet casting
(a) Furnace Spout packing shall be checked
(b) Launder and Billet Table shall be pre heated
(c) Ceramic foam filter shall be preheated
(d) By pass sow mould shall be preheated
(e) After preheating keep the LPG burner in a designated place
(f) Face shield shall be used while casting
(g) While lifting the billet from the casting pit using EOT crane, maximum care shall be taken

(vii) The following safety precautions shall be implemented in 'T' Casting
(a) Spout packing condition shall be checked
(b) Pre-heating of launder shall be ensured.
(c) V-launder packing condition shall be checked
(d) Tundish blanket condition shall be checked.

(viii) The following safety precautions shall be implemented in Sow Casting
(a) Sow mould shall be pre heated before pouring liquid metal to it
(b) Distance shall be maintained while pouring hot metal
(c) Proper PPE shall be used by the Skimmer while skimming

(d) **Utility Services**

(i) The following precautionary measures shall be implemented while producing Nitrogen Gas
(a) Ensure requisite compressed air Pressure in Receiver
(b) Ensure requisite Nitrogen Pressure in gas Receiver
(c) Dispose the spent Copper Catalyst, Zeolite in a designated Place
(d) Proper care to taken while replacing the empty hydrogen cylinder to avoid Leakage

(ii) The following precautionary measures shall be implemented during shifting of Finished Product Cast house to despatch
(a) Use proper industrial vehicle for shifting of different finished product to

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despatch

(b) The area to cordoned to avoid any human movement.

(b) COPPER METALLURGICAL INDUSTRIES

(i) FEED Section (Copper Ore handling area):

Conveyer movement at Feed section is the main cause which can bring the operator in contact with moving machinery. These can cause injuries the human body. The safeguards which include interlocks causing conveyer to trip, machine guards and safe practices to help in managing the risk to personnel working in the area.

(a) Rotary and rotating parts of machines shall be guarded.

(b) Slip hazard and hand trap hazard on running conveyor while walking on conveyor side platform shall be shielded or covered and uniform hand rail shall be provided.

(c) Dust flies over while raw material unloading/loading/screening shall be controlled by providing dust exhaust system.

(d) Separate pedestrian walkway and adequate safety protection to warn pedestrian from moving vehicles /heavy equipment like safety convex mirror, laser line light etc shall be provided.

(e) Toppling of vehicles/trucks/forklifts while handling materials shall be prevented by strict compliance to speed limit, healthy condition of vehicles, Safe behaviour of drivers and adherence to road safety precautions and vehicle Safety standards.

(ii) Primary Smelting Section:

The following are the hazards and mitigation measures in primary smelting section

(a) Monitoring of tab block temperature and refractory lining shall be complied with.

(b) Shield plate with refractory shall be ensured to use while poking to avoid burn injury.

(c) Periodic cleaning and hard barricading of area, and authorized entry to smelting section shall be ensured.

(d) Employees shall wear appropriate personal protective equipment.

(e) Copper concentrate to silica composition and various metallurgical factors shall be analysed and oxygen flow meter and weigh feeders shall be checked regularly and regular temperature monitoring of furnace shell shall be ensured.

(f) Periodical trial with emergency power for rotation and limit switch checking shall be ensured.

(g) Brick arrester or any other device to control the metal flow shall be installed.

(h) Regular cleaning of spray pond and adequate water flow in granulation system shall be ensured.

(i) Exposure to sulphur dioxide gas shall be prevented by installation of monitors at

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various work area of RHF.

(j) Adequate Sulphur dioxide leakage warning system shall be provided.

(k) Emergency response plan shall be developed for leakage of Sulphur dioxide gases.

(l) Flash back arrester shall be provided in the line.

(iii) **Secondary Smelting Section (**Blister Copper)

The following safety measures in secondary smelting section shall be ensured:

(a) Use always mist cooling at tuyere end and concrete shielding around converter.

(b) Comply with scheduled ladle and crane accessories inspection crane and lifting safety standards.

(c) Provide separate pedestrian walkway and adequate safety protection .

(d) Red light alarm with hard barricading

(e) Periodical trial with emergency power for rotation and limit switch checking and encoder device shall be installed as a mitigation measure.

(f) Ensure wearing of reflecting clothes while individual enters into hot metal handling crane aisle.

(g) Provide anti-collision device.

(h) Provide silencer in converter tuyere and blower

(i) Comply with wearing of safety belt and periodical inspection of platform.

(j) Provide aluminized heat resistant clothes and hard shield.

(k) Ensure regular monitoring of shell temperature.

(l) Provide flash back arrester and comply with zero residual steam and LPG in the line.

(m) Provide hard shield for work at skim door.

(n) Comply with periodical changing of tuyere block and LPG leak test.

(o) Install dust exhaust system in baryte coating area.

(p) Provide hard barricading and shielding of area.

(q) Ensure pre-heating of launder and mould to appropriate temperature.

(iv) **Copper Refining Section (Electrolysis)**

The following safety measures in Copper refining section shall be ensured:

(a) Ensure Chemical Safety Precautions including appropriate PPE, eye wash fountains, emergency safety showers, emergency kits for acid spill, spill dilution, and barricading of areas as per National Standards.

(b) Ensure proper storage of chemicals, maintain MSDS.

(c) Avoid combustible or reactive materials to clean up or absorb spills.

(d) In anode lug milling, wear proper PPE like face shield or safety goggles.

(e) While lifting cathode plates or anodes, comply with regular maintenance and Crane Safety standards.

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(v) **Sulphuric Acid Section:**

The following safety measures in Sulphuric acid section shall be ensured:

(a) Ensure Chemical Safety Precautions including appropriate PPE, PVC suit, hood and face shield, eye wash fountains, emergency safety showers, emergency kits for acid spill, spill dilution, and barricading of areas as per National Standards.
(b) Ensure proper storage of chemicals, maintain MSDS.
(c) Install SOx monitors at various work area of Rotary Holding Furnace (RHF).
(d) Provide alarm and interlocking system to trigger if sulphur dioxide level exceeds beyond permissible exposure limit.
(e) Provide appropriate respiratory protection devices
(f) Ensure proper maintenance, condition monitoring and timely replacement of pipe lines.
(g) Monitor wall thickness of tanks.
(h) Comply with Chlorine handling process as per MSDS during the chlorine dosing process.

(vi) **Sulphuric Acid storage**

(a) For concentration from 93 to 99 percent, it shall be stored in mild steel tanks, drums and glass carboys. For concentration below 93 percent, it shall be stored in glass carboys, earthenware jars or other suitable containers lined with acid-resistant materials.
(b) Storage shall be located in the open or in well ventilated buildings or sheds.
(c) Hydrogen pressure inside the container shall be relieved frequently by opening plugs of the metallic containers or alternatively such containers shall be provided with safety vents.

(d) Each storage tank shall be provided with a vent of sufficient size and of a type which shall maintain the tank at atmospheric pressure and which is capable of being cleaned easily.

(e) All tanks shall be placed squarely on good foundation and raised off the ground by at least two layers of acid-proof bricks.

(f) The tanks shall be mounted with a slight slope towards the sludge hole or outlet valve.

(g) A plug operated from the top of the tank shall be provided over the outlet valve.

(h) Gauge glasses in acid tanks shall be avoided.
(i) The tank shall be surrounded by a bund or dyke wall having adequate capacity to

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hold the complete content of the tank. If a common bund wall is made for more than one tank, then capacity of the bund shall be enough to hold the content of the largest tank.

(j) Drums shall be stored with the plugs up. Storage period of acid in drums should be kept to a minimum. They shall be vented once a week or earlier in hot weather to release hydrogen build-up.

(k) Glass carboys used for storage of sulphuric acid shall be of sound construction and be kept in strong individual wooden crates. The carboys shall not be carried.

(l) Glass carboys shall be stored on a bed of limestone dust or calcareous sand.

(m) Glass carboys containing acid shall not be stored more than two high. After their contents have been removed no attempt shall be made to wash the carboys with water. They shall be drained off as completely as possible and used either to refill with the same acid or returned to the supplier.

(n) The flanges on the acid pipelines shall be so covered that any leakage shall not cause spray of acid. If the flanges are above working and walking surfaces, catchpots with adequate drain pipes shall be provided to avoid dripping of acid on the body.

(o) Floors of the storage area shall be of acid resistant material and shall have adequate slope for easy draining of any spilled acid.

(c) **MANAGANESE METALLURGICAL INDUSTRIES**

(i) **Reduction**

Conveyer movement at Raw Material Handling (RMH) is the main cause which can bring the operator in contact with moving machinery. These can cause injuries the human body. The safeguards include: -

(a) Interlocks causing conveyer to trip, machine guards and safe practices to help in managing the risk to personnel working in the area.

(b) Rotary and rotating parts of machines pose a “nip” point hazard (getting caught at the pinch point). This shall be guarded 360 degree adequately and securely.

(c) Slip hazard and hand trap hazard on running conveyor while walking on conveyor side platform which shall be shielded/covered and uniform hand rail.

(d) Dust flies over while raw material unloading/loading/screening shall be controlled by providing engineering control to avoid respiratory problem to workers.

(e) Respiratory protection and full body shower with eye wash fountain shall be provided near the work area.

(f) The separate pedestrian walkway and adequate safety protection to warn pedestrian from moving vehicles /heavy equipment’s like safety convex mirror, laser line light etc shall be provided.

(g) The occupier shall ensure preventive maintenance of all equipment in the plant.

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(ii) **Leaching, Jarositing, Goethiting and sulphiding process to make liquor**

(a) Chemical Safety Precautions including appropriate PPE, PVC suit, hood and face shield, eye wash fountains, emergency safety showers, emergency kits for acid spill, spill dilution, and barricading of areas shall be ensured as per National Standards.

(b) Proper storage of chemicals and MSDS shall be ensured.

(c) Adequate respiratory protection devices shall be provided to workers to protect from exposure as per applicable national standards.

(d) Damage to pipes and equipment due to corrosion effects shall be prevented by proper maintenance and condition monitoring and timely replacement of same with acid proof material of construction.

(e) Storage tank leakage hazard shall be prevented by regular thickness monitoring of tanks and adherence to maintenance procedures and chemical safety precautions.

(iii) **Electro winning**

(a) Employee shall wear the appropriate PPEs like PVC suit and acid proof Safety goggles /glasses which cover his eye at all the time.

(b) Fly over of manganese particles shall be avoided by wearing PPEs like face shield, RPD / Safety goggles/protective clothing.

(c) Pinched finger hazards during hammer operations while separating manganese from anode and other manual work shall be mitigated by automation of manual work and wearing cut resistant hand gloves and following material handling safety precautions.

(d) EOT cranes collision hazard shall damage structures/ spill the metal. It shall be mitigated by providing anti-collision device and deputing experienced crane operators

(iv) **Ferro Manganese**

(a)**Hazards at Submerged Arc Furnace**

(i) Appropriate barricading / insulation shall be provided to avoid contact with spillage of molten ferro-alloys.

(ii) Ensure that molten metal shall not come in to contact with water, to prevent explosions

(iii) Gas safety man shall accompany the team and shall test the atmosphere for the presence of CO, before starting the work. If CO, concentration is found exceeding the sage limit, the job shall be undertaken using necessary safety appliances viz., Oxygen Breathing Apparatus/Blower type Gas mask.

(iv) Any gas cutting /welding job shall be undertaken with the clearance from Gas safety man.

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(v) Any accumulation of water shall be prevented in such vulnerable areas. In case of minor leakages, the flow of molten metal shall be controlled. If there is major breakout, the area shall be cut off and cordoned.

(vi) Adequately rated and quick response circuit breakers, aided by reliable and selective digital or microprocessor based electromagnetic protective relays shall be incorporated in the electrical system design to protect the worker from electrocution.

(b) **Hazards at Sinter Plant**

(i) Dust shall be controlled by providing Dust exhaust system to avoid respiratory problem.

(ii) Appropriate barricading / insulation shall be provided to avoid contact with hot Sinter ,and prevent burn hazard and injuries due to heat radiation.

(iii) Electrical hazard shall be prevented by proper earthing and following Lock Out and Tag Out standards.

(c) **Hazards at Coal Handling Plant**

(i) Coal handling unit shall be minimum 500 meters away from the residential area.

(ii) Coal storage unit shall provide paved approach with adequate traffic carrying capacity.

(iii) Coal storage unit shall ensure that stacking of coal in heaps does not get higher than the compound wall of premises of unit.

(iv) Adequate dust suppression measures shall be provided to prevent fugitive emission and also risk of fire.

(v) Coal ash shall be transported in tankers, which are covered and closed and there is no chance of spillage during transportation.

(vi) Firefighting measures shall be provided to avoid any fire and ensure that there is no explosive or chemical reaction in storage yard.

(d) **Hazards at Loading/Unloading operation/ Storage**

(i) Dust during Loading/unloading operation shall be maintained under permissible levels.

(ii) Conveyor moving parts pose a “nip” point hazard. They shall be guarded 360 degree adequately and securely.

(iii) Motor overloading shall be avoided.

(e)**Screening**

(i) Rotary and rotating parts shall be guarded 360 degree adequately and securely.

(ii) Dust shall be controlled by providing dust extraction system.

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(f) **Jigging**

(i) Scheduled ladle and crane accessories inspection and adherence to crane and lifting safety standards shall be ensured.

(ii) Red alarm with hard barricading shall be provided to avoid heat radiation and spill of hot metal while deskulling the ladle.

(iii) A limit switch checking and encoder device shall be installed to prevent hot metal overflow.

(iv) CO emission shall be mitigated by adequate ventilation and installation of gas detection monitors at various work area and alarm and interlocking system shall be installed.

(v) Hit by crane hazard shall be controlled by provision and usage of walkway platform and ensure wearing of reflecting coat while individual entered into hot metal handling crane aisle.

(vi) EOT cranes collision hazard shall be mitigated by providing anti-collision device.

(vii) Occupier shall provide adequate ear protection equipment to protect from noise hazards.

(viii) Heat radiation shall be controlled by wearing aluminized heat resistant coat and providing hard shield and regular monitoring of temperature and maintaining refractory condition in furnace.

(ix) Flash back arrester can be provided to prevent back fire while cleaning exit nozzle and metal pouring hole lancing and LPG burner operation.

(x) Hard shield can be provided and ensure cleanliness of skim door to prevent hot metal splashing while skimming operation.

(xi) Dust hazards shall be mitigated by Installation of Dust exhaust system in and providing adequate Respiratory Protection Devices to the workers.

(xii) Electrical hazard shall be prevented by proper earthing and following Lock Out and Tag Out standards.

(g) **Magnetic separation and Grinding**

(i) Rotary and rotating parts of machines pose a “nip” point hazard (getting caught at the pinch point). They shall be guarded 360 degree adequately and securely.

(ii) Occupier shall provide adequate ear protection device to protect from noise hazards.

(iii) Dust extraction system shall be provided

(iv) Eye wash and safety shower shall be provided nearby area.

(d) **LEAD METALLURGICAL INDUSTRIES**

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(i) **Lead ore handling area- Raw Material Handling (RMH)**

Following safeguards shall be provided: -

(a) Interlocks for tripping the conveyers with respect shall belt sway, snapping of belt and machine guards shall be provided

(b) Rotary and rotating parts of machines shall be guarded adequately and securely.

(c) Conveyor side platform shall be provided with shields/covers and uniform hand rail.

(d) Dust fly over while raw material unloading/loading/screening shall be controlled by providing Dust exhaust system.

(e) Respiratory protection and full body shower with eye wash fountain shall be provided.

(ii) **Oxidation of Lead Ore –**

(a) Back Fire in Bottom blowing furnace shall be prevented by installing appropriate metal braided hoses, air and oil flow control system.

(b) Access control shall be ensured so that only persons authorized by the responsible person are present near the furnace.

(c) Adequate precautions shall be taken to control and contain hot metal overflow from furnace.

(d) The occupier shall ensure adequate detection and warning system to warn employees in case of Sulphur di oxide and carbon monoxide leakage beyond permissible exposure limits.

(e) Emergency response plan shall be prepared in case of gas leakage and all employees shall be trained for emergency response.

(f) Flash back arrester shall be provided in the LPG line and LPG temperature shall be monitored before light up.

(iii) **By-product (Sulphuric Acid) production**

(a) Exposure to sulphur dioxide gas shall be prevented by installation of monitors at various work area of RHF. The alarm and interlocking system shall be triggered if sulphur di oxide level exceeds beyond permissible exposure limit. Adequate respiratory protection devices shall be provided to workers to protect from exposure as per applicable national standards.

(b) Damage to pipes and equipment due to corrosion effects shall be prevented by proper maintenance and condition monitoring and timely replacement of same with acid proof material of construction.

(c) Regular thickness monitoring of tanks and pipelines , adherence to maintenance procedures and chemical safety precautions shall be followed to prevent leakage in storage tanks.

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(iv) **Anode moulding**

(a) Alarm with hard barricading to avoid exposure of hot metal shall be ensured.

(b) Occupier shall provide access control and appropriate PPE to protect workers from thermal hazards.

(c) Heat radiation from anode furnace shall be controlled by regular monitoring of shell temperature and maintaining refractory condition in furnace.

(d) Hard shield shall be provided and cleanliness of skim door shall be ensured.

(e) Hard barricading shall be provided and area shall be shielded to prevent hot water splashing in mould cooling area.

(v) **Refining of Lead (Electrolysis)**

(a) Moving crane shall be provided with alarm and flash light.

(b) Acid spillage or mist hazard shall be prevented by following Chemical safety precautions to dilute the spill /barricade the area and follow proper storage of chemicals, maintain MSDS and never use combustible or reactive materials to clean up or absorb spills.

(e) **ZINC METALLURGICAL INDUSTRIES.**

(i) **Zinc ore handling area- Raw Material Handling (RMH)**

Conveyer movement at RMH is the main cause which can bring the operator in contact with moving machinery. These can cause injuries the human body. The safeguards include: -

(a) Interlocks causing conveyer to trip, machine guards and safe practices to help in managing the risk to personnel working in the area.

(b) Rotary and rotating parts of machines pose a “nip” point hazard (getting caught at the pinch point). This shall be guarded 360 degree adequately and securely.

(c) Slip hazard and hand trap hazard on running conveyor while walking on conveyor side platform which shall be shielded/covered and uniform hand rail.

(d) Dust flies over while raw material unloading/loading/screening shall be controlled by providing Dust exhaust system to avoid respiratory problem to workers.

(e) Respiratory protection and full body shower with eye wash fountain shall be provided near the work area.

(f) The adequate safety protection to warn pedestrian from moving vehicles /heavy equipment’s like safety convex mirror, laser line light etc shall be provided.

(ii) **Reduction of zinc ore (roasting)**

(a) Back Fire in rotary holding Furnace (RFH) shall be prevented by installing high quality metal braided hoses, control of air flow and oil flow through automation, periodic inspections, adequate access control and ensuring housekeeping of

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area.

(b) Hot metal spillage while carrying out cleaning with poking rod shall be prevented by ensuring a Shield plate with refractory during poking to avoid burn injury. Bottom windows shall be kept shut during poking to avoid metal spilling.

(c) The workers are provided with appropriate personal protective equipment to mitigate thermal hazards, noise hazard etc.

(d) Access control shall be ensured so that only persons authorized by the responsible person are present near the furnace.

(e) Adequate precautions shall be taken to control and contain hot metal overflow from furnace.

(f) The adequate protection system to warn employees in case of Sulphur dioxide leakage beyond permissible exposure limits and emergency response plan shall be developed for leakage of Sulphur dioxide gases and all employees shall be trained for the response plan.

(g) Back fire from LPG burner hazard shall be mitigated by ensuring Flash back arrester in the line and monitoring of LPG temperature before light up.

(iii) **By-product (Sulphuric Acid)production**

(a) Acid spill / splash hazard shall be prevented by following Chemical Safety Precautions and adhere to wearing of appropriate PPE like acid splash goggle, PVC suit with hood and face shield.

(b) The occupier shall ensure availability and healthy condition of eye wash fountains, emergency safety showers and emergency kits for acid spill as per national standards.

(c) Acid spillage or mist hazard shall be prevented by following Chemical safety precautions to dilute the spill /barricade the area and follow proper storage of chemicals, maintain MSDS and never use combustible or reactive materials to clean up or absorb spills.

(d) Exposure to sulphur dioxide gas shall be prevented by installation of monitors at various work area of RHF. The adequate protection system to warn employees in case of Sulphur dioxide leakage beyond permissible exposure limits.

(e) Adequate respiratory protection devices shall be provided to workers to protect from exposure of sulphur dioxide and any other gases as per applicable national standards.

(f) Damage to pipes and equipment due to corrosion effects shall be prevented by periodic maintenance and condition monitoring and timely replacement of same with acid proof material of construction.

(g) Storage tank leakage hazard is prevented by regular thickness monitoring of tanks and adherence to maintenance procedures and chemical safety precautions.

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(h) Mercury is a by-product in the conversion of sulphur dioxide to sulphuric acid. Mercury handling process as per MSDS shall be carefully followed.

(i) Chlorine handling process as per MSDS shall be followed during the chlorine dosing process.

(iv) **Conversion of Zinc Oxide to Zinc Sulphate (Leaching)**

(a) Exposure to acid while cleaning of filter cloth shall be prevented by following Chemical Safety Precautions and adhere to wearing of appropriate PPEs like acid splash goggle, PVC suit with hood and face shield. The availability and healthy condition of eye wash fountains, emergency safety showers and emergency kits for acid spill as per national standards shall be ensured.

(b) Acid spillage or mist hazard shall be prevented by following Chemical safety precautions to dilute the spill /barricade the area and follow adequate storage of chemicals, maintain MSDS and never use combustible or reactive materials to clean up or absorb spills.

(c) Hydrogen ----Second opinion

(v) **Extraction of Zinc (Electro-Winning)**

(a) During Cell sludge Cleaning, the worker shall slip and get in contact with the electrolyte, to avoid injury, he shall wear the appropriate PPEs like PVC suit and acid proof Safety goggles /glasses which cover his eye at all the time.

(b) Acid spill / splash hazard. shall be prevented by following Chemical Safety Precautions and adhere to wearing of appropriate PPEs like acid splash goggle, PVC suit with hood and face shield. The availability and healthy condition of eye wash fountains, emergency safety showers and emergency kits for acid spill as per national standards shall be ensured.

(c) Acid spillage or mist hazard shall be prevented by following Chemical safety precautions to dilute the spill /barricade the area and follow proper storage of chemicals, maintain MSDS and never use combustible or reactive materials to clean up or absorb spills.

(d) Fly over of zinc particles shall be avoided by wearing PPEs like face shield / Safety goggles/protective clothing.

(e) Contact with the moving parts of machines like cutting machine to remove zinc from aluminum cathode shall lead to an injury to the worker and shall be avoided by adequate guarding /interlock sensors and hard barricading of area.

(f) Pinched finger hazards during hammer operations and other manual work shall be mitigated by automation of manual work and wearing cut resistant hand gloves and following material handling safety precautions.

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(g) EOT cranes collision hazard shall damage structures/ spill the metal. It shall be mitigated by providing anti-collision device and deputing experienced crane operators

(3) Personal Protective Equipment

S. No.	Activity/ Process	Recommended PPE
1	-Raw Material Handling	-Dust Masks, -Fall protection, -Safety Helmet -Safety Shoe with Steel toe -eye wear for protection from dust and flying particles -Ear plugs
2	Rotary holding Furnace/Blast Furnace /Bottom Blowing Furnace	-Heat resistant Safety Helmet -Face shields -Face Hood -Heat resistant sole Safety Shoe -Gas masks -Body Suit for Thermal Hazards.
3	Sulphuric acid Section	-Safety Helmet -Safety Shoe with chemical resistant sole -PVC suits -PAPR -chemical splash eye wear -Ear protection
4	Leaching	-Safety Helmet, -Safety shoe with chemical resistant sole -PVC suits -PAPR -Chemical splash Eyewear -Ear protection.
5	Electro winning/Electrolysis	-Safety Helmet -PVC Gum boots, PVC suits -PAPR, Chemical splash -Ear protection - Fall protection - Electrical Hand gloves

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91. **Foundries (ferrous and non-ferrous) -** under serial no. 3 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all parts of factories where any of the following operations or processes are carried on :

(a) the production of iron castings or, as the case shall be, steel castings by casting in moulds made of sand, loam, moulding composition or other mixture of materials, or by shall moulding, or by centrifugal casting and any process incidental to such production;

(b) the production of non-ferrous castings by casting metal in moulds made of sand, loam , metal, moulding composition or other material or mixture of materials, or by shall mouldings, die-casting (including pressure diecasting), centrifugal casting or continuous casting and any process incidental to such production; and

(c) the melting and casting of non-ferrous metal for the production of ingots, billets, slabs or other similar products, and the stripping thereof;

(d) but shall not apply with respect to -

(e) any process with respect to the smelting and manufacture of lead and the Electric Accumulators;

(f) any process for the purpose of a printing works; or

(g) any smelting process in which metal is obtained by a reducing operation or any process incidental to such operation; or

(h) the production of steel in the form of ingots; or

(i) any process in the course of the manufacture of solder or any process incidental to such manufacture; or

(j) the smelting and casting of lead or any lead-based alloy for the production of ingots, billets, slabs or other similar products or the stripping thereof, or any process incidental to such melting, casting or stripping.

(2) Prohibtion of use of certain materials as parting materials.-

(a) A material shall not be used as a parting material if it is a material containing compounds of silicon calculated as silica to the extent more than 5 percent by weight of the dry material :

Provided that this prohibition shall not prevent the following being used as a parting material if the material does not contain an admixture of any other silica -

(i) Zirconium silicate (Zircon)

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(ii) Calcined china clay
(iii) Calcined aluminous fireclay
(iv) Sillimanite
(v) Calcined or fused alumina
(vi) Olivine
(vii) Natural sand

(b) Dust or other matter deposited from a fettling or blasting process shall not be used as a parting material or as a constituent in a parting material.

(3) Arrangement and storage.- For the purposes of promoting safety and cleanliness in workrooms the following requirements shall be observed :-

(a) moulding boxes, loam plates, ladles, patterns, pattern plates, frames, boards, box weights, and other heavy articles shall be so arranged and placed as to enable work shall be carried on without unnecessary risk;

(b) suitable and conveniently accessible racks, bins, or other receptacles shall be provided and used for the storage of other gear and tools;

(c) where there is bulk storage of sand, fuel, metal scrap or other materials or residues, suitable bins, bunkers or other receptacles shall be provided for the purpose of such storage.

(4) Construction of floors.-

(a) Floors of indoor workplaces in which the processes are carried on, other than parts which are of sand, shall be made of a hard material.

(b) No part of the floor of any such indoor workplace shall be of sand except where this is necessary by reason of the work done.

(c) All parts of the surface of the floor of any such indoor workplace which are of sand shall, so far as practicable, be maintained in an even and firm condition.

(5) Manual operations involving molten metal.-

(a) There shall be provided and properly maintained for all persons employed on manual operations involving molten metal with which they are liable shall be splashed, a working space for that operation -

(i) which is adequate for the safe performance of the work and

(ii) (b) which, so far as reasonably practicable, is kept free from obstruction

(b) Any operation involving the carrying by hand of a container holding molten metal

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shall be performed on a floor all parts of which where any person walks while engaged in the operation shall be on the same level:

Provided that, where necessary to enable the operation shall be performed without undue risk, nothing in this sub-para shall prevent the occasional or exceptional use of a working space on a different level from the floor, being a space provided with a safe means of access from the floor for any person while engaged in the operation.

(6) Gangways and pouring aisles.-

(a) In every workroom to which this sub-para applies constructed, reconstructed or converted for use as such after the making of these stanadards and, so far as reasonably practicable, in every other workroom to which this sub-para applies, sufficient and clearly defined main gangway shall be provided and properly maintained which -

(i) shall have an even surface of hard material and shall, in particular, not be of sand or have on them more sand than is necessary to avoid risk of flying metal from accidental spillage;

(ii) shall be kept, so far as reasonably practicable, free from obstruction;

(iii) if not used for carrying molten metal, shall be at least 920 millimetres in width;

(iv) if used for carrying molten metal shall be -

(a) where truck ladles are used exclusively, at least 600 millimetres wider than the overall width of the ladle;

(b) where hand shanks are carried by not more than two men, at least 920 millimetres in width;

(c) where hand shanks are carried by more than two men, at least 1.2 matters in width; and

(d) where used for simultaneous travel in both directions by men carrying hand shanks, at least 1.8 metres in width.

(b) If the workroom to which this sub-par applies has been constructed, reconstructed or converted for use as such after the making of these standards, sufficient and clearly defined pouring aisles shall be provided and properly maintained which -

(i) shall have an even surface of hard material and shall, in particular, not be sand or have on them more sand than is necessary to avoid risk of flying metal from accidental spillage;

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(ii) shall be kept so far as reasonably practicable free from obstruction;

(iii) if molten metal is carried in hand ladles or bulk ladles by not more than two men per ladle, shall be at least 460 millimetres wide, but where any moulds alongside the aisle are more than 510 millimetres above the floor of the aisle, the aisle shall be not less than 600 millimetres wide;

(iv) if molten metal is carried in hand ladles or bull ladles by more than two men per ladle, shall be at least 760 millimetres wide;

(v) if molten metal is carried in crane, trolley or truck ladles, shall be of a width adequate for the safe performance of the work.

(c) The requirements of sub-para (1) and (2) shall not apply to any workroom or part of a workroom if, by reason of the nature of the work done therein, the floor of that workroom or, as the case shall be, that part of a workroom has shall be of sand.

(d) In this para "workroom to which this sub-para applies" means a part of a ferrous or non-ferrous foundry in which molten metal is transported or used, and a workroom to which this para applies shall be deemed for the purposes of this para to have been constructed, reconstructed or converted for use as such after the making of this standard if the construction, reconstruction or conversion thereof was begun after the making of these standards.

(7) Work near cupolas and furnaces.- No person shall carry out any work within a distance of 4 metres from a vertical line passing through the delivery end of any spout of a cupola or furnace, being a spout used for delivering molten metal, or within a distance of 2.4 metres from a vertical line passing through the nearest part of any ladle which is in position at the end of such a spout, except, in either case, where it is necessary for the proper use of maintenance of a cupola or furnace that work shall be carried out within that distance of that work is being carried out at such a time and under such conditions that there is no danger to the person carrying it out from molten metal which is being obtained from the cupola or furnace or is in a ladle in position at the end of the spout.

(8) Dust and fumes.-

(a) Open coal, coke or wood fires shall not be used for heating or drying ladles inside a workroom unless adequate measures are taken to prevent, so far as practicable, fumes or other impurities from entering into or remaining in the atmosphere of the workroom.

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(b) No open coal, coke or wood fires shall be used for drying moulds except in circumstances in which the use of such fires is unavoidable.

(c) Mould stoves, core stoves and annealing furnaces shall be so designed constructed, maintained and worked as to prevent, so far as practicable, offensive or injurious fumes from entering into any workroom during any period when a person is employed therein.

(d) All knock-out operations shall be carried out -

(i) in a separate part of foundry suitably partitioned off, being a room or part in which, so far as reasonably practicable, effective and suitable local exhaust ventilation and a high standard of general ventilation are provided; or

(ii) in an area of the foundry in which, so far as reasonably practicable, effective and suitable local exhaust ventilation is provided, or where compliance with this requirement is not reasonably practicable, a high standard of general ventilation is provided.

(e) All dressing or fettling operations shall be carried out -

(i) in a separate room or in a separate part of foundry suitably partitioned off; or
(ii) in an area of the foundry set apart for the purpose; and shall, so far as reasonably practicable, be carried out with effective and suitable local exhaust ventilation or other equally effective means of suppressing dust, operating as near as possible to the point of origin of the dust.

(9) Protective equipment.-

(a) The occupier shall provide and maintain protective equipment specified for the protection of workers,

(i) suitable gloves to other protection for the hands for workers engaged in handling any hot material likely to cause damage to the hands by burn, scald, or scar, or in handling pig iron, rough castings or other articles likely to cause damage to the hands by cut or abrasion;

(ii) approved respirators for workers carrying out any operations creating a have dust concentration which cannot be dispelled quickly and effectively by the existing ventilation arrangements.

(b) No respirator provided for the purpose of sub-para (a) (ii) has been worn by a person shall be worn by another person if it has not since been thoroughly cleaned and

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disinfected.

(c) Persons who for any of their time -

(i) work at a spout of or attend to, a cupola or furnace in such circumstances that material there from shall come into contact with the body, being material at such a temperature that its contact with the body shall cause a burn; or

(ii) are engaged in, or in assisting with, the pouring of molten metal; or

(ii) carry by hand or move by manual power any ladle or mould containing molten metal; or

(iii) are engaged in knocking-out operations involving material at such a temperature that its contact with the body shall cause a burn;

shall be provided with suitable footwear and gaiters which worn by them prevent, so far as reasonably practicable, risk of burns to his feet and ankles.

(d) Where appropriate, suitable screens shall be provided for protection against flying materials (including splashes of molten metal and sparks and chips thrown off in the course of any process).

(e) The occupier shall provide and maintain suitable accommodation for the storage and make adequate arrangements for cleaning and maintaining of the protective equipment supplied in pursuance of this para.

(f) Every person shall make full and proper use of the equipment provided for his protection in pursuance of sub-para (1) and (4) and shall without delay report to the occupier, manager, or other appropriate person any defect in, or less of, the same.

(10) Maintenance and examination of exhaust plant.-

(a) All ventilation plant used for the purpose of extracting, suppressing or controlling dust or fumes shall be properly maintained.

(b) All ventilating plant used for the purpose of extracting, suppressing or controlling dust or fumes shall be examined and inspected once every week by a responsible person. It shall be thoroughly examined and tested by a competent person at least once in every such examination and test shall be entered in an approved register which shall be available for inspection by an Inspector-cum-Facilitator. Any defect found on any such examination and carrying out the examination and test to the occupier or manager of the factory.

(11) Material and equipment left out of doors.- All material and equipment left out of doors (including material, and equipment so left only temporarily or occasionally) shall be so arranged and placed as to avoid unnecessary risk. There shall be safe means of access

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to all such material and equipment and, so far as reasonably practicable, such access shall be by roadways or pathways which shall be properly maintained. Such roadways or pathways shall have a firm and even surface and shall, so far as reasonably practicable be kept free from obstruction.

92. **Coal (including coke) industries -** under serial no. 4 in the first schedule under clause (za) of sub-section (1) of section 2

— coal, lignite, coke and like other substances

— fuel gases (including coal gas, producer gas, water gas)

(1) This shall apply to Coal (Including Coke) Industries – Coal, Coke and Like Other Substances and Fuel Gases (including Coal Gas, Producer Gas, Water Gas)

(2) **Coal, Lignite, Coke and Like other Substances**

(a) **RECEIVING**

(i) Wagon Tippler and Track Hopper

(a) Wheel chokes and Scotch block shall be used below wagon wheel to prevent injuries while coupling and decoupling the wagons

(b) Interlock between the side arm charger operation and ground working shall be provided to prevent people getting struck by wagon side arm charger.

(c) No movement shall be permitted across the track while wagons are pushed or pulled.

(d) A siren warning shall be provided while the wagons are rotated.

(e) Access to the tippling area shall be restricted only to the authorized persons by providing hard barricade with interlocking to the machine.

(f) Dust generation and accumulation shall be prevented and controlled.

(g) Track hopper shall not be used for unloading high Volatile Material Coal.

(ii) Truck Tippler and Excavator unloading

(a) Trucks shall be fixed to the tippling platform without man entry

(b) Incoming trucks to Truck Tippler shall maintain the queue and overtaking of the truck prohibited.

(c) The trucks shall be checked for the headlights, brake lights, and turn signal lights at the time of entry to the plant.

(d) Pedestrian movement near Truck Tippler shall be prohibited.

(e) Buffers and wheel lock arrangement shall be avoided to prevent truck toppling.

(f) During manual unloading of trucks by excavator, unauthorized persons access shall be restricted.

(b) **Storage Location (Yard and Silos)**

(i) For storing high volatile material, 'First In First Out' (FIFO) feeding

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methodology shall be followed and periodic thermography of Coal stock Pile shall be carried out.

(ii) Heap height shall be maintained as per the National Standard.

(iii) Dust suppression and water sprinkling system shall be provided and maintained in the storage yards.

(iv) Adequate space shall be provided and maintained between the edge of the coal heap and the retaining wall to permit fire fighting vehicle, ambulance and truck movement.

(c) **Raw Material Processing and Feeding:**

(i) Power transmission parts between the motor and Shafts, couplings, pulley dragging, crushing or entanglement on contact with rotating parts or pinch points shall be provided and maintained with proper fencing and guarding of adequate strength.

(ii) Dragged into in-running nips, in abrasion and friction burns from rubbing against the belt, and injuries from being struck by a ruptured belt shall be prevented by providing appropriate safeguards.

(iii) Injuries resulting from shearing and crushing between the load and fixed objects shall be prevented.

(iv) Collision between loading/unloading equipment i.e. Excavator, Payloader, Other stacker, Hywa etc. shall be prevented by providing necessary safeguards.

(v) The workers shall be protected from falling loads and impact with loads.

(vi) Hooter shall be kept in ON position during long travel motion.

(vii) No work shall be done on and beneath the running conveyor.

(viii) Any maintenance work with the conveyor or beneath conveyor shall be carried out only by using permit to work system.

(ix) Any repair shall be attended only taking shutdown with work permit and electrical isolation

(x) Always operate Local emergency switch or pull chord for approaching conveyor

(xi) Siren system shall be provided and blown prior to restarting of the conveyor.

(xii) Conveyor guard shall be provided throughout length of conveyor including return side.

(xiii) Head end and tail end guard shall be provided in every conveyor.

(xiv) Conveyor shall be crossed only through the designated place.

(xv) Effective communication between the operators, supervisors and control room shall be ensured.

(xvi) Spillage, if any, shall be cleaned regularly to avoid slippages.

(xvii) Guards shall be provided in all the rotating parts of Crushers and Screens.

(xviii) Standard platform shall be provided for inspection of crusher and screen

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process.

(d) **COKE OVENS**

(i) Recovery type Coke Oven Batteries

(a) Coke oven doors, jambs and other equipment shall be designed to minimize the occurrence and magnitude of leaks.

(b) Leaks from coke oven doors, lids, and other equipment shall be eliminated or reduced through a comprehensive operation and maintenance program designed for that purpose.

(c) Leaking doors and jambs shall be identified through a 24-hour inspection program designed by the Occupier and repaired at the conclusion of the coking cycle. Other leaks shall be eliminated as soon as practicable.

(d) Coke shall not be pushed from the oven before the coking process is complete.

(e) Sealants for doors, lids and other equipment shall be free of asbestos and other hazardous materials.

(f) Larry cars, pusher machines, door machines and similar equipment shall be operated from enclosed cabs equipped with filtered, conditioned air systems.

(g) Emission monitoring system from Oven doors, lids and off takes shall be instituted and monitored at fixed intervals preferably weekly.

(h) A respiratory personal protective equipment shall be provided for workers in Gas and chemical vapour prone areas.

(i) Clean air stations with appropriate ambient temperature control shall be designated or provided for workers in regulated areas, where they can take breaks or go when they are not needed for a particular task. Lunchrooms and break rooms shall be provided with facilities for washing, and clean filtered air.

(j) The employer shall supply and launder the work clothing for coke oven workers, provide secure and well-maintained locker rooms with showers and separate lockers for street and work clothes, in order to avoid exposing persons outside the facility to contaminants on clothing.

(k) Coke oven workers shall receive regular medical surveillance, particularly focusing on the early detection of cancer, with appropriate follow-up.

(l) Mobile coke oven machines shall be designed for safe entry and exit and provided with travel alarms. Operator’s cabin shall be Air-conditioned. Cameras, Signal system and other devices shall be installed to allow the operator to see all sides of the machine with suitable interlocks.

(m) As far as are practicable, walkways on coke batteries shall be designed so as not to cross the path of mobile equipment. Walkways and work areas

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shall be well lit, with multiple escape routes in case of emergency.

(n) When maintenance is performed on or near mobile coke oven machines, the machines shall be locked out, or appropriate interlocks such as anti-collision devices or trips shall be provided to stop the machine before it enters the area.

(o) Workers exposed to hot surfaces or radiant heat from open ovens shall be provided with appropriate personal protective equipment and covered by a heat stress prevention program.

(p) A program shall be instituted to ensure that explosive atmospheres are not created in off takes, mains and other equipment that transports coke oven gas. Special attention shall be given to maintenance procedures to ensure this.

(q) Emergency siren shall be fixed at central location of coke oven plant

(r) Windsock shall be installed at a height clearly visible from different location in coke ovens plant

(s) Assembly points, fire tender and ambulance point shall be identified and displayed

(t) First AID box with necessary items in it shall be made available at site

(u) Portable CO detector shall be provided to workers deployed in gas area

(v) Adequate numbers of fixed type Carbon Monoxide detectors shall be installed in the gas distribution cellar areas.

(ii) Non-recovery batteries

(a) Uncontrolled "beehive" ovens shall be replaced by newer and safer designs.

(b) The negative pressure system shall be ensured to prevent the release of coke oven emissions into the working environment.

(c) Where necessary, the stacks or flues of non-recovery batteries shall be equipped with desulphurization systems and systems for the collection of heavy metals and dust.

(d) Oven sole/repair work:

(i) Oven shall be kept out of operation and allow to cool below 45^{o}C

(ii) Man-cooler shall be placed with chicken mesh on it.

(iii) Jacking and metallic arch shall be placed to protect fall of roof bricks

(iv) SOP prepared by the Occupier shall be instituted and strictly adhered to during repair.

(v) Hot zone working PPEs shall be provided

(e) Machine interlock shall be provided to avoid wrong pushing

(f) Chimney damper shall be locked at desired position as battery under negative pressure

(g) Condition of door: Health of Door lifting sling, hook and Pin shall be

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monitored and maintained periodically.

(h) Warning Hooter shall be placed in moving machines and anti-collision system shall be installed

(i) Flap gate shall be provided in Quenching Car to prevent coke spillage.

(j) Hand rail on drain and settling tank shall be provided

(k) Civil structure in Pusher track beneath which the flue pipe is placed shall be inspected on regular basis

(l) Danger Signs and warning lights shall be provided at suitable location of Charged Power trolley line.

(m) Stamping /Compacting unit Workers shall be provided with Ear plug

(n) Quenching Tower structure and pipeline shall be periodically inspected and maintained

(o) Overhead sheets or loose sheets shall be periodically inspected and maintained

(p) Sag ovens shall be identified on early stage and kept out of operation

(q) Movement over Sag ovens shall be prohibited.

(iii) **Coke Sorting Plant**

(a) The standard operating procedures for conveyors shall be followed

(b) To prevent hot coke carried in the conveyor and causing fire, spot quenching and automated Medium Velocity Water Spray System (MVWSS) shall be installed.

(iv) By-product plants associated with Coke Ovens

(a) An engineering assessment by the Occupier shall be performed to identify potential points from which benzene, ammonia and other hazardous substances might leak. The result of this assessment shall be used to design a program for eliminating such leaks.

(b) Measures shall be taken to eliminate or reduce the escape of hazardous substances during maintenance operations, while samples are drawn for laboratory analysis, and during barge, truck and railcar loading.

(c) Chemical containing tanks shall be installed in a leak proof dyke having volume as per safety standard. The dyke shall have a covered sump with provision to recycle the spillages back into the system.

(d) Gas detection and alarm systems for CO and Hydrogen Sulphide shall be installed in all areas where coke oven gas might build up in a release. A gas safety program shall be instituted in the by-product plant and entire gas network areas where coke oven gas is transported, stored and used as a fuel. All gas pipes shall have provision such as U-seal, valves and flanges for positive isolation. Further, gas lines shall have nitrogen or steam injection system and vents for purging out the gas.

(e) A periodic ambient air monitoring program shall be instituted, particularly

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for CO, Ammonia and benzene.

(f) Coke by-product workers shall receive regular medical surveillance, particularly focusing on the early detection of leukaemia and other blood disorders caused by benzene, with appropriate follow-up.

(g) Work areas and walkways shall be well lit, with multiple escape routes in case of emergency.

(h) Full body showers with eye wash facility shall be provided in all Chemical storage areas such as Caustic Soda, Acids, Benzene etc.

(i) Provision for earthing connection shall be provided in Tar and Benzene loading stations.

(j) Jump over stripes of conductive metal preferably Copper shall be provided across all flanges on Pipes carrying Tar, Tar products, Benzol, Benzene, Toluene, Xylene and other hydrocarbon products.

(k) All Gas pipelines shall be provided for gas condensate drains through adequately designed seal pots.

(l) Confined space job shall be executed after clearance from Confined Space Competent person authorize by Factory Inspector.

(m) Periodic mock drills shall be conducted to improve awareness and ensure readiness on emergency scenarios.

(n) SOP training shall be given on day basis of each area to improve the operating skill of agencies.

(o) Emergency contact numbers shall be displayed on site at every location

(p) Assembly points identified and displayed on site with dedicated fire and ambulance point.

(q) All chemicals MSDS displayed on site to improve awareness on hazards of chemicals

(r) Overhead rotational boom anchor shall be installed for safety of tankers driver/helper while tankers loading/unloading

(s) Adequate numbers of emergency equipment such as Breathing Apparatus (BA) set, stretcher, oxy-pack and first aid box shall be available

(t) Portable CO detector shall be provided to all working agencies who are associated in gas handling area

(u) Keep portable fire extinguisher ready on easy approach or call fire services for stand by duties if required

(v) **Gas Condensation Section:**

(a) Regular inspection of flanges / glands shall be carried out to observe leakage before change over and rectify the same with safety protocol.

(b) To prevent exposure to Coke Oven Gases (COG) from leaky lines/ flanges/ valve gland packing etc, regular inspection of COG lines to detect leakage if any shall be carried out at frequent intervals. Online CO monitors with

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alarm system shall be installed and portable CO monitors shall be used to detect Gas leakage.

(c) Online oxygen analysers shall be provided in Coke Oven Gas circuit before electrostatic precipitator interlocked for tripping of High-voltage transformer in case of Oxygen % above 0.8 and oxygen content in COG shall be check periodically in Orsat analysis at lab in every 2 hrs.

(d) Thorough isolation of COG lines shall be ensured before opening any flanges.

(e) Grease smeared tools / non spark generating tools shall be used in the gas condensation area.

(f) Gas mask and water seal shall be used if CO concentration is found to be above 50 ppm

(g) Gas pipelines thickness shall be measured annually.

(h) Explosion flap shall be provided in Electrostatic Tar Precipitator.

(i) In flare stack pressure control system is shall be installed to maintain line pressure if any pressurization shall happen in coke oven gas pipeline.

(j) In flare stack water seal system shall be installed for safety purpose of gas pipeline.

(k) In each vent, sample point provision shall be provided.

(l) Protocol system shall be followed for all hot works nearby gas lines and critical works.

(m) Any hot job near the gas pipes shall be done in presence of fire fighting crew

(vi) **Ammonium sulphate plant:**

(a) To prevent exposure to Ammonium sulphate Powder, PPEs shall be used and the area shall be maintained cleanly.

(b) To prevent exposure to sulphuric acid spray regular checking and repair of pipelines, as per requirement shall be carried out. Condition of pipes, flanges and flange guards, valve glands etc. shall be properly maintained. While acid unloading is going on safe distance shall be maintained.

(c) To prevent exposure to acidic liquor, use of face shield, PVC suit and shoes shall be ensured while working on acid line. Safety shower shall be provided in the plant.

(vii) **Ammonia stripping section**

(a) Ammonia vapor release shall be avoided while operating strippers.

(b) Proper MSDS shall be followed while caustic soda handling

(c) Sample collection of Stripper water, de-acidified water, and waste water shall be handled properly

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(d) Refractory bricks line shall be provided in caustic area with proper dewatering arrangement to handle any exigencies

(viii) **Benzol Recovery and Rectification section**

(a) Continuity jumpers over pipeline flanges and mechanical seals in pumps shall be used and checked frequently for their integrity. Gas masks shall be used to prevent Benzol, Benzene, Toluene and Xylene (BTX) vapour poisoning.

(b) Nitrogen blanketing system shall be provided in all benzol associate tanks to prevent any release of benzol to atmosphere.

(c) Volatile Organic Compounds (VOC) detector shall be installed in BTX plant.

(d) Explosion proof electrical equipment shall be installed in BTX plant.

(e) Steam injection system shall be added in each tank of benzol area for any exigencies purpose to cut off oxygen ingress in the oil tanks.

(f) Water sprinkler system shall be provided in each oil tank to mitigate fire hazard.

(g) Movable foam trolley system and reserve foam tank systems shall be available for any exigency.

(h) Prohibition on usage of mobile phones.

(ix) Sulphur recovery and solidification section

(a) Do not operate the Sulphur transfer pumps unless steam jacketing is in service and at operating temperature.

(b) Keep a flow through the pumps at all the time during pump operation to provide proper lubrication and prevent overheating.

(c) Overheating of refractory shall be avoided, to prevent refractory health.

(d) High reaction furnace temperature shall result hot spots.

(e) Hot jobs shall be carried out with proper protocols.

(f) Avoid sulphur release to environment.

(x) Tar handling section

(a) Flange guard shall be provided in high pressure pipeline.

(b) Tar sludge shall be recycled properly.

(xi) Biological treatment plant

(a) Biological-chemical sludge shall be recycled properly.

(b) Follow MSDS for handling the chemicals.

(xii) Tar distillation plant

Use of apron, face shield, gum boot etc shall be ensured. Isolation of line and draining of line shall be ensured before starting any maintenance job to prevent spray of Tar and tar products.

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(xiii) Sulphuric acid plant:

(a) Regular checking of pipelines, flanges and glands shall be carried out for possible leakages and leakages shall be attended on priority.

(b) Safe distance shall be maintained from acid lines while pump is in operation.

(c) PVC suit, face shield and all required PPEs shall be used while handling acids and sulphur fumes.

(d) SOP shall be developed and followed in acid loading / lifting.

(e) Proper isolation and shutdown shall be ensured before handing over of acid line for maintenance.

(f) Hand gloves, gum boots, Face shield, dust mask, goggles, and acid proof apron shall be used wherever required.

(g) Access control shall be provided for Sulphur storage area.

(h) While start up of the plant, SO_2 neutralization shall be ensured.

(i) All flanges in Acid pipes shall be equipped with flange guards.

(j) Emergency water bathtub shall be provided for usage if a person is exposed to Acid.

(xiv) **Coke Dry Cooling Plant:**

(a) As explosive mixture shall be formed on **Circulating gas** circuit:

(i) Working of interlocks and automation shall be ensured.

(ii) Percentage of Oxygen content shall not exceed 1%.

(iii) Percentage of Hydrogen content shall not exceed 3% (LEL).

(iv) Percentage of Carbon Monoxide shall not exceed 6%.

(v) Availability of Nitrogen shall be ensured in CDQ area.

(vi) Automated nitrogen injection shall be ensured in case of Mill/ Gas circulation fan trips.

(vii) Proper maintenance of gas bleeder valve and pre- chamber bleeder valve after Gas circulation fan/ mill fan shall be ensured.

(viii) Explosion flaps located in the circulating gas path shall be maintained.

(ix) Scheduled maintenance of air breather valve at pre- chamber shall be ensured.

(x) Proper functioning of gas analyzer shall be ensured and calibrated.

(xi) While prolonged shutdowns when boiler inlet temperature <600 deg C, Gas circulation blower/Mill fan shall be stopped and N_2 shall be purged.

(xii) Incomplete Carbonized Green coke shall not be charged in chamber.

(b) **Crane Area**

(i) Carbon Monoxide detectors shall be installed and continuously monitored on crane floor.

(ii) Crane motor room shall be free from oil spillage.

(iii) While crane cabin movement no person shall be allowed to walk on

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platform.

(iv) Crane Rope thickness shall be monitored monthly.

(v) Crane rope shall be changed annually.

(vi) Crane emergency motor (for bucket lifting) trial shall be taken every month.

(vii) Crane operators shall carry portable Carbon Monoxide detector.

(viii) Fire extinguisher shall be available in crane motor room.

(c) **Coke Charging facility:**

(i) All Seal-pots shall be hourly checked for water level.

(ii) Operators shall stay away from charging facility while charging and movement.

(iii) Bleeders shall be kept closed to avoid Oxygen ingress.

(iv) Emergency water tank shall be provided to make up water level in seal pots in case of regular water supply failure.

(d) **Coke Discharge Area**

(i) Carbon Monoxide detectors shall be provided to track any leakage.

(ii) An adequate Operating practice shall be instituted to remove stuck foreign material in coke discharge Rotary Seal valve.

(iii) Rotary Seal valve sealing pressure shall be adequate as per chamber inlet pressure.

(e) **General**

(i) Stay away from all moving and rotary equipment.

(ii) Portable Carbon Monxide detector shall be used while inspecting De-dusting Area.

(iii) Coke dust discharge shall be carried out with adequate moisture and proper PPEs.

(iv) All Confined Spaces shall be identified and standards shall be adhered.

(v) Steam traps shall be checked monthly.

(vi) All safety valves shall be maintained annually.

(vii) Boiler tube thickness shall be monitored annually.

(viii) All interlocks shall be checked periodically.

(ix) Any interlock shall be bypassed only after appropriate authorization and documentation.

(x) Interlocks shall be restored at the earliest, else management of change shall be instituted.

(3) Fuel Gases (including Coal Gas, Producer Gas, Water Gas)

(a)**Fire in flammable Gas line**

Before commencing and/ or executing any work in and around the gas line the following

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shall be ensured:

(i) There shall not be any naked power cabling near gas lines.

(ii) No work shall be taken near leaky flammable gas lines. If any leakage is found in the pipe, fittings or flanges, the owner shall be informed to rectify the leak. The work shall be started only after the gas line owner attends to the leak.

(b) **Fire due to Hot Work (Cutting/ Welding/ Grinding/ Drilling Job) near Charged Flammable Gas Line**

(i) Check physically the pipe thickness before start of welding job on gas line.

(ii) Check for presence of CO% in the working area / vicinity of job less than equal to 50 ppm.

(iii) Check for presence of explosive mixture before start of job.

(iv) Put clay/ POP (Plaster of Paris) in the joints of all nearby gas lines and cover with fire-proof ceramic cloth.

(v) Gas cutting torch flame shall not "hit" the charged gas pipelines.

(vi) Flammable material shall not be stored or utilised below the working area.

(vii) Do not use gas pipe/ gas pipe supporting structure for earthing the welding machine.

(viii) Earthing shall be located near the welding spot.

(ix) Continuous monitoring of flammable gases shall be done throughout the job.

(x) Keep ready the fire hose with nozzle at the job point.

(xi) Keep a minimum of two nos. of DCP/ CO2 type fire Extinguisher at site.

(xii) If the presumed severity of fire is very high, make the fire tender stationed at the site.

(xiii) During welding on live gas line, the percentage of oxygen present in the gas shall be monitored on regular basis and shall be less than 1%.

(xiv) During the welding on live gas line the current shall be kept under control all the time (70 – 100 amps).

(xv) Falling of spatters from height must be prevented.

(xvi) While hot work on gas line, a positive pressure must always be maintained inside the gas line to prevent entry of atmospheric air. If required, inert gas shrouding at the welding tip must be ensured by providing Nitrogen in the hose.

(xvii) Fire retardant cloth shall be wrapped over all the nearby flange joints.

(c) **Specific Safety Requirements for Flammable Gases**

(i) Maintenance/ repair/ replacement works with Blanking and De-blanking, Valve, compensator repair/replacement, Major repair/ replacement of part of the pipe shall be carried out through positive isolation of the portion with purging by inert gas.

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(ii) If the Carbon Monoxide content in that area is more than 50 ppm, the gas mask conforming to the National Standard shall be used.

(iii) Online monitoring system with alarm for Carbon Monoxide concentration shall be provided in the areas around equipment/ process handling these gases. Performance of online monitoring system shall be checked once in a month for its proper operation and record maintained.

(iv) No personnel shall be allowed to work on charged system (where there is possibility of presence of fuel gases) without gasmasks.

(v) Cutting or welding job shall not be allowed on isolated system without analysis and written clearance of the responsible person.

(vi) Proper electrical jumpers shall be provided between all flanges and equipment's.

(vii) Platform and adjoining structures shall be covered with Ceramic blanket / Fire resistant clothes while blanking and de-blanking and the personnel working shall not be allowed to wear nylon or other synthetic fabric/garments.

(viii) Lime water shall be poured after loosening the bolts of flanges in Gas lines/ equipment's at the time of blanking or de-blanking or opening the manhole covers.

(ix) The deposits/ incrustation in coke oven and other gas lines and associated equipment shall be kept wet either by steam or by water, after the system has been isolated and opened to atmosphere.

(x) Cutting in Coke Oven lines and associated equipment shall be carried out after cleaning of the deposits.

(xi) Lighting in enclosed area shall be done with portable spark proof electric lamp of 24 V or explosion proof fittings.

(xii) All pipelines/ systems shall be checked for leakage after completion of repair job. The leakages shall be detected by soap solution and all leakages shall be rectified before charging the system.

(xiii) Blanking/ de-blanking jobs on gas lines shall not be taken up at the time of extreme weather conditions, particularly when the possibility of thundering/ lightning exists.

(xiv) Drain pots and other auxiliaries of gas lines shall be inspected for proper operation at least once a month and record maintained.

(xv) Permanent connections for purging by steam/ Nitrogen shall be blanked after purging requirements are completed.

(xvi) There shall not be any discontinuity in blanking/ de-blanking.

(xvii) Workers required to work in gaseous atmosphere shall be trained in First Aid and methods of giving artificial respiration.

(d) **Personnel Protective Equipment (PPE'S):**

(i) Workers shall wear cotton clothes during entire working hours.

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(ii) People shall wear fire retardant jacket while working in the Coal Gasification Plant.

(iii) Gas detectors shall be tested by Bump test before usage.

(iv) Suitable Gas mask and Breathing Apparatus conforming to National Standards shall be supplied, used, maintained in the plant.

(e)**Process Safety**

(i) Isolate the executing portion of gas lines completely from the process from all ends by putting blanks. So, not only the inlet line, but, the outlet line also needs shall be blanked. There are cases where, many blanks are required to isolate completely from the system/process.

(ii) Periodic purging of dead ends shall be carried out to prevent accumulation of flammable gas/liquid at the dead ends.

(iii) During erection / dismantling of Gas pipes, ensure the working pipes as "close ended" as there are potential of fire hazards.

(iv) Ensure the "deposits/ mucks (inside the pipes) wet" by spreading water and then the open ends shall be closed100% to avoid any cross ventilation.

(f) **General**

(i) **Hazardous Area Classification (HAC) study shall be conducted and as per the outcome of the study, appropriate flame proof fittings and Equipment conforming to National Standard shall be provided and maintained.**

(ii) **Lightning arrestors shall be installed and maintained conforming to National Standard to protect the entire plant.**

(iii) **Open drain system shall be prohibited in the plant.**

(iv) **The control rooms shall be provided and maintained with Toxic and flammable gas monitors.**

(v) **Mobile phones, Cameras, smoking and others spark generating electronic equipment shall not be permitted inside the plant.**

(vi) **Transport and other vehicles shall be fitted with spark arrestors and the same periodically checked to ensure its effective functioning.**

93. **Power generating industries -** under serial no. 5 in the first schedule under clause (za) of sub-section (1) of section 2

This shall apply to Coal, lignite, and Gas Power Generating Stations.

(1) **Coal, Lignite Power Stations**:

(a)**Coal and Lignite stock Piles:**

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(i) Water sprinkler system shall be provided to reduce the dust generation and prevent fire.
(ii) The stock yard shall be provided with covered shed.
(iii) Yard drainage system shall be cleared and inspected frequently.
(iv) Employees working in the Storage area shall be medically examined once in six months by the Factory Medical Officer.
(v) Wind barriers shall be erected on all sides based on wind direction up to the height of the stock piles.
(vi) Self-ignition of piles shall be monitored on continual basis.
(vii) Dozers and shovels shall be operated by trained personnel having valid driving license under supervision.
(viii) Storage area shall be kept clear of vegetation and foreign materials.
(ix) Flammable materials, such as paints and oils, shall be stored away from the pulverizing plant.

(b) **Stacker and Re-claimer:**

(i) Cleaning shall be done frequently and coal accumulation shall be cleared on daily basis.
(ii) The belt conveyor drive guards and drum guards, nip point guards, etc. shall be provided and maintained.
(iii) Track rail foundations of shall be of sound construction to prevent derailment.
(iv) A SOP shall be prepared and implemented to ensure the rigidity and integrity of the rails and rail foundations.
(v) No work shall be carried out while the conveyors are running and any maintenance work shall be carried out only with a valid permit to work.
(vi) Pull chord switches and local stop buttons shall be provided and maintained.
(vii) Pull chord switches working continuity shall be checked every day.
(viii) The area shall be maintained free from combustible and foreign materials.
(ix) Crossings over Conveyors shall be permitted only through the cross over bridges provided with standard fencing and railings on both sides.

(c) **Conveyors and Junction Towers / Transfer points.**

(i) No worker shall be allowed to work on a running conveyor.
(ii) Maintenance work shall be taken only with valid permit to work, lock out tag out and isolation of all energysources.
(iii) Pull chord switches and local stop buttons shall be provided and maintained.
(iv) Pull chord switches working continuity shall be checked every day.
(v) Guards of sufficient strength shall be provided to the exposed sides of the rotating drums and couplings.
(vi) Area shall be maintained free from combustible and foreign materials.
(vii) Crossings over Conveyors shall be permitted only through the cross over

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bridges provided with standard fencing and railings on both sides.

(viii) The floors and structures shall be kept free from coal and other flammable materials.

(ix) Broken and loose roof and side sheets shall be replaced by new ones immediately.

(x) Dust extraction and Suppression System of adequate capacity shall be provided, maintained and tested periodically by competent person.

(d) **Crusher House**

(i) The floor and walls shall be kept clean from accumulation of all types of dust.

(ii) Dust extraction and Suppression System of adequate capacity shall be provided, maintained and tested periodically by competent person.

(e) **Bunkers and Mill Feeder Conveyors**

(i) The floor and walls shall be kept clean from accumulation of all types of dust.

(ii) Dust extraction and Suppression System of adequate capacity shall be provided, maintained and tested periodically by competent person.

(iii) Bunker Choke removal system shall be done in a safe manner to prevent high velocity fall of coal or lignite.

(iv) Mill feeder conveyors shall be fully covered throughout its length.

(v) No work shall be taken in the feeder conveyors while they are operating.

(vi) Visual/Audio indication shall be provided to show that the conveyors are running.

(vii) Dust extraction and Suppression System of adequate capacity shall be provided in the bunker floor, maintained and tested periodically by competent person.

(f) **Mills**

(i) No maintenance work shall be carried out while the mill is in operation.

(ii) Sudden release of coal or lignite deposited dust inside the pipelines and mills, which is known as Puffing, shall be prevented by periodic examination and monitoring of the pipelines.

(2) COAL, LIGNITE AND GAS POWER STATIONS

(a)**Boiler operations**

(i) When viewing flames or furnace conditions, tinted goggles or a tinted shield shall be worn to protect the eyes from harmful light intensity and flying ash or slag particles.

(ii) The Workers shall not stand directly in front of open ports or doors, especially when they are being opened.

(iii) Aspirating air shall be used on inspection doors and ports of pressure-fired units

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to prevent the escape of hot furnace gases.

(iv) Open-ended pipes for rodding observation ports or slag on furnace walls shall not be used to prevent hot gases getting discharged through the open ended pipes.

(v) Appropriate safety precautions shall be followed to prevent exposure to sudden falling of slags and slag leaks.

(vi) The standards pertaining to confined space entry framed as under Section 18 of the Code, shall be followed for entry into a vessel, boiler drum, and blow down vessel or tank.

(vii) 24 Volt Direct Current shall be used for internal lighting inside Boiler area.

(viii) Hazard Communication shall be provided in English and local language for the hot fly ash and refractory surfaces.

(ix) Workers working in the slag bath shall be provided with hot water suit to prevent injuries due to splash of hot water due to fall of clinkers.

(x) Boiler furnace negative pressure shall be maintained to prevent flames coming out of doors.

(xi) Inspection doors and other openings of the Circulating Fluidized Bed Combustion (CFBC) boilers shall be kept always in locked condition.

(xii) Thermal insulation and aluminium cladding of the Boilers shall be maintained without any discontinuity.

(b) **Steam Pipes and valves:**

(i) Steam lines shall not run under the coal stockpiles.

(ii) Thermal insulation and aluminium cladding shall be provided to all the steam pipe lines throughout its length and valves.

(iii) Periodic inspection of hangers and supports of the pipelines shall be checked for ascertaining healthiness.

(c) **Steam Turbine:**

(i) Any leakage of Lubricating and Control oil of Turbine and Bypass system shall be prevented and continuously monitored.

(ii) Excessive noise generation shall be prevented and controlled by providing appropriate Engineering Intervention, isolation and acoustic enclosures.

(iii) Pressurization of Low and high pressure heaters due to tube leaks shall be monitored remotely from control room.

(iv) Pressure relief safety valves shall be tested and certified once in twelve months by competent person.

(v) Periodic inspection of hangers and supports of the pipelines shall be checked for ascertaining healthiness.

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(d) **Balance of Plants:**

(i) The Circulating Water Forebay shall be guarded with hand rails on both sides.

(ii) Life Buoys shall be provided in the Circulating Water forebay.

(iii) Cooling tower maintenance work shall be undertaken only by the trained and experienced workers under supervision.

(iv) The cooling towers shall be regularly inspected for corrosion.

(e)**Chlorine Storage and Handling**

(i) Sensors with audible and visible Alarms shall be provided for detecting Chlorine leakages.

(ii) Copper flexible hose shall be checked periodically for any physical damages.

(iii) Emergency kit shall be provided to meet chlorine leak in the body/ valve of the tonner.

(iv) Self Contained Breathing Apparatus (SCBA)/ Half face gas cartridge mask, shall be provided and used during chlorine leakages/ emergency.

(v) Water sprinkling system shall be provided around the storage area.

(vi) PVC hood with exhaust arrangement to collect the chlorine gas from the probable release points to the caustic scrubbing.

(f) **Caustic Storage and Handling**

(i) Dyke wall of sufficient holding capacity shall be provided.

(ii) Two independent High level indicators with alarm shall be provided for the tank.

(g) **Chlorine Dioxide**

(i) Only trained and authorized personnel shall be permitted into a chlorine dioxide generation plant.

(ii) The plant used for storage or generating of chlorine dioxide shall have minimum of two exits.

(iii) Storage facilities and handling operations shall eliminate possible contact with chemicals or other materials that shall cause a fire, explosion, or other chemical reactions.

(iv) All equipment involved in the chlorine dioxide process where pressure shall be generated shall be provided with adequate pressure relief devices and rupture disc connected to the scrubbing system or blow down drum.

(v) Smoking and other sources of fire and spark producing equipment shall not be permitted in a chlorine dioxide generation plant when it is in operation. Warning signs shall be posted.

(vi) A hose with adequate supply of water shall be available where spills of chlorine dioxide shall occur.

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(vii) Scrubber system with power back-up for Chlorine shall be provided.

(viii) Sensors with Alarms shall be provided for detecting Chlorine and chlorine dioxide leakages.

(h) **Gas Receiving station**

(i) Gas leak detectors /sensors shall be provided, maintained and calibrated as per the manufacturer guidelines.

(ii) Thickness measurement shall be conducted yearly once for gas pipelines and the same shall be validated against design and operational requirements.

(iii) Gas line support columns and pedestals shall be checked annually once for ascertaining its healthiness.

(iv) Hazard Communication boards displaying strict prohibition in the hydrogen storage and handling area in English and local language shall be provided.

(i) **Gas Turbines**

(i) Positioning of safety equipment and warning signs shall be considered well in advance to reduce the chance of injury during maintenance activities.

(ii) Where vibration levels in the drive shaft line can escalate to excessive levels resulting in the potential for dangerous situations and hence, vibration monitoring equipment shall be installed to continuously monitor and detect any escalation and initiate appropriate action (e.g. shut-down) to bring the gas turbine to a safe condition if vibration levels exceed a preset limit.

(iii) Temperature protectives devices shall be provided and maintained to prevent failures due to over and high temperature.

(iv) Gas detectors shall be provided at the gas turbine compressor air inlet where a Zone 2 hazardous area exists from a credible leak, or where there is still the potential for flammable gases or vapours to enter the gas turbine compressor air inlet.

(v) The electrically powered heaters used shall be assessed for safety with the proposed fuel.

(vi) Overheat protection shall be provided to ensure that to avoid excessive heat input to the fuel.

(vii) Appropriate precautions shall be taken to ensure that liquid fuels cannot enter the gas-fuel system where gas fuel is used to purge the liquid fuel burners.

(viii) Where only a single fuel can be fired at any one time, interlocks shall be provided to ensure that the standby fuel system cannot operate or is isolated.

(ix) Where more than one fuel can be fired at any one time, it shall be assured that excess energy input due to over-fueling cannot occur in the gas turbine.

(x) If exhaust dampers are fitted, controls shall be provided to detect uncontrolled damper closure and to shutdown the gas turbine before an overpressure condition

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can arise.

(xi) No flexible exhaust joints shall be situated close to walkways, any electrical or instrument cable or hydrocarbon pipe work where leakage or the potential temperature increase can lead to a hazardous situation.

(xii) Outdoor enclosures shall be constructed so that the level of weather protection achieved ensures that the correct operation of safety equipment is not impaired by environmental conditions or influences.

(xiii) All the flanges and pipe lines that carry flammable gas or liquid fuel shall be provided with bonding and grounding for continuity.

(xiv) Any leakage of Lubricating and Control oil of Turbine and Bypass system shall be prevented and continuously monitored.

(j) **Generators**

(i) The hydrogen gas purity shall be maintained at 98 % w/w and above to avoid high dew point.

(ii) Healthiness of the Seal oil system shall be ascertained once in a year, apart from the regular monitoring of the operational parameters of seal systems.

(iii) Seal oil differential pressure shall be maintained as per manufacturer's Guidelines.

(iv) The vibration levels of the Generator stator bar overhang portion shall be monitored to avoid explosion due to water leakage inside generator in conformance with manufacturer's guidelines.

(v) Accumulation of static electricity shall be prevented by providing necessary dissipating mechanism through earth pits of adequate rating.

(vi) The hydrogen gas piping shall be provided with bonding and earthing system in conformance with the standards.

(vii) During the operation of hydrogen cooled Generator, no hot work shall be carried out in the vicinity of the Generator.

(viii) Any leakage of Lubricating and Control oil of Turbine and Bypass system shall be prevented and continuously monitored.

(ix) Mobile phone shall be strictly prohibited.

(k) **General**

(i) Mobile phone shall be prohibited in the entire power plant premises.

(ii) No smoking shall be ensured in the power plant premises and caution boards displaying " NO SMOKING " provided at conspicuous places in English and local language.

(iii) The mechanical structures, support columns, galleries, fencing and railings shall be examined to ensure mechanical integrity and periodical anticorrosion paintings to steel structures shall be provided to prevent corrosion.

(iv) Conveyors shall be provided with sirens with interlocks while starting.

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(v) Accumulation of static electricity shall be prevented by providing necessary dissipating mechanism through earth pits of adequate rating.

(vi) Over speed testing of shall be carried out as per manufacturer Guidelines.

(vii) Workers shall be given thermal resistant suits while they are inspecting the turbine, steam pipings, valves and glands.

(viii) Non sparking tools shall alone be used in the vicinity of storage and handling of fuel gases, hydrogen and fuel oils.

(ix) Aviation light and lightning arrestors with dedicated earth pits shall be provided and maintained for Chimney, Stack and natural draft cooling tower.

(x) Thermography studies shall be conducted for the entire plant every six months to ascertain the integrity and healthiness.

(xi) Effective Housekeeping and 5 S (Sort, Set in order, Shine, Standardize, Sustain) Management shall be implemented and adhered.

94. **Pulp and paper (including paper products) industries -** under serial no. 6 in the first schedule under clause (za) of sub-section (1) of section 2

This shall apply to the Pulp and Paper including paper products such as Paper Board, packaging grade papers, tissue papers, etc.

(1) HARDWOOD PULP MILL

(a) **Wood Handling**

(i) Unloading

(a) While removing of Tarpaulin and rope in the Wood loaded truck, safety belt with fall arrestor system and helmet must be used at designated place.

(b) A truck driver shall not remain in the truck during unloading operations after placing the wheel choke below the wheel.

(c) Entry shall be restricted and only authorised persons permitted to the unloading area.

(ii) Handling / Debarking of Logs / Size Reduction Of Oversize Logs

(a) PPEs like Hand gloves and earplug / muff shall be worn by the Workers.

(b) The block upon or against which the wood is rested shall have a corrugated surface or other means provided so that the wood shall not slip.

(c) A clear and unobstructed view shall be maintained between equipment and workers around the block and the workers' help area.

(d) In case of processing in Wood splitting machine, power to activate the splitter shall be controlled by a clutch or valve and shall be designed for single stroke operation only.

(iii) Chipping

(a) Chipper knives shall be transported on a carrier.

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(b) The area around wood log feeding equipment shall be kept free from material accumulation and human movement.

(c) Hearing protection equipment (ear plug/ ear muffs) and safety goggles shall be worn by the Worker and others in the immediate area if there is any possibility that the noise level shall be harmful.

(d) Where it is necessary for a worker to stand on a conveyor for the purpose of clearing a log jam, the conveyor shall be stopped and locked out before the work is started.

(e) Workers employed in feeding a chipper shall not have a work station in direct line with the chipper hopper.

(f) The in-feed conveyor shall be guarded for its entire length by an enclosure or standard barrier.

(g) The chipper hopper shall be enclosed not less than 40 inches from the blades to the opening and be baffled to prevent wood from being thrown from the hopper.

(h) A Worker feeding a chipper within 2 meter of the hopper shall wear a safety belt and line designed to prevent falling into the hopper.

(i) Where jam-ups cannot be cleared, the in-feed equipment shall be stopped and locked out.

(j) The Worker clearing the jam shall wear a safety belt and a lifeline which shall prevent contact with the blades before additional clearing is done. If it is necessary to remove or loosen a blade hood, the power shall be shut off and locked out.

(b)**Wood Pulp Mill**

(i) Cooking

(a) A means of egress shall be provided at each end of the room at every floor level of a digester building.

(b) Digester being a pressure vessel shall be tested and certified as per the prescribed standards.

(c) A warning signal shall be given before loading the batch type digester and during the blow.

(d) The digester shall be provided with the followings:

(i) A blow off valve located in such a way that it can be operated from another room, remote from safety valve.

(ii) Blow valves on rotary digesters pinned or locked in a closed position during the cooking period.

(iii) In case of batch cooking process, an audible alarm shall be blown during every discharge/blow.

(iv) Pipes, valves, and fittings classified as heavy duty between the digester and blow pit. These pipes, valves, and fittings shall be checked at least

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semi-annually to determine the degree of deterioration, and shall be replaced as and when necessary.

(e) A side opening to a blow pit is preferred. If the opening is on top, the opening shall be protected by a standard barrier.

(f) The entry to the digester by the workers shall be treated as a confined space entry and accordingly applicable standard laid down under Section 18 shall be complied with.

(ii) Hot Stock Screening

(a) While dumping rejects, the area shall be kept free from human movement.

(b) "High Temperature Hazard" shall be displayed / painted in English and in the language understood by the majority of the workers.

(2) CHEMICAL BAGASSE AND OTHER AGRO BASED PULP MILL

(a) **Bagasse and Agro Based Materials Handling**

(i) Unloading

(a) While removing of Tarpaulin and rope in the bagasse loaded truck, safety belt with fall arrestor system and helmet must be used at designated place.

(b) A truck driver shall not remain in the truck during unloading operations, except tipping operation.

(c) Before raising the unloading platform, the truck shall be safely parked, hooked to front axle and rear stopper raised and ensure no manpower on the lifting platform.

(d) In case of manual unloading dust mask conforming to National standards shall be worn.

(e) In the event of jamming in the unloading hopper, worker shall not enter the hopper. The jam shall be cleared only from the operating platform and a safety belt with anchorage of adequate capacity shall be used to clear the jam with a wooden log.

(ii) Storage and Wet Piling

(a) Telescopic chute shall be provided and operated to minimise dust spread in the work area.

(b) In case of large pile levelling, the dozers shall be provided with spark arresters in the exhaust.

(c) Dozers used in the pile operation shall be fitted with safety seat belt.

(d) Stacking equipment shall be mechanically locked with the rails during high wind velocity.

(iii) Reclaim and Feeding

(a) Dozers and Loaders used in the feeding operation shall be fitted with safety seat belt.

(b) Area of operation of feeding point shall be free from human movement.

(iv) Digester Feeding

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(a) Conveyors shall be tested and certified by responsible person appointed by the occupier.

(b) During maintenance, work at height procedure shall be followed.

(b) **Bagasse and Agro Based Pulping**

(i) Cooking

(a) A means of egress shall be provided at each end of the room at every floor level of a digester building.

(b) Digester being a pressure vessel shall be tested and certified as per the prescribed standards.

(c) A warning signal shall be given before loading the batch type digester and during the blow.

(d) The digester shall be provided with the followings:

(i) A blow off valve located in such a way that it can be operated from another room, remote from safety valve.

(ii) Blow valves on rotary digesters, if any, pinned or locked in a closed position during the cooking period.

(iii) In case of batch cooking process, an audible alarm shall be blown during every discharge/blow.

(iv) In case of continuous cooking process, an audible alarm shall be blown during every blow back.

(v) Pipes, valves, and fittings classified as heavy duty between the digester and blow pit. These pipes, valves, and fittings shall be inspected at least semi-annually to determine the degree of deterioration, and shall be replaced when necessary.

(e) A side opening to a blow pit shall be provided. If the opening is on top, the opening shall be protected by a standard barrier guarding system.

(f) The entry to the digester by the workers shall be treated as a confined space entry and accordingly applicable standards as laid down under Section 18 of the Code shall be complied with.

(ii) Hot Stock Screening

(a) While dumping rejects, the area shall be free from human movement.

(b) "High Temperature Hazard" shall be displayed / painted in English and local language as understood by majority of the workers.

(3) RECYCLED FIBRE/ DEINKED PULP MILL

(a) Waste Paper Handling

Fork lift operation shall not create spark or fire hazard while handling waste paper and, pulp and paper bundles.

(b) Pulping

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Suitable pressure control devices shall be provided to avoid pressure build up in the disperser.

(4) BLEACH CHEMICALS

(a) Chlorine Storage and Handling

(i) Sensors with audible and visible Alarms shall be provided for detecting Chlorine leakages.

(ii) Copper flexible hose shall be checked periodically for any physical damages.

(iii) Emergency kit shall be provided to meet chlorine leak in the body/ valve of the tonner.

(iv) Self Contained Breathing Apparatus (SCBA)/ Half face gas cartridge mask, shall be provided and used during chlorine leakages/ emergency.

(v) Water sprinkling system shall be provided around the storage area

(vi) PVC hood with exhaust arrangement to collect the chlorine gas from the probable release points to the caustic scrubbing.

(b) Caustic Storage and Handling

(i) Dyke wall of sufficient holding capacity shall be provided.

(ii) Two independent High level indicators with alarm shall be provided for the tank.

(c) Chlorine Dioxide – Integrated Process

(i) Only trained and authorized personnel shall be permitted into a chlorine dioxide generation plant.

(ii) The plant used for storage or generating of chlorine dioxide shall have minimum of two exits.

(iii) Storage facilities and handling operations shall eliminate possible contact of sodium chlorate and chlorine dioxide with wood or other materials that shall cause a fire, explosion, or other chemical reactions.

(iv) All equipment involved in the chlorine dioxide process where pressure shall be generated shall be provided with adequate pressure relief devices and rupture disc connected to the scrubbing system or blow down drum.

(v) Contamination of chemicals in the preparation systems shall be prevented by having appropriate systems in place.

(vi) Smoking and other sources of fire and spark producing equipment shall not be permitted in a chlorine dioxide generation plant when it is in operation. Warning signs shall be posted.

(vii) A hose with adequate supply of water shall be available where spills of chlorine dioxide shall occur.

(viii) Scrubber system with power back-up for Chlorine, Hydrogen and Hypo Chlorite shall be provided.

(ix) Sensors with Alarms shall be provided for detecting Chlorine, chlorine dioxide and Hydrogen leakages.

(x) Only Non-sparking tools shall be used for maintenance.

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(d) Methanol

(i) The workers shall wear pants, jackets, safety shoes, face shield and gloves made of Neoprene.

(ii) Ventilation in the work area shall be adequate to drive away the fumes and gases generated, released and emitted in the process.

(iii) Flame proof motors conforming to National Standards shall be used in methanol handling and transporting through pipelines and process operations.

(iv) Storage area shall be provided with dyke of adequate capacity and hazard communication.

(v) Sensors with audible and visible Alarms shall be provided for detecting Methanol leakages.

(e) Sodium Chlorate

(i) Sodium Chlorate shall be stored in an isolated place free from Electrical connections.

(ii) No other chemical shall be stored along with the sodium chlorate.

(iii) The worker shall wear facemask conforming to the National Standard.

(iv) The sodium chlorate shall be dissolved in the dissolving tank a safe manner while preparation of Sodium Chlorate solution.

(v) The emptied bags shall be thoroughly cleaned with water before disposal.

(vi) The worker shall wash their used clothes only in the designated area.

(f) Oxygen

(i) For Cryogenic Oxygen, Anti Frost PPE's shall be used.

(ii) Grease and oil shall not be used to prevent fire and explosion.

(iii) Welding shall be carried out only after purging with Nitrogen.

(g) Sulphur Di Oxide Preparation

(i) Scrubber system of the SO_2 shall be provided with power back-up.

(ii) Sensors with visible and audible alarms shall be provided for detecting SO_2 leaks.

(h) Hydrogen Peroxide Storage and Handling

(i) Adequate and appropriate measures shall be implemented to prevent contamination of Hydrogen peroxide.

(ii) Spill detection and control system shall be framed and implemented.

(5) SODA RECOVERY PLANT

(a) Weak Black Liquor Receipt and Storage

(i) The black liquor screens shall be guarded.

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(ii) Thickness of roof sheet shall be measured once in a year to check for any possible thickness reduction due to corrosion (or) a Platform shall be provided to walk over the liquor storage tank roof.

(iii) Flange guards shall be provided for the transfer lines.

(iv) Care shall be taken during maintenance to avoid hot liquor spillage/leakage by way of passing valves or leaking flanges.

(b) Black Liquor Evaporation

(i) A stripping column shall be provided for collecting and stripping the non-condensable gases from the evaporation process.

(ii) Stripped gases shall be incinerated in the Lime Kiln (or) in Recovery Boiler.

(iii) The high pressure water hose used in the tube/lamella cleaning shall be checked for leakages/damages and shall be disposed off periodically as per manufacturer's guidelines.

(iv) Safety valve shall be provided in the vapor duct to prevent release of hot black liquor.

(v) Flange guards shall be provided for the transfer lines.

(vi) Thermal protection and chemical resistant suite shall be used during isolation of evaporator bodies

(c) Heavy Black Liquor Storage

(i) Thickness of roof sheet and walls shall be measured once in a year to check for any thickness reduction due to corrosion.

(ii) A separate platform with fencing shall be provided over the liquor storage tank roof.

(iii) Flange guards shall be provided for the transfer lines.

(d) Firing Black Liquor Solids In Recovery Boiler

(i) To prevent back fire, operation of Induced Draft fan shall be ensured by providing interlock arrangement.

(ii) The smelt tank shall be equipped with a cover which shall be kept closed except during sampling.

(iii) The smelt tank shall be equipped with a vent stack explosion door.

(iv) Fire retardant suite shall be used during air port cleaning, spray gun cleaning and spout cleaning

(e) Liquor Storage and Handling

Flange guards shall be provided for the transfer lines.

(f) Rotary Lime Kiln

(i) To prevent back fire, operation of Induced Draft fan shall be provided with interlock arrangement.

(ii) Flash back arrestor shall be provided, in case of using Non Condensable Gases, Producer Gases and Bio gas.

(g) Burnt Lime Handling

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(i) Appropriate steps shall be taken for preventing accumulation and generation of dust.

(ii) Dust collection system conforming to the requirements shall be provided and maintained.

(6) PAPER / PAPER BOARD MACHINES

(a) An audible alarm shall be sounded 30 seconds before starting a section of a paper machine.

(b) All ingoing "nip" points shall be protected by rigid barrier guards.

(c) A hand held device capable of going through the nip point shall not be used.

(d) The broke feeding in to pulpers shall be suitably guarded on all sides.

(e) The reel shall not be lifted until it comes to halt.

(f) The reel shaft having a square block end shall be end guarded.

(g) The disengaged doctor blade accessible to a worker shall be covered. The sharp edges shall be covered during transportation and storage.

(h) Handling of doctor blades shall be done only with appropriate doctor holder or cut resistant gloves.

(i) All dryers shall be provided and maintained with barrier guards.

(j) Mechanical integrity of the steam heated dryer cylinders shall be ensured by conducting periodical assessment by technically qualified persons.

(k) While starting a dryer section, steam to heat the drums shall be introduced slowly while the drums are turning.

(l) The broken carrier rope shall not be removed from a dryer while the section is in operation.

(m) The end of a "yankee" type dryer exposed to human contact shall be provided with guarding.

(n) The Calender roll shall be cleaned on the outrunning side. An alloy steel scraper shall be used to remove deposits from the rolls.

(7) CONVERSION OPERATION

(a) Winder/Re-winder

(i) The winder shall be guarded to prevent entry to the rewind bearing housing.

(ii) An in running nip point on a roll-type embosser, drum winder or rewinder shall be guarded by a barrier interlocked with the drive mechanism in such a manner that the barrier can be raised only when the rolls have stopped.

(iii) The barrier shall be constructed so that the worker cannot reach over or around it into the nip point.

(iv) The crane Worker shall ascertain that the reel is properly seated at the winder stand or at the reel arm before the hook is disengaged.

(v) A powered roll ejector shall be interlocked to prevent accidental activation until the receiving platform or lowering table is in position to receive a roll.

(vi) The slitter blade shall be kept in the unload position while not in use.

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(b) Packing

(i) Access to the reel packing system shall be prohibited, during operation.

(ii) In a shrink wrapping machine, paper bundles shall be removed safely from the tunnel, during any stoppage of conveyor and conveyor shall not be stopped without stoppage of tunnel heater.

(c) Reel Splitter / Salvage

(i) The roll splitter shall have an interlocked barrier which covers the point of operation before the blade descends.

(ii) A manually operated paper baler shall be provided with a device, to prevent kickback of the operating lever.

(iii) A powered paper baler shall have the hopper door interlocked to the power source to prevent operation when the door is open.

(iv) A powered paper baler producing a bale with a compressed dimension of more than 42 inches shall have hook type door locks that permit a restricted pressure relieving so that the door shall not open more than two inches, before the door can be fully opened manually.

(8) GENERAL

(a) Warning signs shall be provided to indicate hot surfaces and High temperature operations.

(b) Access into the Automatic Storage and Retrieval System shall be prohibited, during operation.

(c) Appropriate prevention and control measures shall be implemented to protect workers from getting exposed to wood, bagasse, coal, lime, filler and other dusts.

(d) Appropriate preventive and control measures shall be implemented to protect workers from Biological agents include microorganisms such as bacteria, fungi and viruses, and other pathogenic Microorganisms.

(e) Adequate and appropriate measures including supply and use of PPE's shall be implemented to protect workers against heat stress.

(f) Noise prevention and control measures shall be implemented at the high noise work areas.

(g) Devices and equipment containing radioactive material shall comply with the standards on radioactive materials prescribed under Section 18 of the Code.

95. **Fertilizer industries (nitrogenous, phosphatic and mixed) -** under serial no. 7 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to the factories that are involved in the manufacture, storage and handling of the following type of fertilizers:

Straight fertilizers which supply only one primary plant nutrient, namely nitrogen

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or phosphorus or potassium. Some examples are Straight Nitrogenous fertilizers such as Urea, Ammonium salts [Ammonium Chloride, Ammonium Sulphate and Calcium ammonium nitrate (CAN)] and Straight phosphatic fertilizers such as Single super phosphate (SSP) Complex fertilizers (NP/ NPK) which contain two or three primary plant nutrients of which two primary nutrients are in chemical combination. These fertilizers are usually produced in granular form. Some examples are Diammonium phosphate (DAP), Ammonium nitro phosphate (ANP) etc.

(2) **GENERAL–**

(a) All equipment shall be designed as per the prevailing and accepted National Standards while doing so material compatibility, process design pressure and temperature shall be taken care.

(b) All the equipment shall be properly and securely placed in the basement and grouted as per the design load to withstand the prevailing weather condition of the area where the plant is situated. The piping route shall be so done to prevent tripping, walking or other movement that could result in personal injury.

(c) All manually operated valves and switches controlling operations of machines and equipment shall be clearly marked and readily accessible.

(d) All pipes carrying hazardous chemicals shall be color coded, and clearly labelled along with the direction of flow for immediate identification.

(e) Appropriate trips and interlocks shall be provided for all equipment. There shall be Layer of Protection system and voting system for tripping actions with redundant sensors and they are shall be checked at specified periodicity for its healthiness. The selected Instrumentation shall be designed in such a way that during instrument failure it shall reach a failsafe condition.

(f) Appropriate process gas vent design to vent out gases at critical steps of the process shall be ensured. Appropriate design for emergency shutoff management along with quick response automatic valves to take care of the plant from an inadvertent incident shall be provided as per National Standard.

(g) The instrument air lines shall be provided with dew point monitors to measure the moisture content in the air lines.

(h) Suitable Gas detectors covering all the four directions shall be installed in strategic location where there is likely hood of leakage of toxic or flammable gases in the process and storage areas.

(i) The equipment and its connected vessel shall be located in a ventilated area (either

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natural or forced ventilation shall be made available). Adequate ventilation in all areas where ammonia, nitric acid and aqueous formaldehyde is handled shall be ensured.

(j) Provide air extraction and filtration in all indoor areas where urea, ammonium nitrate or other dust can be generated.

(k) Only qualified, trained operators as per the competency matrix for shall operate the plant. They must be well conversant with the plant operation (Regular, startup, normal shutdown and emergency shut down as well as act as per the requirement during plant emergencies) They shall have authority to initiate emergency steps to trip the plant and follow required emergency action, stop a reaction and emergency dump or water flood the contents of a reactor system when safe boundary conditions are exceeded.

(l) The Plant maintenance activities shall be carried out by qualified, trained maintenance technicians under the supervision of qualified, trained supervisors. Suitable check list shall be developed and used for maintaining proper record of observations while dismantling and assembling the equipments.

(m) Operational procedures shall be established for all operation modes, including normal startup and shutdown, emergency shutdown and restart, process upsets, and prolonged temporary stoppages that include activities to prevent conditions such as the following:

(i) Confinement without circulation during idle periods
(ii) High acid concentration

(n) Temperature increase
(o) Crystal formation
(p) Maximum hold time in the neutralizer shall be no longer than 8 hours or 1 shift
(q) Appropriate procedures shall be established for hazardous activities like line breaking, equipment opening, hot work, entry into vessel and other confined spaces, Energy isolation/ Lock out tag out etc. addressing all necessary precautions and controls.

(r) Perform a facility siting study to ensure adequate separation between storage and process areas, and other important buildings or structures.

(3) **Ammonia Production**

(a) Suitable procedure both for Operation and Maintenance to fulfill the components of the Process Safety Management system shall be developed, followed and improved as and when arises.

(b) Standard Operating Procedures shall cover the following:

(i) All the requirements of process including startup, shutdown and emergency

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shutdowns.

(ii) The critical parameters which needs shall be monitored at specified intervals for continuous operation of the plant, needs shall be identified and recorded in suitable manner both in control panel as well as in the field. This shall help for proper analysis of the plant parameter.

(iii) Suitable checklist/checklists for the respective area of the plant, covering all the critical step which needs shall be fulfilled before attempting to start the plant in the laid down sequence.

(c) Standard Maintenance Procedures:

(i) Maintenance procedure shall cover Preventive Maintenance, Predictive Maintenance and Breakdown Maintenance.

(ii) Original Manufacturer's guidelines for maintenance shall be followed.

(iii) Hazard associated with the maintenance activity shall be identified and suitable control measures shall be integrated in the maintenance activities.

(d) Before starting the Plant, the Relevant Trips associated with the Plant shall be checked for its healthiness and availability and shall be recorded for further reference.

(4) **Catalytic tubular reformers (Primary and secondary reformer)**

(a) Proper sequence of process operation with clear responsibilities shall be made available.

(b) Proper startup operation as per the manufacturer's recommendations and proper loading of catalyst and reduction as per manufacturer's guidance shall be ensured.

(c) Thorough inspection of reformer tubes shall be carried out during shutdown.

(d) Burner tip shall also be inspected regularly for any partial blockage to prevent direct impingement of flame on the reformer tube.

(e) Continuous monitoring of temperature profile shall be done.

(f) Appropriate measures shall be put in place to monitor metal dusting or accelerated carburization due to high operating temperature and prevent the degradation of burner liners/ refractory lining of the secondary reformer.

(g) Maintain recommended steam carbon ratio to avoid inadvertent failure of catalyst leading to tube overheating.

(h) Maintain all the trip interlocks associated with the Primary and Secondary reformer in line. The trip interlocks shall be based on voting system to avoid false trip.

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(5) **CO shift reactor and CO2 removal section**

(a) There shall be proper, adequately sized midstream venting arrangement with silencer and shall have back flow protection to avoid explosion.

(b) The catalytic vessels in CO shift convertor and Methanation shall have multi point temperature sensors to avoid any runaway reaction.

(c) Hold up tanks with adequate capacity to hold the carbon dioxide absorption solution shall be provided.

(d) Gas detectors shall be provided around reactor area and provision for remote isolation and depressurization shall be ensured.

(6) **Synthesis Section:**

(a) The material selection has to take care of the chemical property of ammonia, High temperature and Pressure.

(b) The compressor used for pressurizing shall have all the protection devices like Overspeed trip, vibration associated trips, lubricating oil pressure and temperature trips, temperature associated trips for process gas and Surge protection trip based on the flow requirement across the compressors. Suitable inter stage coolers and Pressure relieving devices to avoid excess pressure build up shall also be provided

(c) The ammonia convertor shall have temperature sensors at various levels to monitor and avoid runaway reaction across the same.

(d) The refrigeration system to cool the gas and to condense the formed ammonia shall have adequate protection in the form of process, equipment trips as mentioned in synthesis compressor.

(e) The heat exchangers used in this section shall have material compatibility of handling hydrogen gas as well as ammonia formed. It shall be so designed to handle High pressure on one side and low pressure on the other with suitable pressure relieving devices fixed on them at appropriate places.

(f) There shall be ammonia sensors fixed as an early warning device covering all the directions at strategic places at higher elevation. These sensors can be hooked to tripping of the section as the case shall be.

(g) In the Purge gas recovery section, sensors shall be fixed for detecting methane gas.

(7) **Ammonia storage tanks**

(a) Siting of ammonia storage tanks shall be avoided close to installations where there is a risk of fire or explosion.

(b) Risk based inspection of ammonia storage tanks shall be carried out.

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(c) Overpressure protection with Relief valves and trips shall be provided.

(d) Storage refrigeration system shall be designed to take care of evaporation load of ammonia as per the site-specific ambient conditions. The refrigeration compressors prime drive shall have emergency power backup.

(e) There shall be two 100% fire load capacity relieve valve fitted on the storage with castle lock system to ensure that one relief valve shall always be available. The vent of the relief valve shall be suitably piped to a safe place.

(f) An excess flow check valve shall be provided at the liquid out let of the ammonia from the storage to avoid accidental release of ammonia.

(g) The storage shall be fitted with multiple level sensing devices with alarms at various levels trip interlocks to avoid over filling of the storage.

(h) If subjected to hydro test suitable allowances shall be given based on the liquid density of ammonia handled.

(i) Thermal shocks shall be avoided during commissioning and decommissioning of the storage.

(j) Proper operating procedures shall be made available and operator shall be trained on all the equipment of refrigeration system as well as their functioning.

(k) The pressurized parts of the refrigeration system shall be fitted with pressure relief valves to ensure the system pressure does not exceed the maximum operating pressure. The relief valve discharge shall be routed to a scrubber system.

(l) Ammonia gas detectors shall be placed appropriately around the reservoir for early identification.

(m) In case of high-pressure ammonia storage, emergency shutdown valve shall be provided on Ammonia reservoir liquid outlet to prevent toxic ammonia gas leak.

(8) **Flare system:**

(a) Ammonia plant shall be associated with a flare system to take care of process purge gases and for emergency venting. The Flare shall be suitably sized to take care of the volumetric flow in extreme condition.

(b) The Flare Location shall be as per the applicable National standard and shall be located minimum 90 metres away from process plant equipment and vessels.

(c) It shall have built in safety system to avoid plug flow of gas and liquids during sudden surge due to process trips.

(d) There shall be flame sensors to detect the healthiness of pilot and main flame with alarm to warn persons at control room.

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(e) The pilot flame system shall be of fail proof system so that a small flame shall always be there for meeting any plant emergency.

(9) **Urea Plant**

Procedures to avoid and control hazardous gas mixtures shall be implemented for reducing below 10 parts per million (ppm) hydrogen content in Carbon dioxide feed in urea plants.

(10) **High pressure Ammonia pumps / Ammonium carbamate pumps**

(a) Overpressure protection devices such as Pressure relief valves and overpressure protection interlocks shall be incorporated in the design to prevent over pressurization due to blocked outlet.

(b) Ammonia gas monitoring/ Seal monitoring shall be done to monitor the conditions all the time.

(c) Double block / Bleed isolation valves shall be provided at the inlet and discharge of high-pressure pumps.

(d) Proper drain and vent provisions shall be ensured for the high-pressure pumps.

(e) Availability of proper Safe Operating Procedures (SOP), training and adherence to the SOP shall be ensured.

(f) Pressure testing of critical valves shall be done periodically to identify valve passing issues.

(11) **Urea reactor**

(a) Titanium/ SS 316L with multilayer shell shall be used for constructing the Urea reactor.

(b) Weep hole monitoring system shall be made available on the shell for continuous monitoring and early detection of the leak.

(c) Overpressure trip and pressure relief protection shall be provided.

(12) **Molten Urea handling**

(a) Remote stop provision for molten urea pump shall be provided.

(b) Preventive maintenance of melt pumps shall be carried out.

(13) **Hot condensate/ Steam handling with Flexible hoses.**

Flexible hose integrity program with periodic testing shall be carried out and proper color coding of hoses as per the relevant national standard shall be ensured.

(14) **Complex Fertilizer plant**

(a) **Combustion chamber of dryer Unit**

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(i) Proper maintenance of burners shall be carried out.

(ii) Temperature and flame monitoring with suitable interlocks shall be provided.

(b) **Neutralizer**

(i) Safety controls and interlocks for temperature and acid concentration shall be provided in the neutralization reactors and attached process equipment.

(ii) Emergency procedures and clear instructions for the neutralization reactor shall be developed when safe operating conditions are exceeded.

(iii) Proper provisions for defoaming of pre-neutraliser and training shall be ensured to safely handle slurry.

(c) **Operation of solid handling equipment (Granulator/ Dryer/Crusher/ Conveyors/Pay loaders)**

(i) Proper energy isolation procedures shall be practiced.

(ii) Reverse horn for the vehicles shall be ensured in low light area and restricted human access to the vehicle pathway shall be ensured.

(15) **Acid Production Plants**

(a) Ammonia-to-air ratio with automatic shut-off valves shall be controlled in nitric acid plants.

(b) Molten Sulphur pits shall be effectively covered or fenced from personnel in sulphuric acid plant.

(c) Appropriate scrubbers shall be installed in the acid production plants to ensure scrubbing of vent gases before releasing it to the atmosphere.

(d) Adequate number of showers and eye wash fountains capable of 15 minutes continuous flow shall be provided and checked periodically.

(e) Appropriate personal protective equipment including respiratory protective devices such as Self-Contained Breathing Apparatus shall be made available to the workers.

(f) Acid neutralizing agents shall be readily available for treatment of spills.

(16) **Acid Storage Tanks**

(a) Corrosion resistant material of construction of the storage shall be ensured.

(b) Temperature indication and alarm devices shall be provided in acid storage tank area and it shall be interlocked with acid feed pump.

(c) Dyke wall of sufficient capacity shall be provided in the storage tanks.

(d) Sprinkler system shall be provided to reduce the excess heat in case of leakage of the acid and to dilute the acid.

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(17) **Storage/ Warehouse**

(a) Storage areas shall be constructed with noncombustible materials. Ensure all materials and fittings used during construction and that shall come in contact with the stored materials under normal operation, or in the event of spillage, are compatible or protected (suitable robust coating).

(b) Storage areas shall have automatic fire detection and alarm system if the areas are not continuously occupied.

(c) Facilities for storage shall be appropriately constructed and maintained to avoid leaks, flooding, or formation of pockets of moisture in areas where the ammonium nitrate is located.

(d) Storage areas shall be inspected regularly by an individual(s) trained to identify potential hazards and ensure that all safety control measures are being properly implemented.

Ammonium Nitrate Storage

(a) Storage buildings shall have adequate ventilation or be of a construction that shall be self-ventilating in the event of fire.

(b) All flooring in storage and handling areas, shall be of non-combustible material or protected against impregnation by ammonium nitrate and shall be without open drains, traps, tunnels, pits, or pockets into which any molten ammonium nitrate could flow and be confined in the event of fire.

(c) Containers of ammonium nitrate shall not be accepted for storage when the temperature of the ammonium nitrate exceeds 130 deg. F.

(d) Due to the corrosive and reactive properties of ammonium nitrate, and to avoid contamination, galvanized iron, copper, lead, and zinc shall not be used in a bin construction unless suitably protected. Aluminium bins and wooden bins protected against impregnation by ammonium nitrate are permissible. The partitions dividing the ammonium nitrate storage from other products which shall contaminate the ammonium nitrate shall be of tight construction.

(e) Height or depth of piles shall be limited by the pressure-setting tendency of the product. However, in no case shall the ammonium nitrate be piled higher at any point than 36 inches below the roof or supporting and spreader beams overhead.

96. **Cement industries -** under serial no. 8 in the first schedule under clause (za) of sub-section (1) of section 2

— portland cement (including slag cement, puzzolona cement and their products

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(1) This shall apply to the manufacture, use and manipulation of cement and cement products such as Portland cement (including slag cement, Puzzolona cement and their products).

(2) Equipment Safety:

(a) It shall be ensured that no grinding mill is operated without emergency stop button and the same shall be located such that they are easily accessible to the operator during any emergency.

(b) The site shall ensure that the emergency stop buttons are inspected periodically; periodicity can be defined by the site; in case of any malfunctioning of the same, maintenance team shall take responsibility to rectify the same, to ensure complete healthiness of the emergency stop button

(c) It shall be ensured that the oil or the primary fluid used as a lubricant in the motor of the grinding mill does not become too hot such that the purpose of lubrication is lost.

(d) Ensure a safety plug is installed in the torque and couplers of the motor in the grinding mill.

(e) No grinding mill shall, unless and otherwise necessary be modified or changes in design be made, without the prior consent and approval from the OEM or any statutory body, in writing, as the case may be. The changes proposed shall not affect the safety, operation, retention life of the grinding mill.

(f) The inlet cone and the nose ring of the kiln shall be covered with a brick of height 200 mm and up.

(g) When entering the crusher chamber of any crusher, provision shall be provided to house safety lock pin to prevent unintentional closure of the housing and the rotor lock pin to prevent unintentional movement of the rotor

(h) Crusher flywheel shall be secured to prevent unintentional movement of the rotor

(i) There shall be a provision to collect waste lubricating oil from the mills such that there is no manual intervention

(j) The internals of the mill shall be lined with refractories such that it can withstand operating temperatures.

(k) The facility shall have proper procedure and equipment for removal of choking which involve material Jam, build-up cleaning, choking at feed and entry points of storage silos, bins, bunkers and equipment like Grinding mills / Crushers / Valves / Ducts / Cyclones / Preheaters /Coolers / Conveyors / Bag filter / ESP.

(l) Cyclone Pre-heaters (of various stages) and Pre-Calciner, Rotary Kilns, Coolers, Ducts (WHRS and Raw meal conveying) - During normal operation the hot raw, intermediate and final products are contained or highlighted. There is far greater risk when contact is possible during abnormal operation of the plant, when clearing blockages, carrying out maintenance or in emergency situations. It is not always

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obvious when something is hot, the risks include personal injury – severe burns and fire – from contact with combustible materials; oils, scaffold boards, ladders, electrical cabling, etc.

(m) Employer shall take adequate precautions to prevent the impairments of workers involved in Planned and unplanned maintenance on kilns, pre-heaters, Air ducts and Cooler etc., for the activities such as Pre-Initial Inspection Clean down, Access following external clean down, Re-inspections, Wrecking of Lining and followed of refurbishment too.

(n) Provisions shall be made for overhead cranes to remove and replace crusher wear parts.

(o) Supports shall be provided for gyratory and conveyor main shafts and lay-down space for the cone crusher bowls is essential. Some shall require a complete spare screen and change out for major screen maintenance. Trolleys, jib cranes and pull points shall be designed to facilitate equipment maintenance.

(p) Oil and lubrication systems shall be centralized and designed for easy automatic changes, with provisions for well-ventilated centralized lubrication rooms where possible. (e.g., a line of fine cone crushers shall have a central oil receiving area, with piping to and from each crusher lube package for quick and easy oil changes.)

(q) Maintenance personnel shall have easy visual and rapid access to screen decks for panel replacement.

(r) Occupier shall ensure that the covers provide good access for working on screens. Screening facilities shall meet rigid dust emission requirements; always ensure that off-the-shelf screen dust covers have kept pace with these requirements. It shall be necessary to custom-design covers that minimize emissions and provide easy access to the screen.

(s) Provisions shall be made for the replacement of wear parts (e.g., install man-doors on head chutes with flood lighting inside the chute.)

(3) Process Safety:

(a) **General**

(i) There shall be procedure for basic planning, methodology, technical and hardware requirement for execution of shut down activities safely and efficiently for both planned and unplanned shut downs.

(ii) Pre-Start- Up Safety Review shall be conducted prior to installation of any new equipment.

(iii) Management of Change needs shall be followed for installation of new equipment, modification of existing equipment, discard of unused equipment, etc.

(iv) Hazard identification studies such as QRA, PHA, HAZOP, HAZID, etc.

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whichever applicable, shall be conducted by a third party. Compliance of the same shall be ensured.

(b) **Dust Explosion**

(i) Occupier shall,

(a) Where, in connection with any grinding, sieving or other process giving rise to dust, and such dust is liable to explode on ignition, all practicable steps shall be taken to prevent such an explosion by enclosure of the plant used in the process or removal of possible ignition sources.
(b) Where there is a possibility of explosion, all practicable steps shall be taken to restrict the spread and effects of such an explosion by the provision of chokes, baffles and vents, or other equally effective appliances.

(ii) The following precautions shall be taken for prevention of dust explosion –

(a) minimization of space filled by dust suspensions,
(b) maintenance of design operating conditions,
(c) minimization of mechanical failure and overheating,
(d) precautions against static electricity and
(e) precautions against passage of burning dust.

(c) **Cyclones**

(i) For cyclones with the product off-take connected to other plant as in a spray drier system, an isolation choke on product off-take shall be provided.
(ii) In cyclones, vent shall be provided for Explosion suppression.

(d) **Silos**

(i) A silo shall be provided with feed arrangements which minimize the formation of dust suspensions. A silo shall be filled by letting the dust fall from the roof or by introducing it down a vertical feeder duct so that it flows sideways onto the existing dust pile, the latter minimizing dust cloud formation.
(ii) Silos shall be provided with vents and rupture disk for Explosion suppression

(e) **Stone Crusher**

(i) Safety guards around all moving equipment, and emergency pull-cords on both sides of any conveyors with personnel access shall be ensured.
(ii) Crushers, screens and dust-collection fans all contribute to high noise levels and

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shall be provided with acoustic coatings to reduce noise levels.

(iii) Well-balanced choke-fed crushers, dust enclosed screens and dust collector fans with silencers shall be provided to keep noise levels under control.

(f) **Driers**

(i) The vapour concentration shall be kept well below its lower flammability limit using appropriate ventilation.

(ii) The hot product from a drier shall be cooled before storage and self-heating shall be avoided.

(iii) For explosion venting, rapid action valves for isolation between the drier and the air heater and between the drier and the cyclones, and a rotary choke valve at the product off-take shall be provided. Isolation arrangements for the explosion suppression shall be provided.

(4) Plant and Design Layout

CRUSHER UNIT –

(a) **Upper Superstructure**

(i) The size of the crane shall be suitable to be used to install the crusher, or to just service the components of the crusher.

(ii) Crane main hook speed shall be slow for inserting the main shaft.

(iii) Crane maintenance access shall include stairs and a platform to service an overhead bridge crane.

(iv) A well-ventilated crusher control room shall be provided.

(v) The electrical room shall be located at the upper or lower level and high-voltage runs shall be kept short.

(vi) The dust collector shall be located taking into consideration the operating length of ductwork.

(vii) Two main shaft supports shall be provided, for the shaft in use and a spare. Storage must be provided for both. The spare shaft shall be stored near the crusher or in the maintenance shop.

(viii) Plant shall provide a maintenance lay-down area.

(ix) Plant shall locate the air compressor in a room away from dusty areas.

(b) **Receiving Hopper Area**

(i) When required, the Plant shall ensure a grizzly is provided in the receiving hopper area, especially in jaw crusher installations.

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(ii) A splitter shall be provided in the receiving hopper area to reduce impact on the spider, particularly in the expectation of large run-of-mine material.

(iii) Well-hatch covers shall be fixed-hinge on one side so they won't accidentally drop to a lower level.

(iv) To minimize dust emission, a vertical dump hopper spray system shall be provided, with up to ten sprays per header. Ensure that this provides greater distance for dust to pass through.

(v) A receiving hopper dust-hood plenum shall be provided for plants using dust collection.

(vi) The Design shall be simple, easily removable, drop-in circular steel seal for the crusher and dump hopper.

(vii) A long length of stud link chain shall be placed on the pocket floor with one end exposed for lifting out and breaking up the stone boxed material in the pocket.

(viii) It shall be ensured that the breaker impact head is parked in the vertical position out of the way of truck dumping.

(c) **Surge Bin Area**

(i) The surge bin access door shall be split horizontally on one side, to allow easy man access to one side without opening the whole door.

(ii) Air cannon discharge points shall be pre-designed. The air receivers and valves shall be located outside the surge bin.

(iii) Level detectors shall be installed at high and low points in the surge pocket.

(iv) Surge pocket withdrawal opening liners shall be made in a minimum number of large pieces for ease of removal. Liners shall be lifted with a sling from the service crane hook through the crusher.

(v) The surge pocket opening slot shall be made as long as practical to maximize live capacity.

(vi) A wide, high-speed take-away conveyor to take the surge to a nearby stockpile or to an external surge bin shall be provided.

(vii) Plant shall install floodlights in the surge pocket to facilitate inspection and maintenance.

(viii) Plant shall provide two pick-up openings through the crusher floor level for dust collection at the back of the crusher.

(ix) Plant shall provide low-level protection for the surge feeder, possibly gamma detectors.

(d) **Feeder area from Surge Bin**

(i) Plant shall ensure a suitable feeder to draw material from the surge bin.

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(ii) Dust collection facilities shall be installed at the feeder discharge point.
(iii) Plant shall ensure dribble chutes shall pass spillage onto the receiving belt, with the feeder discharge being designed to minimize the distance the rock shall fall. This loading point shall also ensure that under all material handling conditions, material shall not be in a stone box or build backup into the feeder.
(iv) The design of feeder skirting shall always provide relief in the direction of flow.
(v) A clean-up chute shall be designed to allow spilled material from the floors above to pass down onto the take-away belt.
(vi) To assist in maintenance of the feeder, equipment pull points in the structures near the feeder shall be provided.

(5) Alternate Fuel and Raw Materials (AFR)

(a) **Solid AFR**

(i) Flammable, ignitable, reactive and non-compatible wastes shall be stored separately and never shall be stored in the same storage shed.
(ii) Storage area shall consist of different sheds for storing different kinds of hazardous substances and these sheds shall be provided with suitable openings.
(iii) Adequate storage capacity for solid and liquid shall be provided in the premises.
(iv) Storage area shall be designed to withstand the load of material stocked and any damage from the material spillage.
(v) The Solid AFR Storage area shall be provided with the flameproof electrical fittings and it shall be strictly adhered to.
(vi) There shall be at least 15 m distance between the solid storage sheds.
(vii) Loading and unloading of wastes in storage sheds shall only be done under the supervision of the well trained and experienced staff.
(viii) Minimum of 1meter clear space shall be left between two adjacent rows of pallets in pair for inspection.

(b) **Liquid AFR**

(i) The container used for storage of hazardous liquids shall be made or lined with the suitable material, which shall not react with, or in other words compatible with the hazardous wastes proposed shall be stored.
(ii) The stacking of drums in the storage area shall be restricted to three meters high on pallets (wooden frames). Necessary precautionary measures shall be taken so as to avoid stack collapse. However, for waste having flash point less

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than 65.5˚C, the drums shall not be stacked more than one height.

(iii) Stacking of drums shall be done on rakes specially designed for holding pallets up to three rows, with height not exceeding 4.5 meters.

(iv) No drums shall be opened in the storage sheds for sampling etc. and such activity shall be done in designated places outside the storage areas.

(v) Drums containing wastes stored in the storage area shall be labelled properly indicating mainly type, quantity, characteristics, source and date of storing etc.

(vi) The drum storage area floor shall be provided with impervious concrete floor and Chemical Resistance Tiles and slope arrangement which shall be routed to spill collection pit to avoid the spread of spilled chemical and fire to the local area and to avoid contamination of the ground water and soil. Ensure segregation of chemical drainage from storm water drainage systems.

(vii) A separation wall for Drum storage area to separate the solid waste and drum storage shall be provided.

(viii) Drum storage shall be segregated as per the requirement of 1m between the two adjacent rows of pallets in pair for inspection.

97. **Petroleum industries -** under serial no. 9 in the first schedule under clause (za) of sub-section (1) of section 2

— oil refining

— lubricating oils and grease

(1) This shall apply to all the factories involved in manufacturing of petroleum and petrochemicals.

(2) Hazards and safety requirements:

Appropriate and adequate safety measures shall be implemented to prevent and control the following hazards;

(a) Hydrocarbon and toxic chemical exposures

(b) Hazards arising from reactive chemicals, uncontrolled chemical reactions and disposal of chemicals

(c) Steam and condensate hazards

(d) Fire, Explosion, Toxic, Pyrophoric, Auto ignition, Cryogenic and Overpressure hazards.

(e) Respiratory hazards: impurities in air arise due to concentration of various substances such as, hydrogen sulphide, sulphur dioxide, mercaptan, ammonia, chlorine, etc.

(f) Asphyxiation hazard caused by physical and chemical asphyxiants

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(g) Corrosion and Erosion
(h) Dust explosion hazards
(i) Biological hazards due to operational activities at Effluent Treatment Plant, Sewage Treatment Plant and Cooling Towers
(j) Spills, leak and overflow with tank farms, intermediate and pressurized storages, loading and unloading operations.

(3) Hazard Identification and Risk Management:

(a) All hazards shall be identified, and appropriate preventive and control measures implemented before and during any plant process commissioning and operational activity, planned turn-around, Maintenance and Inspection activity, and Management of Change (MOC).
(b) Risk assessment studies shall be carried out initially and in case of any change in the process or facility, and appropriate control measures implemented as per the outcomes of the study.
(c) All designs shall be in accordance to applicable standards and best practices keeping inherent safe design concept on focus.
(d) Adequate and appropriate safety distances shall be maintained between the equipment to facilitate safe access for operations for the process equipment, utilities and emergency equipment.
(e) Studies for identifying hazards related to static electricity, lightning, Hazardous Area Classification shall be carried out and implemented to ensure safety in accordance with National Standards.
(f) All instruments and gauges shall be operational, maintained and calibrated as per the standards/OEM recommendations.
(g) Suitable provisions, such as automatic and/ or remote-control arrangements, shall be made for controlling the effects of hazardous processes. In the event of failure of control arrangements, automatic safety instrumented system shall be made available for safe shutdown of operations.
(h) Safety Critical Equipment (SCE) including instruments shall be identified, documented and maintained.
(i) In case of high severity operations, double valve control shall be provided.
(j) Un-interrupted power supply shall be ensured for critical services including automatic safe shutdown systems.
(k) Adequate and appropriate fire, gas and leak detectors and fire fighting systems shall be provided and regularly maintained for healthiness
(l) Adequate drainage shall be provided and shall lead to collection tanks specifically provided for this purpose wherein deleterious material shall be neutralised, treated, or otherwise rendered safe before it is discharged.
(m) All plants and equipment shall be so designed and constructed as to prevent the

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escape of flammable and / or toxic substances. Where necessary, separate buildings, rooms, or protective structures shall be used for the occupied buildings and shall be so designed as to localise any ingress of toxic substances, radiation, or blast wave pressure effects.

(n) Catch pits, bund walls, dykes, or other suitable safeguards shall be provided to restrict the serious effects of such leakages from equipment.

(o) There shall be arrangement of safety relief devices. Any of the flammable/toxic liquid or gases shall be drained or vented to closed system and not shall be released in atmosphere to avoid possible vapour cloud at area where ignition source might be present. These systems shall be always maintained functional.

(p) Operations and maintenance shall be done by trained workers.

(q) Safe start up and shutdown procedures, maintenance procedures and regular monitoring shall be enforced during operations

(r) Hazardous energies such as mechanical, electrical, pneumatic, or thermal energy shall be released or controlled before equipment and utilities are serviced, repaired or maintained using Permit to Work system.

(s) All repair and maintenance (Routine / Non-Routine) related to Process Equipment, Utilities work places shall be carried out with appropriate combination of Permit System of Authorisation after field review, viz., hot work, height work, equipment / workplace / piping / energy isolation, excavation, installation, dismantling, assembling related operations and inspection, examination and testing activities after Job Hazard Analysis incorporating safety measures in the permit document.

(t) Power and hand tools shall meet hazardous area classification requirement as per the applicable National Standards.

(u) Periodic work place monitoring studies shall be conducted in the factory to ensure that the maximum permissible limits of exposure of chemicals and toxic substances in manufacturing processes as laid down under section 18 and 88 of the Code are not exceeded.

(4) Personal Protective Equipment (PPE)

The following PPE shall be procured, supplied, used and maintained in the specified area of work in addition to the PPE prescribed as General Standards under Section 18 of the Code.

(a) Flame resistant coverall to protect from Flash Fires.

(b) Dust mask (P1,P2,P3) for Dusty environments, working with potentially infectious materials

(c) Half face air purifying mask for Dusty environments, potentially infectious materials, chemical vapors, particulates, and select gases (cartridge dependent)

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(d) Full face air purifying mask for greater protection factor in Dusty environments, potentially infectious materials, chemical vapors, particulates, and select gases (cartridge dependent)

(e) Personal toxic gas detectors to warn against release of toxic gases.

(f) Self-contained breathing apparatus (SCBA)for oxygen deficient atmospheres, immediately dangerous to life or health (IDLH) or areas of high concentration or unknown airborne contaminants.

98. **Petro-chemical industries -** under serial no. 10 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall be applicable to all petrochemical industries where highly flammable liquids or flammable compressed gases and highly toxic material are manufactured, stored, handled or used.

(2) **Storage** –

(a) Every flammable liquid or flammable compressed gas used in every factory shall be stored in suitable fixed or floating roof storage tank, or in suitable closed vessel located under the ground, in the open or in a store room of fire resistant construction as per National standard.

(b) Except as necessary for use, operation or maintenance, every vessel or tank which contains or had contained a highly flammable liquid or flammable compressed gas shall be always kept closed and all reasonably practicable steps shall be taken to contain or immediately drain off to a suitable container any spill or leak that shall occur.

(c) Every container vessel, tank, cylinder, or store room used for storing highly flammable liquid or flammable compressed gas shall be clearly and in bold letters marked 'Danger-Highly Flammable Liquid' or 'Danger-Flammable Compressed Gas'.

(d) Highly flammable liquids and compressed gases shall be conveyed within a factory in totally enclosed system consisting of pipe lines, pumps and similar appliances from the storage tank or vessel to the point of use. Such enclosed systems shall be so designed, installed, operated and maintained as to avoid leakage or the risk of spillage.

(e) Wherever there is possibility for leakage or spill of highly flammable liquid or flammable compressed gas from an equipment, pipeline, valve, joint or other part of a system, measures shall be taken to contain, drain off or dilute such spills or leakage as to prevent formation of flammable mixture with air.

(f) Prevention of Ignition– In every room, work place or other location where highly flammable liquid or flammable combustible gas in stored, conveyed, handled or used or where there is danger of fire or explosion from accumulation of highly flammable liquid or flammable compressed gas in air, measures shall be taken to

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exclude the sources of ignition. Such precautions shall include the following:-

(i) All electrical or electronic apparatus shall either be excluded from the area of risk or they shall be intrinsically safe and flameproof and constructed as per National Standards. Such equipment shall be installed and maintained as per hazardous area classification for the facility.

(ii) Measures shall be adopted for prevention of accumulation of static charges and make provisions for discharge using earthings and bondings;

(iii) Footwear shall be used as per the National Standards for flammable atmosphere.

(iv) Smoking, lighting of matches, lighters or smoking materials shall be prohibited;

(v) Transmission belts with iron fasteners shall not be used; and

(vi) All precautions shall be taken to prevent initiation of ignition from all sources such as open flames, frictional sparks, overheated surface of machinery or plant, chemical or physico-chemical reaction and radiant heat.

(vii) Before carrying out maintenance job on the system involving highly Flammable Liquid and / or Flammable Compressed Gas, dedicated systematic hazard identification and risk assessment shall be carried out and recommended safety measures shall be followed.

(viii) Non sparking tools shall be used.

(ix) For hazardous area classification, applicable National Standards shall be followed for all the spark producing sources in the area.

(x) For any work involving spark or flame like drilling**,** welding, gas cutting etc., adequate safety measures for control of spark, decontamination of equipment as required shall be carried out.

(3) Prohibition of smoking - No person shall smoke in any place where highly flammable liquid or flammable compressed gas is present in circumstances that smoking shall give rise to a risk of fire. The occupier shall take all practicable measures to ensure compliance with this requirement including display of a bold notice indicating prohibition of smoking at every place where this requirement applies.

(4) The persons engaged in operation and maintenance of the petrochemical plant / facility, shall be adequately trained for his job role.

(5) The industry shall arrange to prepare and implement standard operating procedures (SOPs) and standard maintenance procedures (SMPs) and review periodically to ensure safe and reliable operation and maintenance in petrochemical plant / facility.

(6) The industry shall implement appropriate and adequate safety measures like safety audit, hazard and operability study, fault free analysis, event free analysis and such other requirements and review periodically to prevent and control the following hazards;

(a) Physical hazards like noise, heat, vibration, illumination, ventilation etc.

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(b) Radiological hazards
(c) Fire and explosion hazard
(d) Toxic chemical exposure
(e) Hazards arising from reactive chemicals, uncontrolled chemical reactions and disposal of chemicals
(f) Interaction of various chemicals in use
(g) Steam and condensate hazards
(h) Pyrophoric, Auto ignition, Cryogenic and Overpressure hazards.
(i) Respiratory hazards: impurities in air arise due to concentration of various substances such as, hydrogen supplied, Sulphur dioxide, mercaptan, ammonia, chlorine, etc.
(j) Asphyxiation hazard caused by physical and chemical asphyxiates
(k) Corrosion and Erosion
(l) Dust explosion hazards
(m) Spills, leak and overflow with tank farms, intermediate and pressurized storages, loading and unloading operations.
(n) Biological hazards due to operational activities at Effluent Treatment Plant, Sewage Treatment Plant and Cooling Towers

(7) Hazard Identification and Risk Management

(a) All hazards shall be identified, evaluated and appropriate preventive and control measures implemented before and during any plant process commissioning and operational activity, planned turn-around, Maintenance and Inspection activity, and Management of Change (MOC).
(b) Risk assessment studies shall be carried out initially and in case of any change in the process or facility, and appropriate control measures implemented as per the outcomes of the study.
(c) All designs shall be in accordance to applicable standards and best practices keeping inherent safe design concept on focus.
(d) Adequate and appropriate safety distances shall be maintained between the equipment to facilitate safe access for operations for the process equipment, utilities and emergency equipment.
(e) Studies for identifying hazards related to static electricity, lightning, Hazardous Area Classification shall be carried out and implemented to ensure safety in accordance with National Standards.
(f) All instruments and gauges shall be operational, maintained and calibrated as per the standards/OEM recommendations.
(g) Suitable provisions, such as automatic and/ or remote-control arrangements, shall be made for controlling the effects of hazardous processes. In the event of

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failure of control arrangements, automatic safety instrumented system shall be made available for safe shutdown of operations.

(h) Safety Critical Equipment (SCE) including instruments shall be identified, documented and maintained.

(i) Un-interrupted power supply shall be ensured for critical services including automatic safe shutdown systems.

(j) Fire, gas and leak detectors and firefighting systems shall be provided as per National Standards and regularly maintained for healthiness.

(k) Adequate drainage shall be provided and shall lead to collection tanks specifically provided for this purpose wherein deleterious material shall be neutralised, treated, or otherwise rendered safe before it is discharged.

(l) All plants and equipment shall be so designed and constructed as to prevent the escape of flammable and / or toxic substances. Where necessary, separate buildings, rooms, or protective structures shall be used for the occupied buildings and shall be so designed as to localise any ingress of toxic substances, radiation, or blast wave pressure effects.

(m) Catch pits, bund walls, dykes, or other suitable safeguards shall be provided to restrict the serious effects of such leakages from equipment.

(n) There shall be arrangement of safety relief devices. Any of the flammable/toxic liquid or gases shall be drained or vented to closed system and not shall be released in atmosphere to avoid possible vapour cloud at area where ignition source might be present. These systems shall be always maintained functional.

(o) Operations and maintenance shall be done by trained workers.

(p) Safe start up and shutdown procedures, maintenance procedures and regular monitoring shall be enforced during operations

(q) Hazardous energies such as mechanical, electrical, pneumatic, or thermal energy shall be released or controlled before equipment and utilities are serviced, repaired or maintained using Permit to Work system.

(r) All repair and maintenance (Routine / Non-Routine) related to Process Equipment, Utilities work places shall be carried out with appropriate combination of Permit System of Authorisation after field review, viz., hot work, work at height**,** equipment / workplace / piping / energy isolation, excavation, installation, dismantling, assembling related operations and inspection, examination and testing activities after Job Hazard Analysis incorporating safety measures in the permit document.

(s) Power and hand tools shall meet hazardous area classification requirement as per the applicable National Standards.

(t) Periodic work place monitoring shall be conducted in the factory to ensure that the maximum permissible limits of exposure of chemicals and toxic substances in manufacturing processes as laid down under section 18 and 88 of the Code are

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not exceeded.

(8) Industry shall implement and maintain Process safety management guidelines as per National Standards to ensure Health, Integrity and Safety of Asset and Workforce.

(9) For safe disposal of emergency discharge of hydrocarbon, Industry shall ensure availability of Flare system all the time.

(10) Industry shall confirm that the Material of construction (MOC) of pipelines (above-ground and under-ground), equipment etc is compatible with chemicals handled is as per Chemical – Metal interaction matrix.

(11) Industry shall develop and maintain shutdown and start-up manual capturing activities like

(a) Shutdown- isolation, de-commisioning, deinventorising, inertisation (decontamination), and handing over for maintenance

(b) Start-up , HOTO (handing over- Take Over), commissioning

(12) A CUI (Corrosion under Insulation) and CUS (Corrosion under support) program shall be developed to address corrosion and erosion issues related to equipment and pipes under insulation, supports of the systems, equipment and piping in cryogenic services, corrosive services etc.

(13) Integrity of brick wall, refractory and insulation of furnaces / fired heaters shall be periodically inspected and maintained.

(14) In polymer service, dust hazard shall be mitigated suitably.

(15) Plant operating parameters, reactor operating parameters shall be monitored at regular intervals with Standard operating conditions (SOC) identified for key parameters along with operator actions on reaching of alarm limits or limits as identified in SOC.

(16) The main chemical reactions handled at the facility shall be mentioned clearly in the operation manual. Reactions in the reactor, reactor operating conditions and hazards and mitigation of runaway reactions in the process- (including storage) (this shall include self-polymerisation, decomposition etc) shall be documented as part of the operation manual. The operating persons shall be made aware of the same.

(17) Pyrophoric material handled in the facility, including possible generation in reaction/process intermediatory shall be identified along with its safe handling.

(18) In process where cryogenic temperatures are present or likely shall be present under certain conditions, the suitability of material of construction and corresponding required operating condition limits of various parameters and operating actions shall be spelt out as part of operation manual and the operating personnel shall be made aware of the same.

(19) The facility shall develop emergency response plan based on listed possible credible scenarios of gas and liquid leaks, (loss of primary containment- LOPC), vapour cloud formation, Fire and explosion, toxic release etc. The facility operating personnel shall be made aware of the same.

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(20) As applicable, the facility shall develop risk assessment for safe handling and carrying out maintenance involving Cryogenic service, Carcinogen, dust along with suitable PPE use for the same.

(21) Personnel involved in operation of Carcinogen shall be monitored for their health.

(22) Facility siting study shall be carried out during the design stage or during major modification/changes. The facility buildings, operating personnel shall be located as per the study outcome.

(23) Personal Protective Equipment

The following PPE shall be used and maintained in the specified area of work in addition to the PPE prescribed as General Standards under Section 18 of the Code. (Use of Five Basic PPEs - Helmet, Goggles, Ear plugs, Gloves and Safety Shoes is mandatory)

Hazards and Personal Protective Equipment (PPEs) Matrix used in Petrochemical Plants		
S. No	**Hazard**	**Personal Protective Equipment**
1	Fire Hazard	Inherently Fire Retardant (IFR) suit 150 GSM 3-layer Nomex suit 220 GSM Heat resistant (Leather) gloves Welding Apron, Leg Guards, Hand Sleeves
2	Toxic chemical exposure hazard	SCBA (Self-contained breathing apparatus) set
3	Reactive Chemicals exposure Hazard	Chemical protective suit
4	Pyrophoric hazard	Special Thermal Protective apparel
5	Steam and condensate exposure hazards	Hot condensate splash suit and gloves Face shield
6	Cut injury	Cut resistant gloves

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	hazard	
7	Fall hazard	Full body harness Safety net
8	Cryogenic hazards	Cryogenic suit and gloves
9	Pressure hazard	High Pressure water jetting /cleaning (Turtle) suit with gloves and shoes, Face shield
10	Respiratory hazards: impurities in air	Dust Mask SCBA (Self-contained breating apparatus) set
11	Asphyxiation hazard caused by physical, and chemical asphyxiates	SCBA (Self-contained breathing apparatus) set
12	Electrical hazard	Arc flash suit HT/LT hand gloves Ambu bag
13	Radiological hazards	Lead suit and gloves
14	Hot Fluid exposure hazard	Hot condensate splash suit
15	Carcinogens Exposure Hazard	Canister mask with chemical specific filters

99. **Drugs and pharmaceutical industries -** under serial no. 11 in the first schedule under clause (za) of sub-section (1) of section 2
-narcotics, drugs and pharmaceuticals

(1) This shall apply to all the industries involved in drugs, pharmaceuticals and formulations production. However, it shall not apply to exclusive RandD and contract RandDs.

(2) Hazards: All the industries under the scope of this standard shall make a provision to identify the hazards that affect or have the potential to cause adverse impact on

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personnel, equipment or machinery and environment. These hazards shall include, but not limited to;

(a) Solvent Vapor and Potent Compound Exposure: workers can get exposed to toxic solvent vapors and potent drugs as airborne dust during various manufacturing operations
(b) Exposure to chemicals like formaldehyde, chlorine, hydrochloric acid, etc.
(c) Hazards arising from reactive chemicals, uncontrolled chemical reactions, disposal of chemicals etc.
(d) Exposure to UV rays, infrared rays, Xrays.
(e) Toxic Hazards
(f) Respiratory hazards: impurities in air arise due to concentration of various substances such as ammonia, chlorine, hydrogen chloride, hydrogen sulphide, etc. and various types of dusts during powder handling.
(g) Dust explosion hazards due to various types of powders handled during formulation

(3) Hazard Identification and Risk Assessment:

(a) Before taking up scale up operations including unit process, pilot plant production/ commercial production of product, sub product or stage or intermediate, process hazards and conditions shall be identified by using appropriate Hazard Analysis and Risk Assessment studies such as HAZOP Study, What-if analysis, Quantitative Risk Assessment, Fault Tree Analysis, Fire and Explosion Risk Assessment, Facility Siting, Vent Sizing, Control Systems HAZOP etc.
(b) Risk assessment studies shall be repeated at the different stages of the project as applicable and whenever major changes are happening in the process or facility.
(c) Based on the studies safety measures shall be implemented and adequate provisions shall be made for dealing with any hazards including effects on workers, plant, facilities, work environment, etc. which shall occur during manufacture, storage and handling.
(d) The above-mentioned exercise shall be repeated whenever there is a change of any manner in Layout, End Product, Product Stages, Ingredients, hazardous wastes, Operating Conditions, Equipment and Skill /Education / Knowledge/ Experience of the operating personnel.

(4) Operational Safety:

(a) Standard Operating Procedures for safety during charging ingredients, sequence, rate of charging, sampling manually or auto, indication of process upsets or deviations, transfer of material from raw material store/ storage yard, possible

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corrective actions to recourse to safety shall be developed, reviewed and introduced duly by educating personnel concerned. This shall also include emergency measures shall be taken to prevent dangerous conditions during Emergency Shutdown and Normal Shutdown.

(b) Procedures to isolate plant or part of the plant with criticalities shall be developed and concerned personnel shall be familiarized and trained. These procedures shall meet requirements of different changes in products and related parameters.

(c) Adequate safety measures shall be taken while carrying out unit operations including Charging ingredients into reactor, Mixing, Agitating, heating / cooling/ chilling- in process Sampling, Catalyst Addition / Filtration- Separations-atmospheric- vacuum- high vacuum distillation-extraction-reflux operations- drying operations.

(d) Hazardous and Specific Reactions (Amination Oxidation, Nitration, Halogenation, Hydrogenation, Redox Operations, Hybrid-Phase Reactions, Phosgenation, Cyanation) related safety shall be addressed through a detailed safety study including compatibility matrix and safety measures, including engineering controls, shall be identified, installed and maintained and the healthiness of these safety critical equipment shall be ensured at all times. Records for the same shall be documented.

(e) Feed rates shall be determined and controlled and hazardous gases of reaction shall be neutralized adequately.

(f) Provisions shall be made for recognizing and mitigating the consequences like excess pressure build up, release and leaking of toxic and flammable gases in work area. Ways and means of early diagnosis of deviations and notifying arrangements shall be provided.

Reverse Flow of contents of reactor to Gas Feeding Tank shall be prevented to the extent possible.

(5) Control of Dangerous Chemical Reactions:

(a) Suitable provisions, such as automatic and/ or remote-control arrangements, shall be made for controlling the effects of `dangerous chemical reactions. In the event of failure of control arrangements, automatic flooding or blanketing or other effective arrangements shall come into operation. In case of manual control of feeding of reactant from a tank to the reactor, double valve control shall be provided. Reactor cooling requirements shall be assessed and provided.

(b) In case of utility failure, alternate automatic/ gravity feeding cooling medium to the jacket of the reactor shall be provided. In the worst-case scenario of reaction going out of control, there shall be arrangement of quick batch dumping through bottom valve by gravity of the contents into an adequately sized dump tank with pressure relief arrangement to avoid runaway reactions in the reactor and

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pressurising of the reactor beyond the capacity of Safety Relief Arrangements.

(c) In cases of gas feeding to the reactor from gas cylinders, effective arrangements to prevent back flow of contents of reactor into gas cylinder system under specific circumstances shall be considered. In addition to Non-Return Valve, barometric leg arrangement / gas flow meters shall be provided. Arrangements to cut off feed gas when feed-gas is not absorbed effectively shall be provided. The gas cylinders are shall be located on weighing scale and feed quantity / rate of feeding shall be monitored to avoid excess feeding.

(d) Quantitative Risk Assessment shall be carried out for location of cassettes of all gas cylinders.

(e) Special precautions of loading of catalyst, retrieving spent catalyst and safe keeping, cleaning and deactivating spilled catalyst shall be included in the Safe Operating Procedures and exposure of pyrophoric catalyst to air in the reactor or outside is shall be avoided.

(f) A standard Scrubber system shall include standby scrubbing medium pump and standby blower arrangement to prevent escape of un- scrubbed vapours / gases in the event of mechanical failure or power failure. Adequate vent emission monitoring system shall be present in the scrubber.

(g) Vent design study shall be done and accordingly appropriate vent shall be provided.

(h) Location of gas detectors including oxygen detectors, proper setting and calibration, maintenance, operator knowledge of hazards shall be considered.

(i) In case of Glass Lined Reactors handling corrosive organic solvents, static charge accumulation shall be avoided by effective discharge arrangements. Line effectiveness and integrity shall be ensured by maintenance procedures.

(j) For cooling, water-reactive reactants in the reactor or similar equipment, in the jacket of the reactor water compositions shall not be used. Safe heat transfer fluids shall be planned and used.

(k) Adequate measures shall be taken to have a check on the impurity control, shelf life, presence of peroxides in the reactants.

(l) Un- interrupted power supply shall be ensured while carrying out critical reactions and such reactions shall be carried out under the supervision of person who possess qualifications and experience in handling hazardous substances and are competent to supervise such handling within the factory and to provide at the working place all the necessary facilities for protecting the workers. When such supervision is not possible, such reaction shall not be planned.

(m) In case of high vacuum distillation, over distillation shall not be carried and safety measures to avoid such conditions shall be included by analysis, design and experience.

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(6) Weighing and Dispensing:

(a) Proper workplace control measures shall be implemented to prevent leak, spills and fugitive emissions during weighing and dispensing of solids and liquids in the warehouse during bulk chemical production and in a pharmacy during pharmaceutical dosage form manufacturing.

(b) Where flammable solvents and powders are used, effective flooring conductivity shall be ensured. Equipment earthing, earth failure alert arrangements shall be provided.

(c) Weighing and dispensing shall be performed in a partitioned workplace area with good dilution ventilation.

(d) The work surfaces in areas where materials are weighed and dispensed shall be smooth and sealed, permitting their proper cleaning.

Local Exhaust Ventilation (LEV) with back draft or side draft hoods shall be provided to prevent the release of air contaminants when weighing and dispensing dusty solids or volatile liquids. Weighing and dispensing highly toxic materials shall require additional control measures such as laminar ventilation hoods or isolation devices.

(7) Liquid Separation:

(a) Closed vessels and piping systems shall be used for transferring hazardous liquids to prevent worker exposures to liquid spills and airborne vapours.

(b) Eyewash and safety showers shall be located near operations where hazardous liquids are transferred, processed or separated.

(c) Adequate spill control measures and fire and explosion prevention and protection measures shall be adopted when using flammable liquids.

(8) Filtration:

(a) Closed process equipment shall be used to filter highly hazardous materials.

(b) Filtration shall be performed in areas with spill control and good dilution and LEV.

(9) Drug Mixing:

(a) Contained process equipment and transfer systems shall be used when mixing highly hazardous drug materials.

(b) Eyewashes and safety showers shall be provided to reduce injuries, if workers accidentally contact corrosive or irritating substances.

(c) Due to the wet surfaces in drug mixing areas, workers need shall be protected from electrical hazards of equipment and utilities.

(d) Thermal hazards are posed by steam and hot water during drug mixing and cleaning activities. Worker injuries from burns and falls shall be prevented by installing insulation on hot surfaces and maintaining dry non-slip floors.

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(10) Granulation:

Enclosed granulators shall be vented to air-control devices, thereby reducing emissions of solvent vapours or dusts to the workplace and atmosphere.

(11) Drying:

(a) Explosion relief venting shall be considered on contained dryers to minimize the chances of formation of flammable or explosive atmosphere due to flammable solvent vapours and explosive airborne dusts.
(b) Dilution and LEV shall be provided to reduce the risk of fire or explosion, in addition to controlling worker exposures to solvent vapours when handling wet cakes, or to airborne dusts when unloading dried products.
(c) Mechanical equipment (e.g., drum jacks, lifts and work platforms) used for heavy material handling shall be maintained in good condition.
(d) Eyewash fountain and safety showers shall be located nearby, in case workers accidentally contact solvents and dusts.
(e) Rotary Cone Vacuum Dryer Related safety shall include safety relief valve, safety bar spacing or door interlock. Hot water shall be used for heating. In the event vacuum pump failure, non-return valve shall come into operation. This shall not be effective, and in the event of vacuum pump failure, nitrogen feeding shall take place with warning arrangement in addition to vacuum gauge.
(f) For Fluidised Bed Dryer, earth interlocking, static charge elimination, dust explosion prevention arrangements shall be in place. Dust Collector choking and differential pressure drop shall be indicated so that remedial measures can be carried out.
(g) In case of spin flash dryer, built in static charge failures, dust collection system explosion prevention arrangements shall be in place and maintained.

(12) Milling:

(a) Explosion prevention and protection measures for milling operations shall involve installing dust-tight electrical equipment and utilities, grounding and bonding equipment and accessories to eliminate electrostatic sparking, installing safety relief valves on enclosed mills, and constructing blast relief panels in walls.
(b) Requirements for blast relief shall be determined through appropriate scientific studies.

(13) Blending:

(a) LEV with flanged inlets shall be provided to reduce fugitive dust emissions during

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blending.

(b) Mechanical equipment (e.g., work platforms, hoists and drum and pallet jacks) shall be maintained in good condition.

(14) Compression:

Adequate guarding shall be provided to Compression equipment.

(15) Equipment Safety:

(a) Adequate Safety Relief Arrangements including Safety Relief Valves, Rupture Discs and combinations- dump tanks safety arrangement, Shaft Sealing Arrangement, Safety of the internal lining shall be ensured.

(b) Over speed protection and over load protection as per standard shall be provided.

(c) Adequate safety distances shall be maintained between the equipment in order to facilitate safe access for operations for the process equipment, utilities and emergency equipment.

(16) Safety Related to Devices:

All instruments and safety devices used in the process shall be periodically calibrated and tested before taking into use and after carrying out any repair to them and examined at prescribed intervals as per the standard or as per process conditions, by a competent person. Records of such tests and examinations shall be maintained in a register.

(17) Electrical Installation:

(a) All electrical installations used in the process areas shall be of any specific type to ensure safety against the hazard prevalent in that area and shall confirm to the relevant National Standards.

(b) Studies for identifying hazards related to static electricity, flame proof equipment, and Hazardous Area Classification, etc. shall be carried out.

(18) Inspection/ Examination/ Testing of Equipment

(a) All parts of plant, equipment and machinery used in the process which in the likely event of their failure shall give rise to an emergent situation shall be tested by a competent person before commencing process and retested at an interval of two years or after carrying out repairs to it.

(b) Adequate safety measures shall be taken while carrying out such inspections.

(19) Toxic Leaks:

(a) All plants and equipment shall be so designed and constructed as to prevent the

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escape of toxic substance. Where necessary, separate buildings, rooms, or protective structures shall be used for the dangerous stages of the process and buildings shall be so designed as to localise any escape of toxic substances.

(b) Catch pits, bund walls, dykes, or other suitable safeguards shall be provided to restrict the serious effects of such leakages. Catch pits shall be placed below joints in pipelines where there is danger involved to maintenance and other workers from such leakage.

(20) Effluents:

(a) Adequate precautions shall be taken to prevent the mixing of effluents from different processes and operations which shall cause dangerous or poisonous gases shall be evolved.

(b) Effluents which contain or give rise to poisonous gases in the presence of other effluents shall be provided with independent drainage systems to ensure that they shall be trapped and rendered safe.

(21) Drainage System:

(a) Adequate drainage shall be provided and shall lead to collection tanks specifically provided for this purpose wherein deleterious material shall be neutralised, treated or otherwise rendered safe before it is discharged.

(b) In case of drains for flammable chemicals, water seal shall be provided to prevent external fire-spread to the tank area.

(c) In case of drains of corrosive / toxic chemicals, drains shall be connected to ETP for checking, neutralization or otherwise treating and rendering drain-receipts innocuous and safe.

(22) Prevention and Control of escape of substances into the work atmosphere:

(a) Effective arrangements such as, enclosure, or by pass, or efficient exhaust draught, maintenance of negative pressure etc., shall be provided in all plants, containers, vessels, sewers, drains, flues, ducts, culverts, and buried pipes and equipment, to control the escape and spread of substances which are likely to give rise to fire or explosion or toxic hazards during normal working and in the event of accident or emergency.

(b) In the event of the failure of the arrangements for control resulting in the escape of substances in the work atmosphere immediate steps shall be taken to control the process in such a manner, that further escape is brought down to the safe level.

(23) Tablet Manufacturing:

(a) Solid dosage- form manufacturing:

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(i) Tablet-coating manufacturing shall be carried out in a controlled and contained environment. Local Exhaust Ventilation can be installed in older open coating pans to control fugitive solvent vapours. Tablet-coating equipment shall be vented to air emission devices to control volatile organic compounds from the process.

(ii) Tablet presses and capsule-filling machines and equipment related to coating machines shall be enclosed by interlocked panels, reducing the hazards of fast-moving parts and dust emissions during their operation.

(b) Sterile Manufacturing:

(i) Sterilization vessels shall be located in separate areas with remote instrument and control system, non- recirculated air and LEV to extract toxic gas emissions.

(ii) Gas sterilization chambers shall be fully evacuated under vacuum and purged with air to minimize fugitive workplace emissions before sterilized goods are removed.

(iii) Gas emissions from sterilization chambers shall be vented to air control devices (e.g., carbon adsorption or catalytic converters) to reduce atmospheric emissions.

(24) Cleaning and Maintenance Activities:

(a) Hazardous energies such as mechanical, electrical, pneumatic or thermal energy shall be released or controlled before equipment and utilities are serviced, repaired or maintained.

(b) Explosion-proof equipment and conductive materials shall be used in vacuum systems for explosive dusts.

(c) All cleaning activities using solvents shall be adequately ventilated and supervised.

(25) Packaging:

(a) Measures like barrier guarding on moving machine parts, accessible control switches and emergency stop cables and employee training on machine hazards and safe work practices shall be considered to reduce the hazards in packaging operations.

(b) Enclosure and isolation of equipment shall be done to reduce vibration levels in packaging areas.

(26) Centrifuge:

(a) Every part of a centrifugal machine shall be of good design and construction and adequate strength, properly maintained and thoroughly inspected by competent person at regular intervals.

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(b) The cage housing, the rotating drum or basket of every centrifugal machine shall be provided with a strong lid. The design and construction of the cage as well as lid shall be such that no access is possible to the drum or basket when the lid is closed.

(c) Every centrifugal machine shall be provided with an efficient interlocking device that shall effectively prevent the lid from being opened while the drum or basket is in motion and prevent the drum or basket being set in motion while the lid is in the open position.

(d) Every centrifugal machine shall be provided with an effective braking arrangement capable of bringing the drum or basket to rest within as short a period of time as reasonably practicable after the power is cut off.

(e) No centrifugal machine shall be operated at a speed in excess of the manufacturer's rating which shall be legibly stamped at easily visible places both on the inside of the basket and on the outside of the machine casing.

(f) For Centrifuge Lid Interlock, anti- vibrating skid, braking safety, variable frequency drive shall be provided. Where centrifuge speeds are high, balancing of rotary parts shall be ensured.

(27) Maintenance Work:

(a) All repair and maintenance (Routine / Non Routine) related to Process Equipment, Utilities work places shall be carried out with appropriate combination of Permit System of Authorisation after field review, viz., hot work, height work, equipment / workplace / piping / energy isolation, excavation, installation, dismantling, assembling related operations and inspection, examination and testing activities after Job Hazard Analysis incorporating safety measures in the permit document.

(b) All hand tools and appliances used for work in hazardous areas shall be of non-sparking type.

(c) Power Tools shall meet hazardous area classification requirement as per the applicable national standard.

100. **Fermentation industries (distillaries and beweries) -** under serial no. 12 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall be applicable to Maltry, Breweries and Distillaries.

(2) **Operational Safety:**

(a) Adequate measures shall be taken to prevent the release of ethanol. Factors like proper storage, accidental releases (spills, containment failures), undetected leaks, inadequate venting of gases, equipment malfunctions, human error and

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transportation accidents shall be given due consideration.

(b) Ignition sources where ethanol is handled shall be controlled. Typical ignition sources where ethanol is handled include electric arcs, human activities (e.g. Smoking), heating equipment (e.g. Furnaces and Ovens), open flames, static electricity, frictional heat, etc.

(c) Provisions shall be made to prevent the overpressure and mechanical damage in the distillation columns which can cause ethanol vapors to leak.

(d) Moisture content of the inlet stream to the dryer shall be monitored to prevent it from becoming excessively dry, as these conditions can lead to smoldering and fires inside the dryers.

(e) It shall be ensured that dead spots in fluidized bed dryer, which usually occur when material stops flowing, accumulates or fluidization is lost, are not formed, resulting in heat buildup and combustion.

(f) Areas where category 1 or unstable liquids are processed, shall have explosion relief venting through one or more of the following methods: open air construction, lightweight walls and roofs, light weight wall panels and roof hatches and windows of explosion venting type.

(g) Equipment shall be designed and arranged to prevent the unintentional escape of liquids and vapors and to minimize the quantity of escaping in the event of accidental release.

(h) Maintenance and operating procedures in flammable liquid processing plants shall be in accordance with established procedures which shall tend to control the leakage and prevent the accidental escape of flammable liquids.

(i) Filling or emptying barrels shall not be allowed in the barrel house. Empty barrels shall never be stored in the barrel house.

(j) Alcohol shall not be stored in metal drums unless they are equipped with adequate pressure relief valves.

(3) **Safe Practices for Distilling:**

(a) Still shall never be left unattended.

(b) Direct firing of distillery stills shall be avoided.

(c) Adequate ventilation shall be maintained in the distilling area so that vapors do not build up if there is small leak in the equipment.

(d) Charging of the still boiler with wash shall be done at alcohol concentrations below 40 percent as charging the boiler with wash higher than 40 percent creates an explosion risk.

(e) Distilled alcohol receiver shall be kept at as low a level as possible which can reduce risk of a spill if the container tips.

(f) Receiver that has a small filling opening shall be used; this reduces the vapor escaping into the room.

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(g) The receiver shall be placed in a large, non- flammable, ethanol- resistant container, which can control an accidental overflow. The container shall be capable of holding at least an hour's worth of output if the receiver spills or leaks.

(h) Before storing, the alcohol shall be diluted to lower its flash point.

(4) **Process Hazard Analysis:**

(a) Employer shall perform an initial process hazard analysis on all the processes carried out in the industry.

(b) The process hazard analysis methodology selected shall be appropriate to the complexity of the process and shall identify, evaluate and control the hazards involved in the process.

(c) The employer shall use one or more of the following methods, as appropriate, to determine and evaluate the hazards of the process being analyzed,

(i) What- If

(ii) Checklist

(iii) Hazard and Operability Study

(iv) Failure Mode and Effect Analysis

(v) Fault Tree Analysis

(vi) Any other appropriate equivalent methodology

(d) All process hazard analyses shall be updated, revalidated, based on their completion date, at least every five years.

(5) **Combustible Dust Hazards:**

(a) Appropriate electrical equipment and wiring based on the Hazardous Area Classification shall be installed in areas where combustible hazards are present to prevent the electrical devices from becoming source of ignition.

(b) Temperature sensors on bearings and other elated controls, like belt alignment sensors shall be installed on belt conveyors and bucket elevators to monitor the overheating of the bearings. These sensors shall have low and high alarm settings interlocked with audible alarms, automated shutdowns and other actions based on the detection of increasingly unsafe conditions. Additionally, effective grounding and bonding shall be considered on process equipment prone to electrostatic discharge during routine operation.

(c) Equipment (e.g. chutes, transfer points, belt conveyors, bucket elevators) shall be designed and maintained as dust tight as possible to minimize dust generation. Highly efficient dust collection and aspiration systems shall be provided to effectively control the dust.

(d) Automatic explosion suppression system shall be used to detect pressure rises indicative of explosions and promptly suppress these events, for e.g., by injecting large volumes of a suppression agent into the operation being controlled. Such

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systems shall be applied to dust collectors, milling rooms and other areas believed to present the greatest risk for explosions.

(e) Automatic systems shall be used to detect sparks and smoldering materials in certain dust- laden air streams, with detection triggering fire suppression at downstream locations.

(f) Explosion relief venting shall be considered to control deflagration pressure by venting combustion products from an enclosure to a safe location. If pressure inside the equipment rises rapidly and unexpectedly, explosion relief panels shall be designed to open to safely relieve the developing pressure and any material discharged from a deflagration outside to a safe location.

(g) Non- sparking tools (e.g. soft bristle brooms, bronze hand tools) and intrinsically safe hazard class vacuums shall be provided.

(h) The use of compressed air to blow dust from surfaces shall be permitted only when all the machinery that presents an ignition source in the area is shutdown or all other known potential ignition sources in the area are removed or controlled.

(6) **Control for Engulfment Hazards:**

(a) Silos, bins and other storage vessels shall be equipped with design features that reduce the need for workers to enter the equipment in the first place. These features shall be thoroughly documented in the literature.

(b) Operating procedures shall specifically prohibit employees from entering stored grain- whether in silos, truck beds or other locations.

(c) Workers shall be forbidden from entering onto or below a grain bridging condition or anywhere that a grain accumulation could fall and engulf a worker.

(d) Measures shall also be implemented to ensure that the workers do not need to work around the perimeter of tall storage piles of solid co- products.

(e) Workers entering grain storage structures with engulfment hazards shall be equipped with body harness and lifelines or a boatswain's chair with a designated observer who is in communication with the worker at all times and can assist with rescue procedures in the event of an unexpected engulfment. The lifeline shall be long enough so that a worker does not sink further than waist- deep in grain. If the required PPE poses a greater hazard or is not feasible, employers shall use alternate means that prevent workers from sinking beyond waist deep in grain.

101. **Rubber (synthetic) industries -** under serial no. 13 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to Rubber (Synthetic) Industries.

(2) Safety Control Measures

(a) **Compounding - powder handling, mixing and milling**

Bale cutting

Bale cutter shall have interlocking guards to prevent access to the cutting area. Fixed

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side and rear guards and interlocked front guards shall be provided.

(b) **Storage**

Particular care is required in storage areas to make sure incompatible materials, such as carbon black and sulphur, are adequately segregated.

(c) Many rubber compounding additives such as azodicarbonamide, calcium and zinc stearates, are known shall be highly explosive when in a finely divided state. Dust extraction and collection systems shall be designed for use with potentially explosive dusts.

(d) Mixing - Internal mixing

(i) The rotors, via the feed opening shall be guarded against by feed tables or conveyors placed in front of the feed opening, with additional fixed side guards, where necessary.

(ii) Safe reach distances shall be maintained as per applicable National Standard.

(iii) There shall be sufficient clearance between the bridge and the fixed bridge casting to prevent a finger-trapping hazard. Access shall be prevented by using the same safeguards as for the rotors.

(iv) Interlock movement of the floating weight with the hopper door shall be provided and maintained.

(v) Where powered movement of the door creates a trapping hazard, it's operation shall be via a hold-to-run control, located out of reach of the door or a two-hand control on the hopper itself. A front feed table preventing access shall also be provided to improve safety. Where bin-tipping units feed mixers, enclosing interlocking guards shall be required to prevent access to shear traps created by the tipping mechanism.

(vi) A trapped key interlocking system shall be provided at both the rear inspection and discharge openings of internal mixers. A trapped key interlocking system on all access doors, including a time delay and scotching of the floating weight shall be provided to prevent access to widely separated danger areas.

(vii) All sources of power shall be isolated and all stored energy dissipated, before access is possible.

(e) **Mixing - External or open mill mixing (two roll mills)**

Lunn bar or sensitive trip bar shall be fitted parallel to the mill rolls and positioned so that the operator works over it. Operators drawn towards the nip shall move the trip bar. Reliance on a single interlock switch for each Lunn bar shall be avoided. Each bar shall have a positively operated switch at both ends.

(f) **Extrusion**

(i) Adequate fixed or interlocking guards shall be provided to prevent access to the screw and other dangerous parts, whatever be the feeding arrangement.

(ii) Where hinged feed hoppers or feeding devices are used these shall be positively

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interlocked with movement of the screw.

(iii) Regular inspection and maintenance of die shall be carried out to prevent die breaking or being ejected.

(g) **Haul off units**

(i) Fixed or interlocking guards shall be provided, if guarding is not possible at feed intake because of the need to allow for different size profiles, adequate protection shall be provided for the largest profile handled. Tunnel guards profiled around the sides of the tracks at the feed intake, and mounted on the top and bottom tracks shall be considered.

(ii) Free-running horizontal guide rollers shall be provided in front of the feed opening to restrict access. Automatic feeding devices shall be used, or feeding shall be done with the haul-off stationary. Where this is not possible a safe system of work is essential.

(iii) Operate the haul-off at proper speed, via a hold-to-run control, which shall be under the direct control of the operator.

(h) **Ram extruders**

(i) Die closure shall be under two hand control and safe systems of work adopted to exclude third parties.

(ii) Interlock movement of the ram with the die, so that ram movement is not possible with the die swung out of position.

(iii) Rotating knives of die face cutters shall have an interlocking guard with appropriate time delay to account for run down.

Calendaring

(i) **Rubber feed nip**

(i) Fixed nip bar that extends the length of the rolls, positioned no more than 6 mm from the surface of the roll shall be provided to prevent a trapping point.

(ii) When rubber is fed manually into the nip access can also be prevented using the feed table as a distance guard, with integrated mesh guards at either end. Dimensions shall meet the requirements of applicable National Standard.

(iii) Horizontal interlocking trip bar might be provided just below and slightly to the front edge of the feed table so that the operator cannot approach the nip between the rolls without hitting the trip bar. This shall then operate two limit switches, one at each end of the bar and bring the rolls to rest in not more than one eighth of a revolution.

(iv) If closer approach is needed for feeding then an interlocked ‘manager guard’ shall be used, with dimensions meeting the requirements of applicable National Standard. This consists of sturdy parallel bars that prevent finger access to the nip.

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A push-stick designed to fit between the bars helps feed the rubber to the nips.

(j) **Fabric feed nip**

A 'limited movement' guard shall be used if fixed nip guards are often not practical because of the varying thicknesses of material being calendered and the need for lower roll adjustment.

(k) **Take-off and wind-up devices**

(i) Automatic tensioning equipment shall be used as it shall not be necessary for operators to feel or manually adjust the tension of the cloth whilst it is in motion. Use devices such as slipping clutches to regulate tension, and 'banana' or bowed rollers to reduce creasing, as they shall also reduce the need for approach.

(ii) Where there is a significant risk of injury, prevent access to the running nip by interlocking guards, pressure sensitive mats or photoelectric safety systems.

(l) **Threading up and maintenance**

(i) Threading up and maintenance shall be done only with the calendar stationary and the rolls separated.

(ii) All operators shall be excluded from the danger areas. If there is more than one operator there shall be flashing lights or an audible alarm.

(iii) Emergency stop buttons shall be provided on both sides of the calendar and at the auxiliary feed and take-off devices.

(m) **Cloth coating**

(i) The risk of entanglement and shear trapping hazards at dough mixers shall be controlled by having interlocking lids, and/or interlocking enclosing guards.

(ii) As many of the solvents are highly flammable suitably protected electrical devices are required. Also, control the risk from static charges. Precautions at evaporating ovens shall include explosion relief and flame failure devices.

(iii) Nip and running nip hazards of Spreading machines shall be prevented by fixed, interlocking guards or emergency stops fitted with trip wires.

(3) Fabrication (including tank lining, roller covering and hose winding)

(a) **Rubber lining operations**

(i) **Tank Lining**

(a) Confined space entry precautions shall be taken for tank lining operation.

(b) Breathing apparatus shall be provided to protect the operator against the health hazard associated with solvent.

(c) Adequate forced ventilation as per National Standards shall be provided to reduce the concentration of flammable vapours in air shall below one quarter of its lower explosive limit.

(d) All potential ignition sources shall be excluded and specially protected hand lamps used.

(e) Earthing of equipment shall be ensured.

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(ii) **Roller covering**

Dust extraction unit and explosion relief valve shall be provided.

(iii) **Hose winding**

(a) Operators shall wear close fitting clothing with cuffed or short sleeves, and tie back long hair to avoid entanglement hazard.

(b) For very short lengths of hose i.e. less than three metres, a hinged guard of horizontal bars, interlocked with a DC injection braking system shall be provided along the length of the mandrel and through which the various materials are fed.

(c) On machines where conventional guarding cannot be used the severity of an injury can be reduced by having a supported trip wire mounted above floor level, preferably so that the operator works over it , interlocked with a DC injection brake, combined with a monitored photoelectric safety device positioned above the mandrel.

(d) On very long mandrels there shall be significant deflection so photoelectric devices shall not be an option. A combination of other safety devices shall be used such as trip wires, foot operated emergency stop controls and hold-to-run controls.

(e) Practice of passing the wire around the back of the operator and through their gloved hand before feeding it onto the mandrel shall be avoided. An alternative method for feeding the wire shall be used, such as a trolley-mounted reel or an automatic winding head, which traverses the length of the machine.

(f) If pressure testing is essential, it shall be in a separate test facility capable of withstanding the effects of sudden energy release if a hose fails.

(iv) **Vulcanisation (including presses, autoclaves and continuous vulcanisation)**

(a)Moulding

(i) Hot machine surfaces shall be insulated to prevent accidental contact where ever possible. Otherwise, warning signs and protective clothing (for lower arms as well as hands) shall be provided.

(ii) Controls against preventing falls due to gravity for down-stroking presses shall be prevented by scotching or having a pilot operated check valve and counterbalance valve assembly in the hydraulic circuit.

(b) Tyre curing presses

There shall be mechanical stops/scotches to prevent gravity fall of the loading chuck. Fit arrestor gear (to activate on loss of tension) in the chains supporting the chuck.

(c)Continuous vulcanisation

Liquid salt baths

(i) Localized hot spots and overheating shall be prevented by effective temperature control.

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(ii) Suitable protective clothing, including full-face protection shall be worn to prevent splashing with hot salt when leading the extrudate through the salt bath and during maintenance and cleaning.

(v) **Pressurized liquid salt continuous vulcanizing (PLCV)**

(a) Interlocks shall be provided between the salt and water pumps

(b) Level controls shall be fitted to prevent water entering the molten salt in the curing chamber.

(c) There shall also be a pressure relief fitted before access into the chamber.

(d) Suitable protective clothing shall be worn for maintenance operations.

(b) **Polyurethanes (including PU foam production, re-constituted foam, foam conversion and rigid urethanes)**

(a) Polyurethane (PU) foam

(i) Open containers shall be avoided for mixing and pouring foam and LEV shall be maintained where enclosed systems cannot be used.

(ii) For block production, fixed fire protection shall be incorporated into the foaming machine. Bulk block stores shall also be fire resisting. Regular checks shall be made of the internal temperature of large blocks and written procedures developed to deal with an overheating block, eg transfer to a safe place outside the building.

(b) Trapping points at the mould closing and at any between the fixed and moving parts of carousel moulding machines shall be guarded. A further trap shall exist between the injection nozzle and the mould in reaction injection moulding.

(c) Reconstituted foam

(i) The production and use of PU foam crumb can give rise to a very high fire hazard unless the operations are strictly controlled. Crumb can spread and act as a fuse for the spread of fire. The dust and fine crumb produced in hammer mills and granulators can cause dust explosions. The Controls include:

(a) Fire resisting separation;

(b) Enclosure and ventilation control at crumbing plant;

(c) Good housekeeping;

(d) Explosion relief on dust collection plant.

(ii) Hammer mills and granulators are often fed by conveyor and the feed openings shall be dimensioned so that operator access to dangerous parts is prevented. Access doors into the granulator/mill shall be positively interlocked with time delay/braked motors, where necessary, to account for rundown times.

(iii) High noise levels at granulators and hammer mills shall be prevented by providing acoustic enclosures around the machines with interlocks where necessary to prevent access to dangerous parts. Otherwise, use localized acoustic cladding.

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(d) Foam conversion

(i) A full chain mail glove shall be worn on the hand closest to the blade when working close to a band knife (the hand guiding the work). Where there is only close approach for the last piece of an otherwise large block, a section of foam shall be used as a push stick.

(ii) Vertical band knives - Sliding interlocking guards shall be provided to prevent access to the blade from the operating position. Guard shall be provided to prevent any access to traps between the frame at the limits of its travel and surrounding plant during the movement of the knife frame.

(iii) Horizontal slitters – Safeguarding shall be provided as per applicable National Standards. Parking guard (usually L-shaped or U-shaped cover) shall be provided to prevent accidental contact with the blade when the machine is not in use. On machines with a reciprocating table, there shall be a shear trap between the table at the limits of its travel and fixed parts or the structure of the building. If this is the case then a sensitive leading edge or pressure sensitive mat can be fitted, or distance fencing provided. Machines with conveyor belts shall not have exposed traps between belts and end rollers.

(iv) Separate fire resisting bulk stores shall be provided with tight control over workflow, stacking, and housekeeping in PU form storage areas.

(v) When solvent-based adhesives are sprayed Local Exhaust Ventilation (LEV) shall be required as well as suitable protective gloves. Solvents used for cleaning the spray gun nozzles shall be stored in suitable lidded containers with spillage trays.

(vi) Flame bonding - Use an enclosure and LEV around the burner and laminating sections to remove fumes containing free isocyanate. The process shall be contained in a fire resisting enclosure. The gas system shall incorporate a flame failure device and be interlocked with the machine drive motor. A high standard of general ventilation with adequate fresh air supply is required.

(e) Tyre building

Tyre building machine: Following safeguard shall be used

(i) Two hand controls

(ii) Fixed and interlocking guards

(iii) Pressure sensitive mats

(iv) Photo-electric devices

(v) Other trip and emergency stop devices

(vi) Use of protective devices (trip bars and pressure mats) to reduce trapping risk at tyre building machines

(c) **Safeguarding of servicers, including their drive mechanisms**

Access shall be prevented during normal operation by interlocking guards or other

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protective devices such as photo-electrics. If tyre builders load their own servicers, manual over-ride controls for loading and setting servicers shall not allow movement at normal operating speeds.

(d) **Safeguarding of the building drum**

(i) Photoelectric devices or pressure sensitive mats shall be used to prevent access to the rotating drum during automatic operation. For manual operation, two-hand control, or where this is not practicable, shrouded hold-to-run controls shall be provided. These shall have a spring-loaded shroud cover, and an un-shrouded emergency stop located at the operator's position.

(ii) Use of uncontrolled movement of pocket bars shall be eliminated. Proprietary mechanical or pneumatic devices such as a Wyko applicator shall replace pocket bars for tyres up to a certain size.

(e) **Tyre retreading**

(i) Access to the rotating rasp shall be prevented by a sensing device, which prevents rotation of the rasp, or raising of the rasp guards where the rasp rotates continuously, until the tyre is inflated and within 50 mm of the rasp head.

(ii) On articulated head machines, close approach is usually necessary, as the operator directly controls the movement of the rasp heads. Practical guarding methods rely on use of a two-hand control system mounted on the handles of the rasp body.

(iii) Two-hand controls shall be provided, as trigger grips shall not meet this standard, as they are easily defeated. Access inside the rasp housing shall be prevented for blade changing .

(iv) Noise level in tyre buffing area, skiving and tyre inflation testing machines shall be maintained below the permissible level. Air exhausts and extraction systems shall be fitted with silencers.

(v) Acoustic enclosures shall be provided in automatic buffing machines.

(f) **Industrial Exposure and Control**

Exposures to butadiene shall be below permissible level by ensuring that fittings on closed-loop systems are not worn or incorrectly connected, use of closed-loop systems for cylinder sampling, use of dual mechanical seals to control release from leaking pumps, use of magnetic gauges to monitor rail-car filling operations and use of a laboratory hood for cylinder voiding.

102. **Paints and pigment industries -** under serial no. 14 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply for the Paints and Pigment industries.

(2) Raw material Receipt, Handling and Storage

(a) Dust extraction systems shall be provided in the raw material powder charging.

(b) Explosion proof electrical equipment shall be provided conforming to Natior Standards to prevent dust explosion.

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(c) All storage locations shall be provided with high level alarms and interlock facili with transfer pumps to eliminate overflows.
(d) Flame proof electrical equipment confirming to National Standards shall be provided in the areas where volatile solvents and monomers are handled.
(e) Storage tanks of flammable liquids shall be provided with flame arresters and breath valves.
(f) Flow sensing switch shall be provided on flammable liquid and monomer dischar lines to avoid dry running of pump leading to fire.
(g) Safety relief valves shall be provided on all the equipments and pipelines operat above atmospheric pressure.
(h) Each container shall be labelled with correct name of the chemical and necessary precautions shall be taken while handling during the processing.

(3) Paint Processing

(a) **Water based paint**

(i) **Emulsion Manufacturing**

(a) Addition of monomer material into the reactor shall be carried in a controlled manner and the reactor shall be provided with controls and interlock with reactor critical temperature.
(b) Safety relief valve and rupture disc shall be provided in reactor in order to absorb any sudden pressure increase within the reactor. The rupture disc in vent line shall be connected to a dump tank.
(c) Dump tank shall be provided with adequate capacity and located in the open ar away from reactor room.
(d) Accuracy of quantity of Monomer material, Initiator and other critical material sha be maintained during the emulsion processing.
(e) The agitator of the reactor vessel shall be kept running continuously during monomer addition to ensure better heat transfer and to avoid accumulation of unreacted monomer mass.
(f) Reactor shall have good temperature control mechanism to ensure reactor temperature is always less than critical temperature. There shall be provided with resistance type temperature detector at different levels to ensure uniform temperature across the reaction vessel.
(g) Cooling media shall be made available to ensure the reactor temperature is alwa less than the critical temperature.
(h) Monomer Inhibitors stocks shall be maintained in reactor floor to control runaw reaction.
(i) Descaling of condenser walls shall be done once in six months.

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(ii) **Paint Manufacturing(Water based)**

(a) All Twin Shaft Dispensers shall have temperature control mechanism to maintain required temperature during grinding.
(b) Sequence shall go on hold if transfer flow rate is less than the defined flow rate.
(c) There shall be an interlocking mechanism to ensure that no inlet valve to the react is opened before the scrubber vent valve is opened.
(d) Pumps interlock shall be provided with the destination valve and flow switch to prevent the dry running of the pump and over pressurization of pipeline.
(e) Storage Hopper of explosive powder shall have explosion vent as pressure relieving device for equipment have volume greater than 1 cubic meter.
(f) Hopper shall have CO sensor and alarm.
(g) Processing equipment shall have dust collector to minimize dust emission.

(b) **Solvent based paint**

(i) **Resin Manufacturing**

(a) Addition of raw materials in reactor shall be carried in a controlled manner. Addition of catalyst, polyols, polybasic acid and solvent material into reactor shall be provided with controls and interlock with reactor critical temperature and pressure.
(b) Safety relief valve and rupture disc shall be provided as control measure in reactor in order to absorb any sudden pressure increase within the reactor.
(c) Reactors shall be provided with rupture disc in vent line connected to dump ta to collect the excess reaction mass in case of pressurisation scenario.
(d) Dump tank shall be designed on the basis of the maximum size of the reactor and shall be installed in the open area away from reactor area.
(e) The agitator of the reactor vessel shall be kept running continuously duri monomer addition to ensure better heat transfer and to avoid accumulation unreacted mass.
(f) Reactors shall be provided with resistance type temperature detector at different level (top and bottom of reactor) to ensure uniform temperature across the reaction vessel.
(g) Reactors shall be provided with good temperature control mechanism to ensure gradual ramp up of temperature to the reacting mass to ensure it is always less than critical temperature to prohibit the runway scenario.
(h) Cooling media shall be available to ensure reactor temperature is brought to le than critical temperature.
(i) Catalyst and antioxidant shall not be stored reactor floor under a circumstances.

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(j) Interlock shall be provided for the material addition in the reactor along with t nitrogen purging inlet valve.
(k) Charging shall be prohibited if oxygen level in the reactor vessel is more than t prescribed limit during raw material charging.
(l) Cooling media shall be available to maintain the temperature of the react within the prescribed critical temperature range.
(m) There shall be an interlocking mechanism to ensure that no inlet valve to t reactor is opened before the scrubber vent valve is opened.
(n) Vent temperature shall be monitored and if reaches to prescribed higher limi heating shall be stopped.
(o) Pumps interlock shall be provided with the destination valve and flow switch prevent the dry running of the pump and over pressurization of pipeline.

(ii) **Paint Manufacturing (Solvent based)**

(a) Addition of resin, mineral turpentine oil and other dispersing additives shall be done in controlled manner.
(b) Extenders and pigment charging shall be done in controlled manner under continuous stirring.
(c) Powder changing system shall be provided with the suitable control measures conforming to National Standards.
(d) All transfer lines flange joints shall be provided with copper jumpers to dissipate the static electricity accumulated during transfer of liquids.
(e) All solvents lines shall have flange guard to prevent accidental splash of material.
(f) Processing equipment shall be provided with dust extraction systems and scrubber systems.

(4) Packing

(a) All the rotating and moving machine parts shall have machine guarding as p relevant National Standards.
(b) All the conveyor system shall have emergency stop and pull cord system to stop t machine in case of emergency
(c) Lid pressing machines shall be provided with two hand controls.

(5) Finished Product Storage and dispatch

(a) **Manual storage and dispatch**

(i) Hand Operated or Battery Operated trucks shall be used for handling paint pails.
(ii) Pathways for truck movement and people movement shall be clearly marked.
(iii) Truck shall be thoroughly examined by a responsible person to check its

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capacity and condition of loading floor.

(b) **Automated storage and dispatch**

(i) Automatic Storage and Retrieval System shall be provided with interlockii machine guarding.

(ii) Automatic Storage and Retrieval System shall have back-up power to avo immediate stoppage in case of power interruption

(6) General

(a) Critical field instruments shall be tested and calibrated as per the frequency prescribed by original equipment manufacturer to ensure accuracy of measurement.

(b) Hydro pressure test shall be carried for reactor heating and cooling coils at least on in a year.

(c) Standard Operating Procedure shall be prepared and implemented for controlling a adverse situation during the reaction.

(d) Pumps shall not be operated until destination valve is opened.

(e) Workplace monitoring shall be conducted as per relevant National Standard.

(f) Safety signage indicating the prominent hazards shall be placed at conspicuous location as per relevant National Standards.

(7) PPE Matrix

Activity	Recommended PPE
Handling for monomer/solvent	Full body suit(PVC), Full face mask (Organic vapour), gum boots, chemical resistant gloves
Charging of powder	Dust Resistant suit, dust mask, cotton dipped PVC gloves
Handling of hot material	Heat resistant gloves as per the temperature of exposure.
Cleaning of filter bag	Dust Resistant suit, dust mask, cotton dipped PVC gloves
Maintenance work	Cut resistance gloves, PVC dotted gloves and safety helmet
Testing of Raw Materials	Chemical resistant surgical gloves, splash proof goggles, vapour mask
Testing of Paints	Chemical resistant surgical gloves, splash proof goggles, vapour mask
Cleaning of reactor (Confined space)	Supplied air breathing apparatus, Chemical resistant full body suit, gum boots, chemical

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	resistance gloves
Finished Goods loading activities	PVC dotted cotton hand gloves and safety helmet

103. **Leather tanning industries -** under serial no. 15 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to liming and tanning of raw hides and skins and processes incidental thereto**.**

(2) Cautionary notices.-

(a) Cautionary notices as to anthrax in the form specified by the Chief Inspector-cum-Facilitator shall be affixed in prominent positions in the factory where they shall be easily and conveniently read by the persons employed.

(b) A copy of a warning notice as to anthrax in the form specified by the Chief Inspector-cum-Facilitator shall be given to each person employed when he is engaged, and subsequently if still employed, on the first day of each calendar year.

(c) Cautionary notices as to the effects of chrome on the skin shall be affixed in prominent positions in every factory in which chrome solutions are used and such notices shall be so placed as shall be easily and conveniently read by the persons employed.

(d) Notices shall be affixed in prominent places in the factory stating the position of the first-aid box or cupboard and the name of the person in charge of such box or cupboard.

Explanation: For the purpose of sub-para (e) effective steps shall include playing an audio-visual explaining the content of the notice specified in sub-paras (a), (b) and (d) and if chrome solutions are used in the factory, the contents of the notice specified in sub-para (e).

The employer shall conduct safety induction training for all new workers and regular trainings can be provided on the notice specified in sub-paras (a), (b) and (d) and if chrome solutions are used in the factory, the contents of the notice specified in sub-para (c).

(e) If any person employed in the factory is illiterate, effective steps shall be taken to explain carefully to such illiterate person the contents of the notice specified in sub-paras (a), (b) and (d) and if chrome solutions are used in the factory, the contents of the notice specified in sub-para (c).

(f) The notice required shall be displayed under sub-paras (a), (b) and (d) and if chrome

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solutions are used in the factory, the contents of the notice specified in sub-para (c) shall be displayed in Hindi or in language understood by majority of workers

(g) Display the MSDS (Material Safety Data Sheet) for all chemicals used in the process.

(h) Reduction in Exposure to Chromium and its compounds: - The employer shall ensure adequate measures to reduce the exposure to chromium or its compounds during handling or storage used as leather tanning agents so far as reasonably practicable and in any case such exposure shall be below the permissible exposure limit prescribed for chromium and its compounds.

(2) **Protective clothing.-** The occupier shall provide and maintain in good condition the following articles of protective clothing :-

(a) waterproof footwear leg coverings, aprons and gloves for persons employed in processes involving contact with chrome solutions, including the preparation of such solutions;

(b) gloves and boots for persons employed in lime yard;
Provision of Chemical goggles or safety glasses and other appropriate protective gears conforming to the requirements of National Standard or EU/ANSI or approved from DGFASLI/NABL lab for person employed in lime yard or chromium handling.

(c) protective footwear, aprons and gloves for persons employed in processes involving the handling of hides and skins, other than in processes specified in sub-paras (a) and (b) above :

Provided that the gloves, aprons, leg coverings or boots shall be of rubber or leather, but the gloves and boots to be provided under sub-paras (a) and (b) shall be of rubber.

Provided further that the gloves shall not be provided to persons fleshing by hand or employed in processes in which there is no risk of contact with lime, sodium sulphide or other caustic liquor.

(3) **Food, drinks, etc. prohibited in workrooms.-** No food, drink, pan and supari or tobacco shall be brought into or consumed by any worker in any workroom or shed in which hides or skins are stored, treated or manipulated.

104. **Electro-plating industries -** under serial no. 16 in the first schedule under clause (za) of sub-section (1) of section 2

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(1) This shall apply to Electro-Plating Industries.

(2) Exhaust draught. - An efficient exhaust draught shall be applied to every vessel in which an electrolytic process is carried on. Such draught shall be provided by mechanical means and shall operate on the vapour or spray given off in the process as near as shall be at the point of origin. The exhaust draught appliance shall be so constructed, arranged and maintained as to prevent the vapour or spray entering into any room or place in which work is carried on.

(3) Prohibition relating to pregnant women and adolescents. No pregnant women or adolescent shall be employed or permitted to work at a bath.

(4) Protective devices. -

(a) The occupier shall provide and maintain in good and clean condition the following articles of protective devices for the use of all persons employed on any process at which they are liable to come in contact with liquid from a bath and such devices shall be worn by the persons concerned

(i) waterproof aprons and bibs; and

(ii) for persons actually working at a bath, loose fitting rubber gloves and rubber boots or other waterproof footwear, and chemical goggles.

(b) The occupier shall provide and maintain for the use of all persons employed suitable accommodation for the storage and drying of protective devices.

(5) Cautionary placard.- A cautionary placard in the form specified below and printed in the language of the majority of the workers employed shall be affixed in a prominent place in the factory where it can be easily and conveniently read by the workers.

CAUTIONARY NOTICE

Electrolytic Plating

(a) Chemicals handled in this plant are corrosive and poisonous.

(b) Smoking, chewing tobacco, eating food or drinking, in this area is prohibited . No food stuff or drink shall be brought in this area.

(c) Some of these chemicals shall be absorbed through the skin and shall cause poisoning .

(d) A good wash shall be taken before meals.

(e) Protective devices supplied shall be used while working in this area.

(f) Spillage of the chemicals on any part of the body or on the floor shall be immediately washed away with water.

(g) All workers shall report for the prescribed medical tests regularly to protect their own health.

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105. (a) **COKE OVEN BY-PRODUCTS AND COALTAR DISTILLATION PRODUCTS -** under serial no. 17 (a) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall is apply to Coke Oven by-products and Coaltar Distillation products.

(2) Safety Provisions in by-product plants

(a) Potential areas of leak of Ammonia, benzene and other hazardous substances shall be identified and appropriate actions shall be taken for eliminating the leaks.

(b) Measures shall be taken to eliminate or reduce the escape of hazardous substances during maintenance operations, while samples are drawn for laboratory analysis, and during barge, truck and railcar loading.

(c) Tanks containing Chemicals shall be installed in a leak proof dyke having volume as per safety standard. The dyke shall have a covered sump with provision to recycle the spillages back into the system.

(d) Coke oven gas contains high levels of carbon monoxide and hydrogen sulphide and is lethal in sufficient concentrations. Gas detection and alarm systems shall be installed in all areas where coke oven gas might build up in a release.

(e) All gas pipes shall have provision such as U-seal, valves and flanges for positive isolation.

(f) Further, gas lines shall have nitrogen or steam injection system and vents for purging out the gas.

(g) A periodic ambient air monitoring program shall be instituted, particularly for CO, Ammonia and benzene.

(h) Coke by-product workers shall receive regular medical surveillance, particularly focusing on the early detection of leukemia and other blood disorders caused by benzene, with appropriate follow-up.

(i) Full body showers with eye wash facility shall be provided in all Chemical storage areas such as Caustic Soda, Acids, Benzene etc.

(j) Provision for earth connection shall be provided in Tar and Benzene loading stations.

(k) Jump over strips of conductive metal preferably Copper shall be provided across all flanges on Pipes carrying Tar, Tar products, Benzol, Benzene, Toluene, Xylene (BTX) and other hydrocarbon products.

(l) All Gas pipelines shall be provided for gas condensate drains through adequately designed seal pots.

(m) Overhead rotational boom anchor shall be installed for safety of tankers driver/helper while tankers loading/unloading

(n) Adequate numbers of emergency equipment such as BA set, stretcher, oxy-pack and first aid box shall be made available

(o) Portable CO detector shall be provided to all working agencies that are associated

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in gas handling area.

(3) Gas Condensation Section:

(a) To prevent exposure to Coke Oven Gases (COG) from leaky lines/ flanges/ valve gland packing etc, regular inspection of COG lines to detect leakage if any shall be carried out at frequent intervals and the leak any shall be attended immediately.

(b) Online CO monitors with alarm system shall be installed and portable CO monitors shall be used to detect Gas leakage.

(c) Online oxygen analyzers shall be provided in Coke Oven Gas circuit before electrostatic precipitator interlocked for tripping of High-voltage transformer in case of Oxygen percentage is above 0.8%

(d) Oxygen content in COG shall be checked periodically at lab in every 2 hrs.

(e) Positive isolation of COG lines shall be ensured before opening any flanges.

(f) Non sparking tools shall be used in the COG condensation area.

(g) Gas mask and water seal shall be used if CO % is found shall be above 50ppm

(h) Gas pipelines thickness shall be measured and validated annually.

(i) Explosion flap shall be provided in Electrostatic Tar Precipitator.

(j) In flare, stack pressure control system shall be installed to maintain line pressure to avoid pressurization that shall happen in COG pipeline

(k) In flare, stack water seal system shall be installed for safety of gas pipeline.

(l) In each vent, sample point provision shall be provided.

(4) Ammonium sulphate plant:

(a) To prevent exposure to sulphuric acid spray, regular checking and repair of pipelines, as per requirement shall be carried out.

(b) Condition of pipes, flanges and flange guards, valve glands etc. shall be properly maintained.

(c) While acid unloading is going on safe distance shall be maintained.

(d) Safety shower shall be provided in the plant.

(5) Ammonia stripping section

(a) All precautions shall be taken to avoid Ammonia vapor release while operating strippers.

(b) Sample collection of Stripper water, de-acidified water, and waste water shall be handled properly

(c) Refractory bricks line shall be provided in caustic area with proper dewatering arrangement to handle any exigencies

(6) Benzol Recovery and Rectification section

(a) Continuity jumpers over pipeline flanges and mechanical seals in pumps shall be used and checked frequently for their integrity.

(b) Nitrogen blanketing system shall be provided in all benzol associated tanks to prevent any release of benzol to atmosphere.

(c) Volatile Organic Compounds (VOC) detector shall be installed in BTX plant.

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(d) Explosion proof electrical equipment shall be installed in BTX plant.

(e) Steam injection system shall be added in each tank of benzol area for any exigencies purpose to cutoff oxygen ingress in the oil tanks.

(f) Usage of mobile phones shall be prohibited.

(7) Sulfur recovery and solidification section

(a) The Sulphur transfer pumps shall not be operated unless steam jacketing is in service and at operating temperature.

(b) Flow shall be kept through the pumps at all the time during pump operation to provide proper lubrication and prevent overheating.

(c) Overheating of refractory shall be avoided, to prevent refractory health

(d) Hot jobs shall be carried out with proper protocols

(e) In sulfur recovery unit, people shall keep body sideways when opening/closing Valves to prevent from being burnt by steam or sulfur

(8) Tar handling section

(a) Flange guard shall be provided in high pressure pipeline

(b) Tar sludge shall be recycled properly

(c) Coal tar is considered shall be a human carcinogen. Care shall be taken to avoid inhalation of Tar Chemicals.

(9) Biological treatment plant

(a) Biological-chemical sludge shall be recycled properly

(b) MSDS shall be followed for handling the chemicals

(10) Tar distillation plant

(a) Isolation of line and draining of line shall be ensured before starting any maintenance job to prevent spray of Tar and tar products.

(b) Napthalene storage area is highly fire prone. Hence all precautions shall be taken while planning in hot job in the area.

(c) Steam jacketing line for tar and other products shall be thoroughly heat insulated.

(d) Water curtains shall be provided around storage tanks for oil fractions such as Light oil, anthracene, Heavy oil, creosote etc.

(e) Dyke wall shall be provided around all storage tanks.

(f) Any liquid discharge to surface drain shall be strictly prohibited.

(g) Floor washings shall be collected in pit and recycled to system as they shall contain inflammable material

(11) Sulphuric acid plant:

(a) Regular checking of pipelines, flanges and glands shall be carried out for possible leakages and leakages shall be attended on priority.

(b) Safe distance shall be maintained from acid lines while pump is in operation.

(c) SOP shall be developed and followed in acid loading / lifting.

(d) Proper isolation and shutdown shall be ensured before handing over of acid line for maintenance.

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(e) Access control shall be provided for Sulfur storage area.

(f) While start up of the plant, SO2 neutralization shall be ensured.

(g) All flanges in Acid pipes shall be equipped with flange guards. Emergency water bathtub shall be provided for usage if a person is exposed to Acid.

(12) General

(a) Workmen shall stay away from all moving and rotary equipment

(b) Portable Carbon Monoxide detector shall be used while inspecting De-dusting Area

(c) Coke dust discharge shall be carried out with adequate moisture and proper PPEs

(d) All Confined Spaces shall be identified and standards shall be adhered.

(e) Steam traps shall be checked monthly.

(f) All interlocks shall be checked periodically.

(g) Any interlock shall be bypassed only after appropriate authorization and documentation.

(h) Interlocks shall be restored at the earliest, else management of change shall be instituted

(13) PPE Matrix

Plant Area	PPEs
Ammonium sulphate plant	face shield, PVC suit and shoes
Ammonia stripping section	Face shield and Gas masks
Benzol recovery plant	Gas Masks, PVC Apron and shoes
Sulphur recovery plant	Anti-static clothing and protective mask
Tar handling section	Face mask, PVC Shoes, Gum boots
Sulphuric acid plant	Hand gloves, gum boots, Face shield, dust mask, goggles and acid proof apron
Tar distillation plant	apron, face shield, gum boot

(b) **Industrial gases (**nitrogen, oxygen, acetylene, argon, carbon dioxide, hydrogen, sulphur dioxide, nitrous oxide, halogenated hydrocarbon, ozone, or any like gases) - under serial no. 17 (b) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all factories involved in manufacture, use, processing, and disposal of

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Industrial Gases viz., Nitrogen, Oxygen, Acetylene, Argon, Carbon dioxide, Hydrogen, Sulphur dioxide, Nitrous Oxide, Halogenated Hydrocarbon, Ozone, or any like gases.

(2) ACETYLENE

(a) A pressure switch interlocked with the pressure sensor shall be installed in the production chamber with the calcium carbide feeding conveyor,

(b) The production chamber shall be installed with temperature sensor having interlocking with the water supply valves to maintain the process temperature.

(c) The Production chamber shall be equipped with Hydraulic jack that operates automatically to seal the carbide feeding space from which produced acetylene can escape.

(d) The production chamber produced gas passage shall be equipped with flash back arrestor.

(e) The location where acetylene production is carried out shall be fitted with flame proof light fittings with temperature maintained at normal room temperature.

(f) Double Earthing of the equipment shall be ensured conforming to National Standard.

(g) Warning sign in self glow reflective material shall be provided to indicate about the potential hazards.

(h) Body shower with eye washers shall be installed in the vicinity of the working area and ensure that the supply of water shall be continuous.

(i) The filling manifold shall be equipped with non-return valve to ensure single direction movement of the gas.

(j) Water sprinklers shall be installed for the cooling of cylinders during gas filling process.

(k) Testing of the Chamber and Pipe lines shall be conducted by the competent person.

(3) ARGON (Ar)

(a) Equipment and systems for the production, storage, transfer, and dispensing of cryogenic Argon liquid shall be of compatible materials with the products handled and the temperatures encountered.

(b) Systems shall be equipped with pressure relief devices to prevent excessive pressure build-up due to the vaporization of the cryogenic liquid as heat leaks into the system.

(c) Pipes carrying Argon shall be equipped with pressure relief devices in a manner that prevents the build-up of excessive pressure due to vaporization of liquid between valves.

(d) Only transfer lines designed for cryogenic service shall be used.

(e) Argon liquid and gas shall be allowed to evaporate only in well-ventilated outdoor locations which are remote from work areas and building air intake.

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(f) Safe handling of liquid argon at very low temperature shall be as per MSDS or manufacture guidelines.
(g) The leak detector shall be installed and the area around shall be well ventilated to quickly dilute the argon gas in case of any leakage.
(h) Warning sign in self glow reflective material shall be provided to indicate about the potential hazards and access shall be restricted.
(i) The equipments and controls shall be maintained and recorded.

(4) CARBON DIOXIDE (CO2)

(a) The Equipment and systems for the production, storage, transfer, and dispensing of liquid / solid carbon dioxide shall be of materials compatible with the products handled and the temperatures encountered.
(b) Systems shall be equipped with pressure relief devices to prevent excessive pressure build-up due to the vaporization of the liquid as heat leaks into the system.
(c) Pipes carrying Carbon Dioxide shall be equipped with pressure relief devices in a manner that prevents the build-up of excessive pressure due to vaporization of liquid between valves.
(d) Only transfer lines designed for cryogenic service shall be used.
(e) For any disposal, carbon dioxide gas shall be vented slowly to a well-ventilated outdoor location remote from personnel work areas and building air intakes.
(f) Liquid carbon dioxide shall be allowed to evaporate only in well-ventilated outdoor locations which are remote from work areas and building air intake.
(g) Safe handling of liquid carbon dioxide at very low temperature shall be as per SOP and MSDS
(h) The leak detector shall be installed and the area around shall be well ventilated to quickly dilute the carbon dioxide gas in case of any leakage
(i) Warning sign in self glow reflective material shall be provided to indicate the presence of potential hazards, to restrict access.
(j) The equipments and controls shall be maintained and recorded.
(k) Emergency response through well-defined and established Emergency Response Plan shall be in place.

(5) HALOGENATED HYDROCARBON

(a) Leak detector shall be installed and the area around shall be well ventilated to quickly dilute the traces of Halogenated Hydrocarbons in case of any leakage.
(b) Earthing of the system shall be conforming to National Standard and maintained to prevent the accumulation of static charge.
(c) All the workers shall be trained in operating procedures and potential hazards of Halogenated Hydrocarbons.

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(d) Adequate warning sign in self glow reflective material shall be provided to indicate the presence of potential hazards, to restrict access

(e) All the equipments and controls shall be adequately maintained and record shall be maintained.

(6) HYDROGEN (H_2)

Electrolysis process

(a) The room in which electrolysis plant is installed for the production of Hydrogen gas and electric generation room shall be separate from the plant for storing and compressing and well ventilated.

(b) The hydrogen gas leak detector shall be installed to warn in case of leakage.

(c) The electrolyser plant shall be fitted with automatic recorder of purity of hydrogen with alarm lights.

(d) The purity of the gas is tested at the suction end of the compressor only.

(e) The limit switch in the gas holder a sensitive negative pressure switch shall be provided in or adjacent to the suction main for hydrogen close to the gas-holder and between the gas holder and the hydrogen compressor to switch off the compressor motor in the event of the gas-holder being emptied to the extent as to cause vacuum.

(f) Electrical connection at the electrolyser cells and at the electric generator terminals shall be so constructed as to preclude the possibility of wrong connections leading to the reversal of polarity and in addition an automatic device shall be provided to cut off power in the event of reversal of polarity owing to wrong connection either at the switch board or at the electric generator terminals.

(g) Hydrogen gas pipes shall be painted with distinguishing colors conforming to national standard,

(h) Hydrogen pipe is opened for repairs or any other work, on reconnection the pipe shall be purged of all air before hydrogen is allowed to pass through that pipe.

(i) All electrical wiring and apparatus in the electrolyser room shall be of flame- proof construction or enclosed in flame proof fittings and no naked light or flame shall be allowed shall be taken either in the electrolyser room or where compression and filling of the gases is carried on and such warning notices shall be exhibited in prominent places.

(j) No part of electrolyser plant and the gas holders and compressor shall be subjected to welding, brazing, soldering or cutting until steps have been taken to remove any explosive substance from that part and render the part safe for such operations and after the completion of such operations no explosive substance shall be allowed to enter that part until the metal has cooled sufficiently to prevent risk of explosion.

(k) Every part of the electrolyser plant and the gas holder and compressors shall have a regular schedule of overhaul and checking and every defect noticed shall be rectified forthwith.

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(l) All hydrogen gas supply systems shall be grounded (bonded and earthed) to provide protection against the hazards of stray electrical currents and static electricity.

(7) NITROGEN (N_2)

(a) Equipment and systems for the production, storage, transfer, and dispensing of cryogenic Nitrogen liquid shall be of materials compatible with the products handled and the temperatures encountered.

(b) Systems shall be equipped with pressure relief devices to prevent excessive pressure build up due to the vaporization of the cryogenic liquid as heat leaks into the system.

(c) Pipe carrying nitrogen shall be equipped with pressure relief devices in a manner that prevents the build-up of excessive pressure due to vaporization of liquid between valves.

(d) Only transfer lines designed for cryogenic service shall be used.

(e) Disposal of Nitrogen gas shall be vented slowly to a well-ventilated outdoor location remote from personnel work areas and building air intakes.

(f) Liquid nitrogen shall be evaporated in well-ventilated outdoor locations which are remote from work areas and building air intake.

(g) Safe handling of liquid nitrogen at very low temperature shall be done as per SOP and MSDS.

(h) Warning sign in self glow reflective material shall be provided to indicate the presence of potential hazards.

(i) The equipments and controls shall be maintained and recorded.

(j) Emergency response through well-defined and established Emergency Response Plan shall be in place.

(8) OXYGEN (O2)

(a) Equipment and systems for the production, storage, transfer, and dispensing of gaseous and liquid oxygen shall be constructed of materials compatible with the products handled and the temperatures encountered.

(b) Systems shall be equipped with pressure relief devices to prevent excessive pressure build-up due to the vaporization of the liquid oxygen that can occur as the liquid oxygen is vaporized by heat flowing into the container.

(c) Pipe carrying oxygen shall be equipped with pressure relief devices in a manner that prevents the build-up of excessive pressure due to vaporization of liquid between valves.

(d) Only transfer lines designed for cryogenic service shall be used.

(e) Easily combustible materials, especially hydrocarbon oils and greases, shall be kept away from high oxygen concentrations and sources of ignition eliminated.

(f) Sudden opening of valves, and particles carried by oxygen flowing at high velocity,

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shall be avoided since these actions can result in ignition.

(g) Piping systems, equipment and containers shall be made free from oil, grease, and other combustible material before putting them into oxygen service.

(h) If liquid oxygen is spilled on clothing, the clothing shall be removed at once and aired out before reuse.

(i) Transfer of liquid oxygen where it shall spill onto gravel or another porous material that shall contain oil drippings shall be avoided.

(j) For any disposal, oxygen gas shall be vented in a manner that does not create an oxygen rich atmosphere in a confined space.

(k) Safe handling of liquid oxygen at very low temperature shall as per SOP and MSDS.

(l) The oxygen concentration monitoring detector shall be installed in confined operating area and the area around shall be well ventilated to quickly dilute the oxygen gas in case of any leakage

(m) All the flanges of pipelines and equipment shall be bonded by suitable conductive jumpers to avoid any accumulation of static charges.

(n) Warning sign in self glow reflective material shall be provided to indicate the presence of potential hazards to restrict access.

(o) The equipments and controls shall be maintained and recorded.

(p) Emergency response through well-defined and established Emergency Response Plan shall be in place.

(9) OZONE (O3)

(10) Manufacturing in Ozone Generator

Bombarding Oxygen with Ultra Violet Radiation**.**

(a) The Ozone Generators shall be light tight closed enclosure with no leakage of Ultra Violet Rays and the produced Ozone Gas.

(b) If the area is not fully enclosed from the Ultra violet source, screens, shields and barriers shall be provided to protect the worker from ultraviolet rays,

(c) The partial enclosures shall not be removed when the equipment is in use. If they are discoloured, degraded, or damaged, it shall be replaced.

(d) The Ozone Generator shall be fitted with automatic recorder of purity of Oxygen with alarm lights

(e) The purity of the gas shall be tested at the suction end only.

(f) The ozone leak detector shall be installed and the area around shall be well ventilated to quickly dilute the ozone gas in case of any leakage

(g) Measures shall be taken to limit access to Ultraviolet source.

(h) Warning sign in self glow reflective material shall be provided to indicate the presence of potential hazards to restrict access

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(i) The equipments and controls shall be maintained and recorded.

(11) Passing air through a high-voltage Alternating Current electrical discharge in dielectric.

(a) The Ozone Generators shall be closed enclosure with no open access to high voltage electrical discharge system and no leakage of the produced Ozone Gas.
(b) The Generator shall be fitted with interlocks to automatically cut off the electrical supply when the interlocks are opened.
(c) Double Earthing of the electrical system and High Voltage Transformer confirming to National Standard shall be provided.
(d) Electrical Insulation mats shall be provided in front of the electrical panels as per national standard.
(e) The ozone leak detector shall be installed and the area around shall be well ventilated to quickly dilute the ozone gas in case of any leakage.
(f) Warning sign in self glow reflective material shall be available to indicate the presence of potential hazards to restrict access.
(g) The equipments and controls shall be maintained and recorded.

(12) SULPHUR DIOXIDE (SO2)

(a) The SO2 Sensors shall be provided in leakage prone areas and the leak shall be immediately attended.
(b) The spilled or leaked gas shall be knocked down by fog or fine water spray.
(c) The storage shall be within a dyke and contaminated water shall be recovered for disposal.
(d) The Sulphur dioxide gas shall be stored in a cool, temperature controlled, dry and well-ventilated area and ensure that it shall not be stored with incompatible chemicals.
(e) The Sulphur dioxide gas shall not be stored in direct sunlight and shall be stored away from heat and ignition source
(f) The storage area shall have access control and authorized persons only can enter the premises.
(g) In case of spills, escape type respiratory protective equipments shall be readily made available.

(13) NITROUS OXIDE

(a) **Exposure Limits:**

(i) PEL:TWA = 46 mg/m^3

(ii) IDLH = Not defined; acute exposures above 100 parts per billion not recommended.

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(b) **First Aid:** The following incidents shall be promptly treated by first aid as indicated:

(i) Eye contact:

(a) Immediate flush with plenty of water, occasionally lifting the upper and lower eyelids, continuing for at least 10 minutes;

(b) Check for and remove any contact lenses; and,

(c) Get medical attention.

(ii) Skin contact:

(a) Flush contaminated skin with plenty of water;

(b) Remove contaminated clothing and shoes;

(c) Get medical attention if symptoms occur or persist.

(d) Wash clothing before reuse.

(e) Clean shoes thoroughly before reuse.

(iii) Inhalation and Ingestion:

(a) Remove victim to fresh air and keep at rest in a position comfortable for breathing;

(b) If it is suspected that fumes are still present, the rescuer shall wear an appropriate mask or self-contained breathing apparatus.

(c) If victim is not breathing, if breathing is irregular, or if respiratory arrest occurs, provide artificial respiration (avoiding mouth-to-mouth resuscitation) or oxygen by trained personnel, while another person calls a poison center or physician.

(d) If victim is unconscious, place in recovery position and get medical attention immediately.

(e) Maintain an open airway.

(f) Loosen tight clothing such as a collar, tie, belt or waistband.

(g) In case of inhalation of decomposition products in a fire, symptoms shall be delayed, and the exposed person kept under medical surveillance for 48 hours.

(c) **Medical Examinations:**

(i) Before beginning employment and at regular intervals after that, for those with frequent or potentially high exposures, the following tests examination of the nervous system shall be conducted.

(ii) If symptoms develop or overexposure is suspected, the following tests shall be done:

(a) Complete blood count; and,

(b) Liver and kidney function tests

(d) **Safety Precautions:**

(i) All related equipment shall be:

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(a) of compatible materials;
(b) cleaned for Oxygen service;
(c) rated for the cylinder pressure;
(d) completely checked for leaks before every use; and,
(e) free of oil and grease.

(ii) Back-flow preventative and pressure-relief devices shall be used in the piping.

(iii) Cylinders and other containers shall always be kept in upright position, protected from damage, and not dragged, slid, or dropped.

(iv) No attempt shall be made to transfer the gas from one cylinder/container to another.

(v) Reduction and other valves, and fittings shall be kept free from water, oil and grease.

(vi) The gas shall be used only outdoors or in a well-ventilated area.

(vii) Labels affixed by manufacturer or supplier shall not be defaced, altered, or removed.

(viii) In case of leak, the following safeguards shall be carried out:
(a) Evacuate affected and surrounding areas;
(b) Keep unnecessary and unprotected persons from entering;
(c) Shut off all ignition sources;
(d) Ban flares, flames, and smoking in hazard area;
(e) Avoid breathing gas;
(f) Provide adequate ventilation;
(g) Wear appropriate respirator when ventilation is inadequate; and,
(h) Put on appropriate personal protective equipment.

(ix) Emissions from ventilation or work process equipment shall be checked to ensure that they comply with local/regional environmental protection regulations, using fume scrubbers, filters, or modifications to the process equipment to achieve this criterion.

(x) The following hygiene measures shall be strictly observed:
(a) Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking, or using the lavatory, and at the end of the working period.
(b) Use appropriate techniques to remove potentially contaminated clothing.
(c) Wash contaminated clothing before reusing.
(d) Ensure that eyewash stations and safety showers are close to the workstation location.
(e) Breathing the gas shall be avoided.

(xi) Oxygen content shall be routinely tested to ensure that it is at least 19% by

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volume.

(xii) Dependency on PPE and exposure to Nitrous Oxide shall be reduced by enclosing operations and/or providing local exhaust ventilation at the site of chemical release.

(e) **Personal Protective Equipment:**

(i) Eye/face protection:

(a) Safety goggles, or glasses with side-shields, complying with an approved standard shall be used, in case of potential exposure to liquid splashes, mists, gases or dusts.

(b) If contact is possible, use safety glasses with side-shields.

(ii) Hand protection:

(a) Chemical-resistant, impervious gloves complying with an approved standard shall be worn at all times when handling chemical products in case of potential exposure.

(b) It shall be ensured that the gloves used still retain their protective properties.

(iii) Body protection: PPE for the body, and footwear shall be selected based on the task being performed and the risks involved, and shall be approved by a specialist before handling this product.

(iv) Respiratory protection:

(a) Respirator shall be selected to meet the standard or certification appropriate for the task and exposure potential.

(b) Respirators shall be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects.

(f) **Handling and Storage:**

(i) Valves shall be closed after each use and kept closed when empty.

(ii) Valves shall not be opened until connected to equipment prepared for use, and then opened slowly.

(iii) Store room shall be kept locked up, when not in use.

(iv) Containers shall be stored tightly closed, in a well-ventilated place, below 50° C, away from heat and ignition sources.

(v) Containers shall be protected from sunlight.

(g) **Waste Handling:**

Waste, scrap, debris, and any other materials contaminated with Nitrous Oxide and consigned for disposal shall be collected and disposed off to conform to National Standards for hazardous wastes.

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(14) Safety Measures for Storage and Transportation

(a) Storage area shall be installed with gas leak detectors and shall be well ventilated.
(b) The Cylinders shall be stored separately with no traces of grease and oil in the vicinity.
(c) Adequate warning sign in self glow reflective material shall be provided to indicate the presence of potential hazards to restrict access.

(15) Through Pipe Lines

(a) Gas pipes shall be painted with distinguishing colours conforming to National Standards.
(b) Whenever any gas pipe is opened for repairs or any other work, on reconnection the pipe shall be purged of all air before gas is allowed to pass through that pipe.
(c) No welding, brazing shall be allowed subjected to repairing damaged/defective area.
(d) Gas leak detectors shall be installed to notify any leakage and automatic supply cut off system shall be installed to cut off the supply in case of any leakage.
(e) The Gas Pipelines shall have a regular schedule of overhaul and checking and every defect noticed shall be rectified forthwith.

(16) Through Trucks/Vehicle

(a) The cylinders shall be transported in specially designed racks/trolleys.
(b) The Cylinders shall be tightly anchored in the racks/trolleys.
(c) The Cylinder Valves shall be equipped with protective caps.
(d) Use of wheel stopper to prevent the rolling of trucks while loading and unloading of gas cylinders.
(e) The trucks/vehicles carrying the cylinders shall be labelled with the type of gas handling and hazards and mitigation methods.
(f) Provisions shall be made at all vehicle loading / unloading stations and product transfer stations for electrical bonding and grounding of the vehicle to prevent statically induced electric discharge.
(g) A separate ground cable and clamp shall be provided for each flammable gas trailer or other non-permanent component.

(17) PPE Matrix

S. No	Activity/Process	PPE
1	Production of cryogenic Argon	Heavy leather or cryogenic protective gloves, cryogenic protective suit, eye

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	liquids at extremely low temperature	protection, aprons, safety shoes and self-contained breathing apparatus.
2	Production of liquid / solid Carbon Dioxide at extremely low temperature	Heavy leather or cryogenic protective gloves, goggles, aprons, safety shoes, eye protection, self-contained breathing apparatus, in case of handling emergencies related to leakage of liquid carbon dioxide.
3	Leakage of Halogenated Hydrocarbon	Goggles, Full face shields, Full body aprons, nitrile/latex hand gloves and organic vapour respirators.
4	Generation of hydrogen	Insulated gauntlet hand gloves, face shield, flame-retardant cotton or Nomex clothing and electrically insulated safety shoes.
5	Production of cryogenic Nitrogen liquids at extremely low temperature	Heavy leather or cryogenic protective gloves, cryogenic protective suit, goggles, aprons, safety shoes, self-contained breathing apparatus, in case of handling emergencies related to leakage
6	Production of liquid Oxygen at extremely low temperature	Heavy leather or cryogenic protective gloves, cryogenic protective suit, goggles, aprons, safety shoes, eye protection, self-contained breathing apparatus, in case of handling emergencies related to leakage of liquid oxygen.
7	Generation of ozone gas by bombarding of oxygen with Ultraviolet rays	Ultraviolet resistant goggles, Ultra violet - absorbing full face shields, Full body aprons, nitrile/latex or tightly woven fabric gloves and face mask.
8	Generation of	Electrically insulated hand gloves and

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	ozone gas by Passing air through a high-voltage ac electrical discharge in dielectric	electrically insulated safety shoes.
9	Sulphur Di-oxide	Aprons, goggles, Respirators, rubber gloves, rubber boots and overalls coverin.

(c) **Industrial carbon -** under serial no. 17 (c) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply for the factories involved in manufacturing of carbon black.

(2) Raw Material unloading, storing and handling - Heavy Furnace Oil

(a) While collecting sample from the oil tanker, Safety Harness shall be used for working at Height.

(b) Oil tankers shall have spark arrestor fitted in the exhaust system.

(c) Wheel Stopper, Hand Break shall be applied and ensured before commencement of sampling and unloading.

(d) "No Smoking" signage shall be displayed at Unloading areas and it shall be strictly followed.

(e) Empty drum shall be kept under main discharge valve of the tanker to gather the leakage/spillage, if any and ensure no spillage of oil. If any collect oil in dedicated bin, shall be put back into unloading header. Unloading area shall be washed with hot water, and the drain shall be connected to Effluent Treating Plant (ETP).

(f) In case of overflow of oil storage tanks, while unloading or transfer of oil, the unloading or transfer shall be stopped immediately.

(g) All the tankers shall be placed with Min. 4 nos of wheel stopper during unloading.

(h) Before unloading, crocodile clip shall be connected to the tanker to dishcharge static electricity continuously.

(i) All flange joints shall be provided with earthing jumpers and shall have adequate continuity test.

(3) Carbon Black Operation

(a) **Oil Pump Operation**

All rotating equipments shall be guarded properly to prevent any injury.

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(b) **Oil Blending and Feeding:**

(i) Secondary Containment System shall be provided at Charge Pump Area Operation to contain Oil leakage and spillage.

(ii) All pumps and lines shall have appropriate colour coding and tagging as per Flow Diagram with Nomenclature.

(c) **Oil Pump House Operation:**

(i) In case of any oil leakage at any point of time during oil line up, inlet valve shall be closed immediately.

(ii) All hot surface area shall be insulated and cladded with proper identification and tagging.

(iii) All oil lines shall be properly identified, colour coded and tagged with their flow indication.

(d) **Additive Preparation and Dosing in Reactor:**

(i) Solution shall be lined up to one of the charge pump and shall be ensured that there is no leakage and the suction strainer is in line.

(ii) Material Safety Data Sheet for related chemicals shall be displayed and the workers shall be given training on safety while handling chemicals.

(iii) All process chemical storage tanks, vessels shall be identified and tagged.

(e) **Bag Filter Operation and Maintenance:**

(i) There shall be no black emission from PBC stack. If any emission observed, it shall be identified and isolated.

(ii) PBC shall be totally purged and CO level shall be less than 50 ppm prior to commencement of maintenance of Bag filters. Temperature of PBC module shall be less than 80 Deg C.

(iii) Work Permit and other relevant clearance shall be adhered with respect to entry into confined Space for maintenance work.

(iv) Supplied Air Line with Breathing Apparatus shall be provided during the maintenance work in Confined Space.

(v) Carbon Black shall be removed by cone washing.

(f) **Palletisation Operation and Maintenance:**

(i) Work Permit and other relevant clearance shall be adhered prior to commencement of maintenance work.

(ii) Cleaning of Pin Mixer shall be carried out only after stopping the Palletizer operation.

(g) **Dryer Operation and Maintenance:**

(i) In case burner flame gets extinguished after firing, oil flow to the burner shall be closed immediately and the burner shall be removed.

(ii) Work Permit and other relevant clearance shall be adhered prior to commencement of Maintenance work.

(iii) Necessary signage boards for hot surface area, loose clothing restriction shall

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be displayed at workplaces.

(iv) Girth gear of dryer shall be properly fenced and the rotating parts shall be properly safe guarded.

(h) **Bucket Elevator Operation and Maintenance:**

Bucket Elevator Operation area shall be clearly marked and unnecessary movement of the workers shall not be allowed during operation.

(4) Carbon Black Packing, Loading and Dispatch

(a) In case any bag found leaky during packing, the packing operation shall be stopped by operating emergency push button.
(b) Forklifts used for handling packing materials shall be in good working condition and fitted with safety devices like Horn, Reverse Horn, Lights, Seat Belt etc., and they shall be in operating conditions.
(c) EOT cranes shall be maintained and operated in safe manner as per SOP.
(d) Truck / Containers shall be parked in designated loading points and shall be ensured that wheel Stopper, Hand Brake are applied before loading.

(5) General

(a) All rotating equipments shall be adequately guarded to prevent any injury.
(b) Proper ear plug/muffs shall be used by the workers to protect them from the high noise level.
(c) Proper housekeeping shall be ensured by regular washing and cleaning of workplaces.
(d) SOP and SWP shall be developed and followed for raw material handling and storing, and operation of carbon black.

(6) PPE Matrix

S. No	Area	Prescribed PPE's
1	Raw Material Area	Safety helmet, Safety belt with fall arrestor, Safety Goggles Nose mask, Safety Shoes, Hand Gloves
		Safety helmet, Safety Goggles Hand gloves,

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		safety shoes Nose mask,
2	Reactor Area	Heat resistant hand gloves, Face shield, Safety helmet, Safety shoes, Nose mask. Protective clothing Use Ear Muff
3	Bag Filter Area	Heat resistant hand gloves, Safety helmet, Safety shoes, Nose mask. Compressed air respiratory system
4	Dryer and Pelletizing area	Heat resistant hand gloves, Safety helmet, Safety shoes, Nose mask.
5	Packing and Loading area	Cotton hand gloves, Dust Mask, Safety harness, Safety Helmet Safety shoes,

(d) **Alkalies and acids -** under serial no. 17 (d) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all factories or any part thereof in which acids or alkalis are manufactured, store, handled, packed or used.

(2) Flooring.:-The floor of every workroom to which this para applies shall be made of impervious, alkalies and acids-resistant material and shall be so constructed as to prevent collection of acids and alkalis. The surface of such floor shall be smooth and cleaned as often as necessary, and maintained in a sound condition.

(3) Protective equipment. :-

(a) The occupier shall provide, maintain in good order and keep in a clean condition for the use of all persons employed in any operation. Suitable protective wear for hands and feet, suitable aprons, acid handlers, goggles and suitable respirators.

(b) The protective equipment provided shall be used by the person concerned while at

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work.

(4) Water facilities.-

Eye wash and water shower shall be provided at a height of 2.1 metres secured from a pipe of 2.5 centimeters diameter and fitted with quick acting valve so that in case of injury to the worker by acid or alkalis, the injured part can be thoroughly flooded with water.

(5) Cautionary notice.-

A cautionary notice in the following form and printed in the language which majority of the workers employed understand, shall be affixed prominently at workplace where it can be easily and conveniently read by the workers. If any worker is illiterate, effective steps shall be taken to explain carefully to him contents of the notice so affixed:-

Cautionary Notice - Danger

Acids and Alkalis cause severe burns and vapours thereof shall be extremely hazardous. In case of contact, immediately flood the part effected with plenty of water for at least 15 minutes.

(6) Transport. :-

(a) Acids or alkalis shall not be filled, moved or carried except in containers, including crates of sound construction and of sufficient strength.

(b) Containers having a capacity of 11.4 liters of acids or alkalis shall be placed in a receptacle or crate and then carried by more than one person at a height below the waistline unless a suitable rubber-wheeled truck is used for the purpose.

(7) Device for handling acids or alkalis.:-

(a) Suitable tilting or lifting device shall be used for emptying jars and carboys containing acids.

(b) Alkalis shall not be handled by bare hands but by means of a suitable scoop.

(8) Opening of valves.-

Valves fitted to containers holding acid or alkali which do not work freely shall not be forced open. They shall be opened by a worker suitably trained for the purpose.

(9) Cleaning tanks, stills etc.

In cleaning out or removing residues from stills or other large chambers used for holding acids wooden implements shall be used to prevent production of arseniuretted hydrogen (arsine).

(10) Storage.:-

Acids and Alkalis shall not be stored in any room used for storing turpentine, carbides, metallic powders, combustible materials and non-compatible chemicals.

(e) **Chromates and dichromates** - under serial no. 17 (e) in the first schedule under clause (za) of sub-section (1) of section 2

(1) CHROMATES

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(a) This shall apply to the manufacture, use, processing, and disposal of various chromates such as Hexavalent Chromium or Chromium (VI) compounds. For Chromic acid, Chromium (II), Chromium (III), and their Chromate compounds, the exposure limits and other factors discussed herein vary considerably, and hence for a particular chemical under Chromates, the MSDS provided by the manufacturer, supplier, or importer shall be referred to, regarding PEL, TWA, and IDLH values, as well as for other properties listed herein.

(b) CHROMIUM (VI) COMPOUNDS

(i) **Exposure Limits:**

(a) PEL: TWA = 0.005mg/m^3.

(b) IDLH (Carcinogen) = 15 mg/m^3 [as Cr(VI)]

(c) As Chromium (VI) is an established carcinogen in humans and there is no safe level of exposure to a carcinogen, and hence all contact shall be reduced to the lowest feasible level.

(ii) **Safety Precautions:**

(a) Work shall be done only in the demarcated areas for Chromium(VI) in a manner that adequately establishes and alerts employees of the boundaries of the regulated area, entry being limited only to responsible personnel.

(b) Periodic monitoring of TWA shall be conducted for each worker to represent full-shift exposure on each shift, for each job classification, in each Chromium (VI) work-area.

(c) If monitoring reveals exposures above PEL: TWA, it shall be repeated every six months until they drop below the PEL.

(d) Monitoring shall be performed whenever there is any change in the production process, raw materials, equipment, personnel, work practices, or control methods that shall result in new or additional exposures to Chromium (VI).

(e) Where air monitoring is performed, affected workers or responsible persons shall monitor worker exposure to Chromium (VI).

(f) Eating, drinking, smoking, chewing tobacco or other materials, applying cosmetics, using the toilet, and other activities likely to expose the workers to contact with Chromium (VI) shall not be permitted in the designated area, or while they are they are in their work clothes and have not undergone thorough removal of Chromium (VI) products from their work clothes, face and skin.

(c) Personal Protective Equipment:

(i) (a)Protective clothes and equipment exposed to Chromium (VI) shall be changed after each shift or separate task.

(ii) Wet or contaminated protective clothing or equipment shall be stored and

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transported for laundering, cleaning, maintenance, or disposal in sealed, permeable bags or containers.

(d) Handling and Storage:

(i) Surfaces exposed to or contaminated with Chromium (VI) shall be cleaned with HEPA-filter vacuuming, or other equivalent methods to minimize further exposure to the chemical.

(ii) Dry shoveling, dry sweeping, and dry brushing shall be used only where HEPA-filtered vacuuming or other methods mentioned in (a) have been tried and found ineffective or infeasible.

(iii) Compressed air shall not be used to remove Chromium (VI) from any surface unless the compressed air is part of a ventilation system to capture the dust cloud created by the compressed air.

(iv) Bags or containers of contaminated protective clothing or equipment that are removed from change rooms for laundering, cleaning, maintenance or disposal shall be labeled in accordance with relevant Standards.

(e) Fire Incompatibilities and Explosion Hazard Controls:

(i) Proximity to or contact with combustible, organic, or other readily oxidizable materials such as paper, wood, sulphur, aluminium, plastics, etc., shall be prevented.

(ii) Contact with metals shall be prevented to avoid corrosion.

(f) Waste Handling:

Waste, scrap, debris, and any other materials contaminated with Chromium (VI) and consigned for disposal shall be collected and disposed of in sealed, impermeable bags or other closed, impermeable containers.

(2) DICHROMATES:-

(1) This shall apply to all factories or parts of factories in which the manufacture of dichromates is carried on.

(2) Prohibition of the employment of pregnant women and adolescent: No pregnant women or **adolescent** shall be employed or permitted to work in any factory on the operation.

(3) Provision of protective clothing: The occupier shall provide and maintain in good condition, loose-fitting rubber gloves of suitable length for the use of all persons coming into contact with chrome solution, suitable protective clothing, and also for persons handling the crystals or Immersing their hands in chrome solutions or handling textile materials saturated with chrome solution.

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(4) Processes relating to noxious dust, fume, etc.- Processes that give rise to noxious dust, fume, vapour or mist shall be isolated from others and shall either be totally enclosed or provided with hoods and suitable exhaust ventilation.

(5) Operations which set free vapors containing particles of chromium

(a) The operations which set free vapors containing particles of chromium are -

(i) fusing of raw materials ;

(ii) dyeing the melted mass before cooling ; and

(iii) concentration and evaporation methods to obtain crystals of bichromates;

(b) The operations referred to in the first para shall be carried out by

(i) using a closed apparatus furnished with efficient exhaust, and

(ii) using an automatic system to eliminate manual handling.

(6) Collection of roast batch

A separate space shall be set apart to collect the "roast batch" when it is drawn out from the furnace. If the cooled "roast batch" has to be transported, it shall be done in covered receptacles.

(7) Processes relating to solution at temperature higher than 50°C

The following processes, where solutions at temperature higher than 50°C arc carried out shall be provided with exhaust ventilating cowls to carry away the vapors:

(a) Vats for lixiviation

(b) Evaporating tanks.

(c) Acidifying vats.

(8) Receptacles containing corrosive liquids

Receptacles containing corrosive liquids shall be effectively dosed to prevent spillage of solutions.

(9) Circulation of salines

The circulation of salines shall be carried out in a water-tight system of pipes.

(10) Dusty operations

The following dusty operations shall be carried out under exhaust ventilation or in separate rooms with adequate ventilation:

(a) Grinding of raw materials;

(b) emptying of containers;

(c) furnace cleaning and withdrawal of roast ;

(d) sifting of ingredients;

(e) mixing of ingredients ;

(f) drying of crystals ; and

(g) packing of products.

(13) Collection of waste materials

All waste materials shall be collected in tanks or store-houses and protected from rain so that the soil shall not be contaminated.

(14) Cautionary notices

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Cautionary notices as to the dangers associated with "Chromates" shall be conspicuously displayed in the factory where they shall be easily and conveniently read by the workers.

(15) Examination of workmen

The worker shall be examined daily to see that they do not have any lesions of the skin.

(16) Examination of workmen by the Certifying Surgeon

Every workman shall be examined once in a month by the Certifying Surgeon and the result entered in the Health Register.

(17) Supply of protective ointment or cream

Protective ointment or cream for application on limbs and in the nose shall be supplied to all workers.

(18) Provision of washable working clothes and washing facilities

All workmen shall be provided with washable working clothes kept in good order. Adequate provision of washing facilities shall also be provided.

(19) Maintenance of tools

All tools issued to the maintenance staff shall be washed daily and kept clean. No fee or charge shall be realized from any worker for this purpose.

(20) Provision of protective footwear

All workers on furnaces shall be provided with protective footwear such as wooden sandals.

(f) **Lead and its compounds -** under serial no. 17 (f) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all factories or parts of factories in which any of the following operations are carried on :-
   (a) work at a furnace where the reduction or treatment of zinc or lead ores is carried on ;
   (b) the manipulation, treatment or reduction of ashes containing lead, the desilvering of lead or the melting of scrap lead or zinc;
   (c) the manufacture of solder or alloys containing more than ten percent of lead;
   (d) the manufacture of any oxide, carbonate, sulphate, chromate, acetate, nitrate or silicate of lead;
   (e) the handling or mixing of lead tetra-ethyl;
   (f) any other operation involving the use of a lead compound; and
   (g) the cleaning of workrooms where any of the operations aforesaid are carried on.

(2) No pregnant women or adolescent shall be employed or permitted to work in any of the operations involving lead and its compounds.

(3) No person shall be employed or permitted to work in any process involving the use of lead compounds if the process is such that dust or fume from a lead compound is produced therein, or the persons employed therein are liable to be splashed with any lead compound in the course of their employment .

(4) Where dust, fume, gas or vapour is produced in the process, provision shall be made for removing them by means of an efficient exhaust draught to contrived as to operate on the dust, fume, gas or vapour as closely as possible to the point of origin.

(5) No food, drink, pan and supari or tobacco shall be brought into or consumed by any

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worker in any worker in any workroom in which the process is carried on and no person shall remain in any such room during intervals for meals or rest.

(6) Suitable protective overalls and head coverage shall be provided, maintained and kept clean by the occupier and such overalls and head coverings shall be worn by the persons employed.

(g) **Electrochemicals (metallic sodium, potassium and magnesium, chlorates, perchlorates and peroxides) -** under serial no. 17 (g) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply for industries using Electrochemicals such as metallic sodium, potassium and magnesium, chlorates, perchlorates and peroxides.

(2) Metallic Sodium, Potassium and Magnesium

(a) **Sodium**

(i) Sodium shall be stored separately from other flammable materials and away from any strong oxidizers.

(ii) Sodium shall be stored in a dedicated flammables cabinet.

(iii) Store room shall be cool, dry, well-ventilated, locked away from incompatible materials.

(iv) Sodium metal shall be stored in closed container under mineral oil, kerosene, or toluene.

(v) When large quantities of sodium are used, work shall be carried out under an inert gas, such as nitrogen or argon, in a fume hood or glove box or any other enclosure.

(vi) Eyewash stations and safety showers shall be provided close to the workplace.

(vii) Sodium shall not be exposed or contact with water or moisture.

(viii) All waste sodium shall be disposed of as hazardous waste.

(b) **Potassium**

(i) When large quantities of potassium are used, work shall be carried out under an inert gas, such as nitrogen or argon, in a fume hood or glove box or any other enclosure.

(ii) Potassium shall not be stored with alcohols, oxidizing agents, hydrated salts, acids and a wide variety of other materials.

(iii) Explosion proof equipment conforming to the National Standard shall be provided.

(iv) Contact with water, acids or alcohols shall be prohibited as potassium produces an exothermic reaction involving release of flammable hydrogen gas.

(v) Potassium shall be stored in inert atmospheres such as moisture, free toluene, kerosene and/or dry inert gas such as nitrogen or argon.

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(vi) Potassium shall be stored in tightly sealed containers in a cool dry place, separate from combustible materials.

(c) **Magnesium**

(i) Local exhaust ventilation system shall be provided at workplaces where Magnesium dust is being formed.

(ii) Accumulation of large amounts of finely divided magnesium in the work area shall be prevented.

(iii) Container shall be kept tightly closed in a dry and non-combustible area.

(iv) Non-sparking conductive tools shall be used where magnesium dust might be present.

(v) Conveyor ducts shall be fabricated of conductive material.

(vi) Ducts shall be electrically bonded and grounded to minimize accumulation of static charge.

(vii) An appropriate conveying velocity shall be maintained throughout the conveying system conforming to the National Standard to prevent the accumulation of dust at any point and to pick up any dust or powder that can drop out during an unscheduled system stoppage.

(viii) Explosion vents, openings protected by anti-flash back swings valves, or rupture diaphragms shall be provided on the duct work.

(ix) Grinding dust shall be captured in a wet dust collector system that is engineered for magnesium and dedicated to magnesium use only.

(3) Chlorates and Perchlorates (Sodium Chlorate, Calcium Chlorate, Potassium Chlorate, Barium Chlorate)

(a) Chlorates shall be stored and isolated from incompatible materials in a dedicated store, either in the open on a concrete pad, with or without a roof, or fully enclosed.

(b) Chlorates shall be stored in a secure area away from sources of ignition and flammable materials, and in such a way as to eliminate the possibility of contamination or it becoming involved in any fire.

(c) Sodium chlorate shall not be mixed with substances such as sulphur and sulphur-containing chemicals, ammonium salts (e.g. ammonium nitrate), amines, phosphorus, cyanides, acids, and powdered metals to prevent fire or explosion.

(d) Stacks of sodium chlorate shall be separated by either a distance of at least 10 m or a substantial thermal barrier (double brick wall or equivalent) from:

(i) combustible materials (including vegetation such as grass or brambles);

(ii) occupied factory buildings and any place in the factory which shall contain combustible materials;

(iii) the boundary of the factory premises.

(e) Any structure used shall be constructed entirely of materials that shall not burn, such

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as concrete, brick or steel.

(f) The floor of the chlorate store shall consist of impervious non-combustible material and have a smooth surface.

(g) Stacks of chlorate shall be limited to a maximum of 25 tonnes, to reduce the risk of detonation through self-confinement.

(h) Minimum 3 meters gap or a thermal barrier such as a brick wall between stacks of chlorate shall be maintained to prevent fire spread.

(i) Smoking, the use of naked flames, and the introduction of any combustible materials in the storage area, shall be prohibited

(j) All rooms where perchlorates are stored shall be of fire resistant construction and be provided with adequate ventilation. The surrounding area shall be free from vegetation.

(k) All electrical wirings, light fittings, motors etc shall be essentially flame and dust proof type only.

(l) All plant and machinery handling perchlorates shall be effectively earthed for controlling the undesirable static electricity.

(m) 'Smoking and naked flame is prohibited' signage shall be displayed near the storage of perchlorates.

(n) Regular medical monitoring shall be provided for the workers who are exposed to perchlorate in the workplace.

(4) Peroxides

(a) Storage

(i) Workplace shall be well ventilated and kept very clean and free from incombustible materials and other compatible chemicals such as alkalis, strong acid, etc.

(ii) Spillages and leaks shall be washed away with water.

(iii) Safety shower and an eye wash fountain shall be provided.

(iv) Pipe lines shall not pass through storage area.

(v) Contact with incompatible materials such as strong acids and strong oxidizers shall be avoided to prevent rapid decomposition releasing flammable vapours.

(vi) Freezer or refrigerated facilities shall be provided for intermediate storage of controlled temperature products.

(vii) Exposure of peroxide products to sunlight shall be avoided.

(viii) Storage area shall be free of all combustible materials.

(ix) Signage like "Organic Peroxide Storage Area" and "No Smoking" shall be displayed in English and language spoken by the majority of the employees.

(x) Storage tanks shall be constructed with compatible materials conforming to the National Standards.

(xi) Storage tanks shall be provided with suitable venting device.

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(xii) Hydrogen peroxide in the piping shall not remain trapped between two valves.

(xiii) For temperature controlled peroxides, emergency backup refrigeration shall be installed and maintained.

(xiv) Air circulation around peroxides stored at low temperatures shall be provided to reduce the chances of localized hot spots that can cause decomposition.

(xv) Small containers of pure aluminium of high density shall be stored unopened in the upright position and shall be stored on concrete flooring, separated from heat and protected from the sun.

(xvi) Bulk storage areas shall be away from all sources of open flame, heaters, furnaces and welding or other flame or spark producing equipments.

(b) Handling

(i) Measures shall be taken to prevent inhalation of peroxide vapour or mist or dust.

(ii) Hydrogen peroxide at work environment shall be kept less than the permissible exposure limit.

(iii) Hydrogen peroxide once removed shall not be returned to the container due to possible contamination.

(5) General

(i) Smoking and naked flame shall be prohibited and essential signage shall be displayed in the process area.

(ii) All the electrical fittings shall be of flameproof construction as per hazardous area classification conforming to the National Standards.

(iii) Adequate ventilation shall be ensured while carrying out an electrochemical process to keep the concentration of airborne contaminants within the Permissible Exposure Limit.

(iv) Signage indicating the flammability and reactivity of sodium, potassium and magnesium shall be displayed in conspicuous locations where the metals are being handled.

(6) PPE Matrix

S. No	Activity	Prescribed PPE's
1.	Sodium Handling	Safety goggles, impervious gloves, and a fire-retardant coveralls.
2.	Potassium Handling	Safety goggles, impervious gloves, and a fire-retardant coveralls.
3	Magnesium Handling	Safety goggles, impervious gloves, and a fire-retardant coveralls.

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4	Chlorates and Perchlorates	Rubber gloves, Safety Goggles, and chemical resistant coveralls. SCBA in case of fire involving perchlorates.
5.	Peroxides	Polyvinyl chloride or polyethylene overalls, neoprene, rubber gloves, boots, Respiratory Protective Device (RPD) and goggles or face shield shall be used to prevent splashing of the liquid into the eyes.

(h) **Electrothermal produces (artificial abrasive, calcium carbide) -** under serial no. 17 (h) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall be applicable to Electrothermal Produces (Artificial Abrasive, Calcium Carbide).

(2) Bonded Abrasives

(a) **Raw Material Handling**

Unloading of RM Jumbo Bags

(i) While removing Tarpaulin and rope from the loaded Vehicle, ensure the wheel reverse arresters were placed on all wheel and Hand brakes were engaged in vehicle.

(ii) Dock leveler is placed in same plane to the unloading platform and the same is ensured with a limit switch such that the loading platform is in same plane to the vehicle.

(iii) While removing Jumbo bags from the closed container, four corner ear ropes were tied to the fork fingers of the forklift.

(iv) Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at unloading area, through doorways and wherever turns or passage must be made.

(v) Aisles and passageways shall be kept clear and in good condition, with no obstruction across or in aisles that could create a hazard.

(vi) Bags, containers, bundles, etc., stored in tiers shall be stacked, blocked, interlocked and limited in height so that they are stable and secure against sliding or collapse.

(vii) Storage areas shall be kept free from accumulation of materials.

(viii) While stacking the material at vertical loading racks, side stands of stacker shall be engaged to prevent fall from height.

(ix) Only authorized persons shall be permitted to the unloading area.

(b) **Mixing Process**

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(i) Interlock shall be provided for mixing machine with lid

(ii) Mixing drum and containers shall be provided with guards interlocked with the drive mechanism so the machine cannot revolve or start unless the guards are in place.

(iii) Machines designed for fixed locations shall be anchored.

(iv) Emergency switches with manual resetting shall be provided on each machine.

(v) Provision shall be made in the machines to prevent machines from automatically restarting upon restoration of power after the power failure.

(vi) Power controls and operating controls shall be located within easy reach of the operator.

(vii) Safety pull cord shall be provided with machines where tilting arrangement is provided

(viii) Auto reversal arrangements shall be provided for machines were positive rotation of rollers and conveyors were provided for transport of materials, whenever entrapment/entries were made in the machinery.

(c) **Pressing process**

(i) Emergency push stopper/cable stopper/safety light curtain shall be provided near the operator and helper stations to ensure immediate stoppage of machine/process equipment during emergency.

(ii) Suitable mechanical lifting equipment shall be made available for the removal and insertion of heavy moulds.

(iii) Conditional monitoring of Handling toggles shall be done to ensure the stability of the equipment

(iv) Hydraulic oil temperature monitoring system shall be provided.

(v) High pressure Safety cut off interlocking system shall be provided to prevent damage to the mould and jigs and possible crushing of the tools.

(vi) Safety interlocks/barricades shall be provided near the rotary tables for possible entrapment of human body parts inside the rotating equipment while material filling and in case of rotary table movement

(vii) During the setting procedure or maintenance or if any of the guards or interlocks have shall be removed, isolate the machine from its power supply, lock off and dissipate any stored energy.

(viii) If powered movement of the press tool is necessary with the guards removed, this shall only be possible through the use of a lockable mode selector key which automatically engages limited movement or low-pressure movement under the control of a hold-to-run device.

(ix) When the guards/interlocks are reinstated, and before returning the machine to the operator, carry out relevant checks from the monthly maintenance list to

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prove the guards are functioning properly.

(x) The operator shall conduct the operational checks independently before starting production on the machine.

(d) **Drying chamber:**

(i) **Electrically Heated Oven**

(a) An airflow safety switch shall be integrated into the recirculation fan assembly, where it shall shut down the unit when the fan ceases operation.

(b) Manual Reset Excess Temperature Control / Hi-temperature limit control shall be provided, this control shall be set approximately (10°C) higher than the oven set point or maximum rated temperature. The hi-limit switch shall trip and shut down the heaters once the excess temperature setting is reached.

(c) Backup Contactors, these are required as a fail-safe. If the primary contactors become fouled or fused, the backup contactors shall ensure that the heaters shut down if an over-temperature condition occurs.

(d) To prevent the explosion of the oven due to the build-up of fumes. Pressure relief valves or a caged pressure-relief panel shall be provided.

(ii) **Gas Fired Oven**

(a) Powered Exhaust Fan shall be provided to forcibly remove any products of combustion, or process by-products, to reduce the chance that a hazardous situation to develop.

(b) Air flow safety switch shall be incorporated with exhaust fan, recirculation fan and to the burner if equipped with combustion blowers. In the event of any of the fan fails the air flow safety must trip and shutdown the burner.

(c) Manual Reset Excess Temperature Control / a hi-temperature limit control shall be provided, this control shall be set approximately (10°C) higher than the oven set point or maximum rated temperature. The hi-limit switch shall trip and shut down the burner once the excess temperature setting is reached.

(d) To prevent the explosion of the oven due to the build-up of fumes, Pressure relief valves or a caged pressure-relief panel shall be provided.

(e) Flame supervision devise to cut off the gas supply if it detects that the flame is extinguished, to prevent the buildup of the flammable gas inside the oven.

(f) A gas filter or strainer shall be installed in the fuel gas piping to protect the downstream safety shutoff valves.

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(g) Individual manual shutoff valves for equipment isolation shall be provided for shutoff of the fuel to each piece of equipment.

(h) Manual shutoff valves shall have permanently affixed visual indication of the valve position.

(i) Vent lines from multiple ovens shall not be manifolded together. To prevent the backload of one oven due to repture of the diaphragm of the other.

(j) A backfire arrester with a safety blowout device shall be provided near the outlet of each mixing pipe that produces a flammable air–fuel gas mixture.

(k) The entry to the oven by the workers shall be treated as a confined space entry and accordingly applicable standard laid down under Section 18 shall be complied with.

(l) Based on the type of gas used, appropriate safety systems shall be provided and maintained.

(m) Gas detection systems shall be set as per the OEM guidelines taking into account of LEL of the particular gas.

(n) SOP for regular start up and shutdown and emergency shutdown shall be developed, displayed and followed.

(o) All the sensors or detectors shall be calibrated periodically as per the OEM guidelines.

(e) **Curing chamber:**

(i) Condition of the fume exhaust blowers shall be monitored and provision of stand by blowers shall be arranged to handle exigencies

(ii) Regular inspection of flanges / glands shall be carried out to observe leakage of Liquid fuel before change over.

(iii) To prevent untoward fire from leaky lines/ flanges/ valve gland packing etc, regular inspection of Fuel lines to detect leakage if any shall be carried out at regular intervals.

(iv) Online flame monitors with alarm system shall be installed to detect proper functioning of the burner.

(v) Positive isolation of Fuel lines shall be ensured before opening any flanges/burners

(vi) Provision of vapor/fume detectors in the curing chamber and stacks for continuous monitoring

(vii) Explosion proof electrical equipment conforming to the national standard shall be installed in curing plant

(viii) The condition of refractory lining shall be monitored on regular basis to ensure the stability of heating chamber.

(ix) Alignment of refractory with product shall be monitored with a scale to prevent any possible damage caused during loading and unloading from the furnace.

(x) Temperature alarm system shall be provided in the exhaust lines to detect the duct

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blockages due to soot formation/sediment accumulation.

(xi) Level of CO, Noxand Sox shall be monitored and provide the necessary entrapments to avoid the possible escape of hazardous gases into the work environment

(f) **Conversion Process:**

(i) Local exhaust with dust collection system shall be provided at product conversion CNC machines.

(ii) Machines that generate very heavy noise beyond the allowable limit shall be provided with acoustic enclosures conforming to national standards

(iii) SOP shall be developed and followed for safe handling/ lifting of abrasive products

(iv) Portable particulate matter monitor shall be used in the conversion area for continuous monitoring of the ambient environment.

(g) **General**

(i) All interlocks shall be tested periodically.

(ii) Abrasive dust shall be collected at the generation point and prevented from accumulation inside the work areas.

(h) **PPE Matrix**

ctivity / process		**Prescribed PPE's**
aw material andling	Unloading of bags	Safety helmet, safety belt with fall arrestor, go and dust mask
	Handling of raw materials bags	Safety helmet, Safety Goggles and Dust mask
	Handling of Chemicals drums	Safety helmet, chemical splash Goggles, Du nitrile or neoprene gloves
ixing process	Handling grains	Safety helmet, Safety Goggles, apron and Dust r

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		Handling of chemicals	Safety helmet, chemical splash Goggles, Dust nitrile or neoprene, gloves
		Machine Operation	Safety helmet, Safety Goggles, apron and Dust ma
3	Pressing operation	Handling the moulds	Safety helmet, Safety Goggles, apron, a resistance hand gloves and Dust mask
4	Curing process	Hot material handling	Safety helmet, Safety Goggles, apron, leathe gloves, Dust mask and temperature resistance retardant suit
5	Conversion process	Surface grinding	Safety helmet, Safety Goggles, abrasion res gloves and Dust mask

(3) Electrothermal Produces (calcium carbide)

This shall apply for the manufacturing of electrothermal produces -calcium carbide

(a) **Lime Section:**

Manual handling shall be according to applicable National Standards.

(b) **Carbon Material Processing Section:**

(i) Ignition sources shall be eliminated.

(ii) All electrical equipment and fittings shall be of flame proof construction conforming to applicable National Standards.

(c) **Furnace Section:**

Lime and Carbon storage Bins area:

Sensors with audible and visible alarms shall be provided for detecting any fire at storage bins area.

(d) **Raw material dressing:**

(i) Ensure proper maintenance of pusher.

(ii) Due to high temperature at the dressing floor, air cooled cabin for operator shall be provided.

(e) **Furnace Section:**

(i) Shell temperature shall be monitored regularly to monitor the condition of

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refractory.

(ii) If the shell temp increases and the hot spot persists then furnace shall be switched off for replacement of refractory.

(f) **Tapping Floor:**

(i) Fire door should be provided at tap hole to avoid drops of molten Carbide coming on human body.

(ii) Proper maintenance of pans and rail track provided for safe movement of pans and avoid derailment.

(g) **Crushing and Packing Section:**

Empty containers and floor shall be kept free from moisture.

(h) **PPE Matrix**

S. No	Area	Prescribed PPE's
1	Lime Section	Safety helmet, plain safety goggles, , gloves, shoes and full length trouser
2	CPS Section	Safety helmet, plain safety goggles, , gloves and shoes
3	Furnace Section	Safety helmet, plain safety goggles, , gloves and safety shoes
		Safety helmet, fire retarded suit, blue face shield/safety goggles, dust mask , gloves and safety shoes and air cooled cabin
		Safety helmet, Blue face shield/safety goggles, dust mask , gloves, fire retarded suit and safety shoes
4	Crushing and	Safety helmet, plain safety goggles, dust mask ,

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	Packing Section	gloves, ear plug and shoes
		Safety helmet, plain safety goggles, dust mask , protective gloves, ear plug and shoes

(i) **Nitrogenous compounds (cynadies, cynamides and other nitrogenous compounds) -** under serial no. 17 (i) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply for industries using Nitrogenous Compounds **(**cyanides, cyanamides and other nitrogenous compounds).

(2) Cyanides and Cyanamides

(a) Cyanide salts shall always be kept in a locked cabinet to prevent unauthorised access and shall never be stored on the open bench or in unlocked cupboards.
(b) For large quantities of cyanides, storage areas shall be fire-resistant with a concrete floor or be raised off the ground. The store shall be well-ventilated and shall be under lock.
(c) Keep cyanides in original containers and keep them securely closed and arrange stock so the oldest material is used first.
(d) Cabinets used for storing poisons shall be clearly labelled and designed such that they cannot be easily removed.
(e) Local exhaust ventilation shall be used with properly calibrated chemical fume hood with demonstrable face velocity of 0.5 m/s. The exhaust of the local exhaust ventilation shall be connected to a scrubbing system.
(f) Acute toxicant storage areas (cupboards, shelves, or secondary containment) shall be labelled “Danger! Acute Toxicants” in English, and local language.
(g) Large amounts of waste products contaminated with cyanides shall be clearly labelled and stored in a secure chemical waste store.
(h) Indoor air quality monitoring shall be done to ensure that the exposure levels are within the permissible exposure limits.
(i) Gas detectors of Hydrogen Cyanide (HCN) shall be installed in the work area where HCN is used, to identify leaks.

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(j) Potentially contaminated PPE shall be removed before entering clean areas.
(k) Hands shall be washed before entering clean areas and after completion of work.
(l) Cyanides shall not be handled while working alone.
(m) Workers handling, storing, using or generating cyanides shall be trained to recognise symptoms of cyanide poisoning.

(3) Other Nitrogenous Compounds
(Nitric Acid, Oxides, Nitrates, Ammonia etc.)

(a) **Nitrates**

(i) Clean up spillages promptly and dispose of contaminated product by dissolving in water before disposal.
(ii) Where possible, operations shall be enclosed and local exhaust ventilation shall be used at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators shall be worn.

(b) **Nitrogen oxides**

(i) Where possible, operations shall be enclosed and local exhaust ventilation shall be used at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators shall be worn.
(ii) Local exhaust ventilation shall be provided at the site of chemical release.
(iii) Clothes contaminated by the chemical shall be changed promptly.
(iv) Eye wash fountains shall be provided in the immediate work area for emergency use.
(v) Gas detectors shall be installed in work area to detect leaks immediately.
(vi) Oxides of nitrogen shall not be stored with incompatible chemicals such as Ammonia, Triethylamine, Acetonitrile, Aluminium Powder, Carbon disulphide, Alcohols, Copper alloys, Reducing metals, chlorinated hydrocarbons, formaldehyde, fluorine, petroleum,
(vii) Store in cool, dry and well-ventilated area.

(c) **Nitric Acid**

(i) The storage tank shall be approved for nitric acid use and the same shall be calibrated.
(ii) Storage shall be in a cool and well-ventilated area and separate from acids, alkalis, reducing agents and combustibles.

(d) **Ammonia**

(i) Unloading from cylinders
(a) Store empty cylinders away from filled cylinders and fasten an empty tag in cylinders immediately upon emptying.
(b) Cylinders shall be handled and stored as per the applicable National Standards.

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(ii)Unloading from tanks

(a) The crew for handling ammonia shall be trained about the procedure and hazards.
(b) Only licensed tanks/tankers shall be used for transporting ammonia.
(c) Brakes shall be set and wheels blocked while being unloaded.

(iii)Storage

(a) Anhydrous ammonia shall be stored inside in a fire resistant structure, away from steam pipes and heating devices.
(b) Storage shall be dry, cool and well-ventilated place.
(c) Suitable safety device like pressure control relieving system must be there to avoid excess pressurization. Safety valve on ammonia storage tanks shall be designed for fire conditions.
(d) Vents from storage tanks, relief valves etc must lead to a safe location to avoid any unwanted ammonia contamination in the working area.
(e) Outdoor storage tanks shall be located at least 15m away from buildings and away from flammable liquid storage.
(f) Storage tanks if kept outside shall be protected from direct sunlight.
(g) Ammonia leak detection sensor shall be provided in storage and work area.
(h) Water curtain shall be provided around the storage area and pumps.

(4) PPE Matrix

Sl. No	**Activity**	**Prescribed PPE's**
1.	Cyanide– Handling and Storage	Safety Goggles, half face respirator, Safety Shoes, Supplied Air Line Respirator (+ive pressure) with chemical resistant coveralls.
2.	Cyanamide – Entry to unknown concentrations.	Self-Contained Breathing Apparatus, chemical resistant coveralls.

(j) **Phosphorus and its compounds -** under serial no. 17 (j) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to phosphorus and its compounds.
(2) Phosphorus Handling

(a)P4 shall be stored in molten condition always above 45 deg C under water in the capsule and storage tanks.
(b)2 cm to 3 cm layer of water shall be maintained above Phosphorus in the drums.
(c)Transportation of any drum containing molten P4 shall be strictly avoided. Any drum containing P4 in molten state shall be allowed to completely cool down to solid, before being moved anywhere.
(d)In case of any spillage, water shall be sprayed on the spilled P4 to cool and solidify

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it and then collect the solid P4 in suitable container.

(e) The spilled P4 shall not be allowed to dry, as it will burn and give out dense white fumes of P2O5 which are harmful.

(f) In case of any leakage from line /gaskets, the source shall be isolated first. If the line is from reactor to capsule, the line shall be flushed with nitrogen. If the line is from melting tank to storage tank or storage tank to capsule, flush it with hot water.

(g) If spilled material does start burning and sufficient water is not available, the spillage shall be covered with sand to stop burning and then scoop up the material carefully.

(h) During cleaning if material is spilled and phosphorus starts burning, water shall be sprayed on it and water shall be diverted to drain pit of plant.

(i) While transferring P4 from the capsule to the reactor ensure that no water is transferred to the reactor. Condition of dip pipe shall be ensured and positioned at bottom of storage tank

(3) Chlorine Handling:

(a) If Chlorine is received through pipeline, ensure that no leakages and same shall be checked by using ammonia torch.

(b) In case of leakage / release of chlorine from pipelines / gaskets / valves, the source shall be isolated, and the line shall be emptied into the reactor or diverted to caustic scrubber.

(c) Chlorine sensors with alarms shall be provided wherever chlorine stored and consumed.

(d) At least one tank or bullet shall be kept always empty to meet any emergency.

(4) Safety in handling of Chlorine in tonners / bullets

(a) Chlorine tonners shall always be stored under a shade

(b) Checking with Ammonia torch shall be ensured before connection and disconnection of tonners

(c) Appropriate Loading and unloading facilities shall be provided

(d) Chlorine leakage detectors and alarm and leak control kit shall be provided in storage area .

(e) Caustic scrubber connected with hood shall be provided to manage chlorine leak emergency.

(f) SCBA shall be provided at storage location.

(g) Appropriate material handling equipment shall be used while handling tonners.

(5) Safe Handling of cryogenic Oxygen

(a) Smoking shall be prohibited in Oxygen storage tank area.

(b) Proper earthing shall be provided oxygen storage tank.

(c) Flexible stainless steel hose from tanker to storage tank shall be properly connected.

(d) No liquid oxygen leakage shall be permitted while unloading of tanker.

(e) Non sparking tools shall be used in unloading area.

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(f) the workers shall wear appropriate PPEs to handle cryogenic liquid.

(6) Safe handling of Phenol

(a) Electrostatic charges in the tanker shall be discharged by earthing before starting to unload operation with interlock system.

(b) Phenol shall be transferred only using flexible SS Teflon hose pipe.

(c) Care shall be taken while connecting steam pipelines to the tanker and it shall be ensured that Phenol is fully in molten condition in tanker using Stainless steel rod before transferring to storage tank.

(d) Appropriate non contact level indicator shall be provide on storage tank

(7) Safe handling of TMP (Tri methyl phosphite)

(a) Electrostatic charges in the tanker shall be discharged by earthing before starting to unload operation with interlock system

(b) Tanker vent shall be connected to HCL scrubber while unloading.

(c) Positive pressure PVC bubble hood shall be worn by workers to prevent exposure to TMP vapors and spill.

(8) Safety in Reaction vessels

(a) Rupture disc with safety valve connected to dump tank shall be provided

(b) Chlorine detectors shall be provided around the reactor.

(c) Safety interlocks shall be provided with Chlorine and Phosphorus addition to prevent run away reaction

(d) Vent design study shall be done, and appropriate vent shall be provided.

(e) Avaibility of dry sand shall to be ensured.

(f) For cooling, water reactive reactant in the reactor or similar equipment in the jacket of the reactor water and its compositions shall not be used. Safe heat transfer fluids shall be identified and used.

(g) Uninterrupted power supply shall be ensured for carrying out critical chemical reactions.

(h) Before scaling up of operations including unit processes pilot plant, commercial production, Process Hazard Analysis shall be carried out.

(i) Safe disposal of hazardous waste shall be ensured, generated during reaction.

(j) Feed rate shall be determined and controlled so that hazardous gases shall be neutralized adequately.

(k) Safety interlocks shall be provided for stopping the addition of Chlorine and phosphorus in case of emergency.

(l) Water shall not be used for mitigating the spill, leaks and fires.

(m) Appropriate visual warnings shall be displayed about incompatibility of water with PCL3.

(9) Safe handling of phosphorus compounds

(a) PCL3 (Phosphorus tri chloride), POCL3 (Phosphorus Oxy chloride) shall be stored, handling and transported under Nitrogen blanketing.

(b) Water shall not be used for mitigating the spill, leak and fire for phosphorus compounds.

(c) Drums / carboys containing POCL3 shall be checked every six months for

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corrosion.

(k) **Halogens and halogenated compounds (chlorine, fluorine, bromine and iodine) -** under serial no. 17 (k) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall be apply for industries using Halogens and Halogenated compounds (Chlorine, Fluorine, Bromine and Iodine).

(2) Chlorine and its compounds

(a) **Handling and storage**

(i) Storage tanks shall be designed and constructed as per relevant National Standards and maintained in good condition.
(ii) Cylinders shall never be lifted by means of the metal cap, nor shall rope slings, chains or magnetic devices be used.
(iii) Cylinders and ton containers being trucked shall be carefully checked, clamped, or otherwise suitably supported to prevent shifting and rolling.
(iv) Using Chlorine From Cylinders—Cylinders normally shall be emptied in the gas phase, standing secured in an upright position.

(v) Ton-containers set in a horizontal position, with the valves in a vertical plane, deliver gas from the upper valve and liquid from the lower valve.
(vi) Chlorine gas shall only be stored in areas approved by PESO, as applicable.
(vii) Sources of ignition, such as smoking and open flames, shall be prohibited where chlorine is used, handled, or stored in a manner that could create a potential fire or explosion hazard.
(viii) All process vents and pressure relieving devices shall be routed to chlorine scrubbing system and all the rotary equipment of this scrubbing system shall have back up emergency power supply.
(ix) Chlorine Leak control kits shall be made readily available in the handling area.
(x) Cylinders shall be stored in an upright position. They shall be secured to prevent from falling over. Full and empty cylinders shall not be stored together. Ton containers shall be stored on their sides. They shall not be stacked or racked more than one high.
(xi) Storage areas shall be remote from, elevators gangways or ventilating systems because, in the event of a chlorine leak, dangerous concentrations of chlorine shall spread rapidly.
(xii) The storage area shall be separate from that in which other compressed gas containers are stored, and shall contain no turpentine, ether, anhydrous ammonia, finely divided metals or other Inflammable, Material.

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(xiii) The storage area shall be cool, dry, well-ventilated, clean of trash, and protected from external heat sources (steam pipes, etc). Sub-surface areas shall be avoided for storing chlorine cylinders.

(xiv) The valves on cylinders and ton containers shall be protected by a stout metal cap securely attached to the cylinder body. This cap shall always be kept in place on all containers in storage and at all times except during evacuation of chlorine.

(xv) All process vents and pressure relieving devices shall be routed to chlorine scrubbing system and all the rotary equipment of this scrubbing system shall have back up emergency power supply.

(xvi) Chlorine gas leak detectors shall be interlocked with scrubber system.

(xvii) All the electrical fittings shall be of flameproof construction.

(xviii) Chlorine shall not be stored near incompatible materials such as Titanium, Carbon Steel, flammable materials.

(xix) Standard Operation Procedure shall be developed for 'Safe handling and storage of Chlorine'. Warning and cautionary signage shall be displayed at conspicuous location.

(b) **Handling and storage of Hydrochloric acid**

(i) Hydrochloric acid shall be stored in a cool, dry, well-ventilated area away from sources of moisture and out of direct rays of the sun and away from sources of heat.

(ii) Keep away from incompatible materials such as oxidizing agents, organic materials, metals, and alkalis. Hydrochloric acid could corrode metallic surfaces.

(iii) Keep container tightly closed and store in a safe place.

(iv) Electrical fixtures shall be of vapour proof construction. All wiring shall be in tight rigid metal conduits, all protected with an acid resistant coating.

(v) Each storage tank shall be provided with a vent of sufficient size for venting vapours to the atmosphere at an elevation higher than the immediate surroundings.

(vi) The fumes shall be carried through acid-resistant ducts toa centrally located scrubbing tower.

(c) **Handling and storage of other chlorides**

(i) Chlorides shall be stored in a cool, dry, well-ventilated area away from sources of moisture and out of direct rays of the sun and away from sources of heat.

(ii) Bulk containers shall be top unloaded by pumping, with the vapor space above always filled with nitrogen.

(iii) Acid chlorides and chloroformates must be blanketed with nitrogen when transported in bulk containers to reduce the fire hazard risk.

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(iv) All acid chlorides and chloroformates transport containers, transfer systems and storage tanks must be electrically grounded. Without electric grounding, static charges shall develop and discharge creating a potential source of ignition.

(v) Empty acid chloride and chloro-formates drums shall be disposed and not reused.

(vi) Final vent streams shall be routed through a caustic tower scrubber to control emissions.

(vii) All equipment must be free of contamination, including water

(viii) For chlorides tends to acquire an electrostatic charge during movement, all pipe work and equipment in transfer system need shall be grounded and earthed.

(ix) Potential areas of leakages shall be checked on regular basis.

(x) Aluminium containers shall not be used for storing Carbon tetrachloride.

(xi) Carbon tetrachloride shall be handled as closed system.

(3) Bromine and its compounds

(a) **Handling and storage of Bromine**

(i) Bromine shall be stored in glass lined or lead lined containers and nickel drums or in glass bottles. Earthenware, stoneware and Monel metal containers shall also be used for storage of bromine.

(ii) Bromine shall be stored in a cool well ventilated area avoiding direct sunlight. The temperature of storage area shall not go below — 7°C to prevent freezing.

(iii) Bromine vapours from reaction vessels or storage tanks shall be vented through an alkali absorber preferably kept under constant pressure. The vent line shall be purged with dry air. To contain release of bromine all the bromine carrying equipment, pipelines etc. the sensors and connected with bromine scrubbing system.

(iv) Store in either a glass-lined steel or lead-lined steel storage tank, properly designed for bromine's weight. Glass-lined steel tanks are not advised in active seismic areas. Stored bromine must be protected from temperatures below -7 °C (20 °F) to prevent freezing.

(v) Storage tanks shall be in concrete paved and diked areas so that any leak or spill can be contained.

(vi) Sprinkler system with sodium thiosulphate solution shall be provided around the storage tank.

(vii) All process vents and pressure relieving devices shall be routed to bromine scrubbing system and all the rotary equipment of this scrubbing system shall have back up of emergency power supply.

(viii) Bottom Nozzle storage tank shall be avoided for the bromine storage.

(ix) For plant use one batch required quantity is transferred in day tank to minimize hazard of leakage during plant operation.

(x) To avoid leakage during transferring suitable MOC (PVDF line) with pressure switch is used.

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(xi) Pressure switch shall stop transfer pump in case of high pressure in transferring line.

(xii) Bromine storage tank dyke shall be kept filled with water.

(xiii) Spill absorbent i.e. Sodium Thio Sulphate is always kept near Bromine storage and handling area

(xiv) The work area shall be provided with emergency Safety shower, eye wash fountain, Diphotherine to mitigate exposure to bromine.

(xv) There shall be provided with Bromine leak detection and alarm system in the areas where bromine is being used.

(xvi) Adequate measure shall be provided for the control of excessive, temperature and overfilling of bromine storage tanks.

(xvii) Bromine shall not be allowed shall be in proximity of or contact with the following chemicals:

(a) Combustible organics (sawdust, wood, cotton, straw, etc.) aluminium, readily oxidizable materials, ammonia, hydrogen, acetylene, phosphorus, potassium, sodium (Note: Corrodes iron, steel, stainless steel and copper).

(b) Incompatible materials: Reducing agents, alkali metals, powdered metals, aluminium, stainless steel, iron, copper, organic materials, bromine shall attack some types of plastics, rubber, and coatings, aldehydes, ketones, arsenic powder, amines, amides, phenols, alcohol, reacts violently with: ammonia, azides, ozone.

(c) Lithium is stable in contact with dry bromine, but heavy impact shall initiate explosion,while sodium in contact with bromine needs only moderate impact for initiation. Potassium ignites in bromine vapor and explodes violently in contact with liquid bromine and rubidium ignites in bromine vapor. Aluminium, mercury, or titanium react violently with dry bromine. Warm germanium ignites in bromine vapor and antimony ignites in bromine vapor and reacts explosively with the liquid halogen. During preparation of praseodymium bromide, accidental contact of liquid bromine with small particles of praseodymium led to a violent explosion.

(d) React explosively with acetylene, Acrylonitrile, Ammonia, Dimethyl formamide, Ethyl phosphine, Hydrogen, Isobutyrophenone, Nickel carbonyl, Nitrogen Triiodide, Oxygen, Difluoride, phosphorous, Potassium, Silver Azide, Sodium Carbide, Ozone etc.

(b) **Handling and storage of bromine compounds**

(i) Natural or mechanical ventilation shall be provided to avoid or remove excessive concentration of bromide vapours as a result of any leak.

(ii) Cylinders using for bromide shall not be unloaded using rope sling, hooks or magnets.

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(iii) Cylinders must never be handled roughly, dropped or bumped or dragged.

(4) Fluorine and its compounds

(a) **Handling and storage of Fluorine**

(i) The storage area shall be cool, dry, well-ventilated, clean of trash, and protected from external heat sources and protected from direct sunlight.

(ii) The valve if the cylinders shall not be opened until it is connected to equipment prepared for use.

(iii) Double valving shall be employed near the source of high-pressure fluorine to facilitate a safe reduction of pressure.

(iv) Any equipment shall be used for fluorine service shall first be thoroughly cleaned, degreased, and dried, and then treated with increasing concentrations of fluorine gas so that any impurities shall be burned out without the simultaneous ignition of the equipment

(v) Use only equipment of compatible materials of construction.

(vi) Keep reduction valves free from grease and oil.

(vii) Storage tanks shall be designed and constructed as per relevant National Standards and maintained in good condition.

(viii) Eating, drinking, and smoking shall be prohibited in areas where this material is handled, stored and processed.

(ix) Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

(x) Fluorine and hydrogen fluoride monitors shall be provided at strategic points to detect and to cut off fluorine flow at the source

(xi) Any equipment that has contained fluorine must be thoroughly purged with a dry nitrogen or inert gas and evacuated prior to opening or refilling.

(xii) All areas containing fluorine under pressure shall be inspected for leaks at suitable intervals. All leaks shall be repaired at once, but not while the system contains fluoride.

(b) **Handling and storage of Hydrofluoric Acid**

(i) There shall be inlets and outlets of adequate size to secure and maintain efficient ventilation in all parts of the workplace.

(ii) the floor shall be covered with gutta-percha and be tight and shall slope gently down to a covered drain.

(iii) the workplaces shall be so enclosed in projecting hoods that openings required for bringing in the objects shall be treated shall be as small as practicable.

(iv) the efficient exhaust draught shall be so contrived that the gases are exhausted downwards.

(v) Hydrofluoric acid shall not be stored or transported except in cylinders or receptacles made of lead or rubber.

(vi) Suitable facilities shall be readily available for sterilizing the blowpipes used by the glass blowers and such blowpipes shall be sterilized at the beginning of the operations of blowing, each day

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(vii) Only plastic or Teflon-coated labware shall be used for HF solutions and storage in glass bottles shall be strictly avoided.

(c) **Handling and storage other fluorine compounds**

(i) Brazing and gas-welding fluxes containing fluorine compounds shall have a cautionary wording to indicate that they contain fluorine compounds.
(ii) In confined spaces, welding or cutting involving fluxes, coverings, or other materials which contain fluorine compounds shall be done according to applicable National Standards.
(iii) Storage areas for UF_6 and process areas handling UF_6 shall be physically isolated from other areas by fire-resistant barriers.
(iv) UF_6 storage areas shall be protected by water sprinklers designed to keep the UF_6 area cool in case of fire.

(5) Iodine and its compounds

Handling and storage
(a) Use with adequate ventilation. Minimize dust generation and accumulation
(b) Store in a cool, dry place. Store in a tightly closed container.
(c) Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.
(d) Facilities storing or utilizing this material shall be equipped with an eyewash facility and a safety shower.

(6) PPE Matrix

General: All contaminated clothing, including gloves, shoes, coveralls, etc, shall be removed as soon as possible after exposure to halogens and halogenated compounds. It shall be thoroughly decontaminated and cleaned before re-use.

Serial No	**Activity**	**Prescribed PPE's**
1.	Chlorine and other chlorine compounds – Handling, Storage and emergency response	Safety Goggles, half face respirator, Safety Shoes, Supplied Air Line Respirator (+ive pressure) with chemical resistant coveralls. Self-Contained Breathing Apparatus, chemical resistant coveralls.
2	Hydrochloric Acid. handle aqueous or anhydrous hydrochloric acid, entering in to tanks	Protective clothing, Suitable gas-tight chemical safety goggles. Rescue harness and lifeline , Air-line masks with the proper reducing valve and filter, self-contained breathing apparatus Industrial gas masks equipped with canisters Safety hard hats made of treated fibre, Brimmed felt hats ,High rubber shoes with built-in steel toecaps , acid

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		resistant clothing, Rubber or synthetic plastic aprons ,Rubber gloves
3	Bromine and other Bromine compounds – Handling, Storage and Emergency response	Chemical safety goggles ,.Face shields ,Spectacle-type safety goggles ,Respiratory protective devices ,Self-contained breathing apparatus (BA Sets),Positive pressure hose masks , Air-line masks (PAPR),Industrial canister type gas masks ,Chemical cartridge respirators ,Safety helmets or , Brimmed felt hats ,steel toe Protection safety shoes with rubber covering ,Body Suits, gloves, sleeves and aprons made of rubber or suitable protective material ,All contaminated clothing, including gloves, shoes, coveralls, etc, shall be removed as soon as possible after exposure to avoid prolonged contact with bromine. It shall be thoroughly decontaminated and cleaned before re-use.
4	Fluorine and other florine compounds – Handling , Storage and emergency response	Full coverage of clothing including acid coat, rubber, neoprene or plasticized polyvinyl chloride overalls, acid proof air inflated suit with a mask and safety belt included ,Hard Hats , Brimmed felt hats, full face mask or chemical goggles with plastic lenses, Chemical Safety Goggles with rubber frame / plastic lenses ,Face Shields , acid hood with plastic window ,gauntlet-type gloves made of neoprene, Air-line masks with proper reducing valve and filter,, self-contained breathing apparatus with stored oxygen or air, Air or oxygen supplied masks, with full face pieces made of plastic, positive pressure hose masks, Industrial canister type gas masks , , Safety showers ,Eye baths ,eye washing fountains, Fall protective equipment including acid resistant rescue harness and a life line and safety shoes with rubber soles.
5.	Iodine and Iodine Compounds– Handling, Storage and Emergency response	Face shield and safety glasses, nitrile gloves, Chemical suits, Respiratory protective devices (RPD), and Powered air purifying respirator(PAPR),BA sets

(l) **Explosives (including industrial explosives, detonators and fuses) -** under serial no. 17 (l) in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply for the manufacturing of explosive (including industrial explosives, detonators and fuses)

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(2) Raw material handling

(a)**Oxidizers (Ammonium Nitrate, Sodium Nitrate)**

(i) Storage shall be in a cool dry and well-ventilated place and protected against direct sunlight.

(ii) Stores shall be away from sources of ignition.

(iii) Empty ammonium nitrate bags shall be disposed of daily in a safe manner.

(iv) No welding shall be permitted or open flames used in or around the mixing or storage area of the plant unless the equipment or area has been completely washed down and all oxidizer material removed.

(b) **Sulphur**

(i) Spark free shovel shall be used for handling and disposal of Sulphur.

(ii) Accumulations of dust on floors, walls and other places in storage areas shall be controlled.

(iii) Storage shall be in a cool dry and well-ventilated place, protected against direct sunlight and away from sources of ignition and oxidizing materials.

(iv) Containers shall be kept closed while not in use.

(c) **Coal dust/powder**

(i) Accumulations of dust on floors, walls and other places in storage areas shall be controlled.

(ii) Storage shall be in a cool dry and well-ventilated place, protected against direct sunlight and away from sources of ignition and oxidizing materials.

(d) **Gelling Agent (Gaur Gum)**

(i) Accumulations of dust on floors, walls and other places in storage areas shall be controlled.

(ii) Storage shall be in a cool dry and well-ventilated and away from incompatible substances.

(e) **Monomethylamine (MMA)**

(i) The container shall be kept dry and away from heat and source of ignition.

(ii) Safety valves, excess flow check valves and pressure gauges shall be calibrated.

(iii) Hydraulic testing of storage tank shall be done as per the applicable National Standards.

(f) **Metal (Aluminium) Powder**

(i) Storage shall be in rooms with a fire-resistant or non-combustible construction.

(ii) There shall be good natural or forced ventilation of the storeroom and areas used for processing.

(iii) Aluminium powder shall be stored in areas away from flammable liquids or other combustible materials or oxidizing materials.

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(iv) Aluminium powder shall be stored in a cool place, protected against direct sunlight.

(v) Containers shall be stored far enough away from steam pipes or radiators to prevent heating.

(vi) Aluminium powder shall be stored dry and any contact with water shall be avoided. Containers shall be always protected against rain, snow and humidity.

(vii) Accumulations of dust on floors, walls and other places in storage areas shall be controlled.

(viii) There shall not be any automatic fire-extinguishing systems (e.g. using sprinklers or carbon dioxide) in areas where aluminium powder is stored.

(g) **Emulsifier(Sorbitan Mono Oleate)**

General precautions for handling chemicals shall be observed as per MSDS.

(h) **Nitric Acid(HNO_3)**

(i) The storage tank shall be approved for nitric acid use and the same shall be calibrated.

(ii) Storage shall be in a cool and well-ventilated area and separate from acids, alkalis, reducing agents and combustibles.

(i) **Perlite (For maintaining density) or any other similar material**

Accumulations of dust on floors, walls and other places in storage areas shall be controlled.

(j) **Crosslinker**

General precautions for handling chemicals shall be observed as per MSDS.

(3) Industrial Explosive Manufacturing:

(a) **Water gels/Slurries Explosive**

(i) MMAN (Monomethylamine Nitrate) Neutraliser

Interlocks shall be provided in MMAN Neutraliser reactor to avoid simultaneous entry of MMA and Nitric Acid to the reactor.

(ii) Mixing and packing

(a) Trained operator authorised by the responsible person shall only be employed in mixing and packing area.

(b) The operations and processes including cleaning, disposal of waste, shall have control mechanism (remote control, temperature control, heating

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medium).

(c) Vessels and machineries including electrical equipment shall conform to the applicable National Standards suitable for safe operation of the process.

(d) Land surrounding the mixing plant shall be kept clear of brush, dried grass, leaves, and other materials for a distance of at least 25 feet.

(e) The entire mixing and packaging plant shall be cleaned regularly and thoroughly to prevent excessive accumulation of dust.

(iii) Magazine

The magazine shall be fitted with lightning conductor as per the applicable National Standards (IS 2309).

(b) **Bulk Emulsion Explosive**

(i) **Mixing**

(a) Mixers, pumps, valves, and related equipment shall be designed to permit regular and periodic flushing, cleaning, dismantling, and inspection.

(b) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

(c) Where fuel oil is used, all fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil shall drain away from the mixing plant building.

(d) Floors in a mixing plant shall be of concrete or of other non-absorbent materials.

(ii) **Truck loading of Bulk Mix Delivery**

(a) The mixing, loading, and ingredient transfer areas where residues or spilled materials shall accumulate shall be cleaned periodically.

(b) A cleaning and collection system for dangerous residues shall be provided.

(4) Detonator

(a) General

(i) Wear cotton clothes only when on work

(ii) Cellphone

(iii) Do not wear wristwatch

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(iv) No person shall be allowed with a matchbox or cigarette lighter or any device produce flame/spark in the premises. Smoking is strictly prohibited in explosive area/factory.
(v) Maintenance and related works are taken up only after obtaining a permit to work.
(vi) Water circulation arrangement is made to all mixers to control temperature.
(vii) Earth pits and lighting arrestors are installed and maintained for all buildings with explosive/flammable material. All motors shall be double earthed.
(viii) If there is severe thunder or lighting, the production shall be stopped and related personnel shall be asked to come out to safe assembly point.

(b) Handling and storage
(i) Spill control and cleaning kits shall be made readily available.
(ii) Non sparking tools shall be used inside the factory where detonator is handled.
(iii) The spilled materials are shall be filled separately and disposed off using disposing agent.
(iv) Use anti-static clothing for entire operation.
(v) The building shall be equipped with non-flameproof lights with bitumen flooring.

(c)Waste Disposal
(i) All the rejected detonators shall not be accumulated, it shall be discarded safely.
(ii) The wood grist used for cleaning the filled fuse shall be burnt out separately.
(iii) The completed detonating fuse shall bundled separately..
(iv) The bundles are packed in a cardboard boxes for despatch.
(v) The packed boxes are shall be stored in a separate building with non-flameproof lights with bitumen flooring.
(vi) The boxes shall not be dropped from heights and dragged.

(5) Fuses

Safety Handling and Storage of Detonating Fuse (DF):

(a)DF SEMI FUSE (static discharge)

(i) All the explosives buildings shall be covered by the mount and shall be maintained with safe distance from other buildings as per the PESO guidelines.

(ii) Man limit and Explosives storage limit shall be maintained as per PESO approval.

(iii) Detonating Fuse Manufacturing building shall be provided with lightning arrestors, body static discharge plate at the entrance of the building and shall be provided with foot wash to remove the grits from the shoes.

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(iv) All the electrical equipment's shall be connected to the earthing pit and all the light fittings must be flame proof and explosion proof as per the applicable National Standards

(v) All electrical panels shall be isolated from the manufacturing unit.

(vi) The relative humidity inside the manufacturing unit shall be maintained above 60 percent.

(vii) Sieved pentaerythritol tetranitrate (PETN) shall be stored in non-conductive type of "Jerry CANS" and the mouth of the "CAN" shall be closed with cock to avoid spillages during movement.

(viii) PETN filled CANS shall be stored on an Aluminium tray connected to the earthing discharge.

(ix) The dry PETN storage area and the spinning area are shall be separated by a wall.

(x) All the semi fuse spinning machines shall be connected with earthing.

(xi) During the flow of PETN into the spinning machine, static charges shall be generated. Care shall be taken by providing a conducting brass lid to a jerry CAN and earthing the same.

(xii) The Aluminium reels used for wounding of semi fuse are coated with rubber as uncoated rim can accidentally impact the semi fuse which can be proved hazardous.

(b) DF EXTRUSION:

(i) The temperature of the extruder head shall be maintained at about 135–140-degree Celsius maximum, which is well below the melting point of PETN.

(ii) Exhaust blowers shall be provided to remove the fumes from the extruder. The coated fuse are immediately run through a tray of water for cooling the fuse and subsequently dried and Wound on aluminium reels. The coated fuse is crushed between the brass rollers at a designated weight to a uniform distribution of PETN.

(iii) Detonating traps shall be provided during the extrusion and cutting process to eliminate the continuation of detonation in case of emergency.

(iv) The cutter shall be provided before and after the extrusion process to cut the detonating fuse in case of power failure thus minimizing the Hazard.

(c)DF REELING PROCESS:

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(i) The reeling machines shall be connected with hand brakes and with an emergency switch for safe operation of reeling.
(ii) The reeled spools shall be labelled as per the PESO guidelines and packed in approved corrugated boxes which is shall be shifted to the designated magazines.

(d) General precautions:

(i) Smooth cement path shall be provided between the process building for ease and safe transportation of explosives and their intermediates. Trolleys duly earthed by means of drag chain shall be used for transporting explosives between the process buildings.
(ii) The explosives vans and tractor trolleys which are used for transportation of finished explosives from process building to Magazine shall be provided with spark arrestors to the exhaust.

(e) General
(i) Smoking, matches, open flames, spark producing devices, and firearms are prohibited inside of or within 50 feet of any warehouse used for the storage of explosives or raw materials. Combustible materials shall not be stored within 50 feet of warehouses used for the storage of blasting agents.
(ii) Flameproof electrical fittings shall be ensured in the storage and process areas.
(iii) Safety Fuse and detonators shall be at all times during transport, handling and storage, be protected from moisture and contact with oil, grease, kerosene or other liquids.
(iv) Detonators shall not be stored with other explosives.
(v) MSDS shall be referred for any clarification with the Raw Materials used in production
(vi) All work shall be carried out under the personal supervision of a competent supervisor.
(vii) Non-sparking tools shall be provided for the purpose of cleaning or repairing machinery or operating any process where inflammable vapours are involved.
(viii) Empty containers used for holding compound shall be thoroughly cleaned of their contents and treated with an inactivating agent before being discarded.
(ix) Static Earthing in Explosives buildings Static Earthing of all metallic parts, with which the explosives come into contact, shall be done for dissipation of static electric charges. Earth continuity test of all the static earthing in explosive building shall be done at least once in six months.

(6) PPE Matrix

Sl No	**Activity**	**Prescribed PPE's**

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1	Raw Material Handling	Oxidizer storage	Safety shoes(anti-static), Safety hand gloves, N95 mask, safety goggles
		Sulphur, Coal dust, Metal dust storage	Safety shoes(anti-static),Safety hand gloves, N95 mask, safety goggles
2	Water gel/Slurry Explosive Manufacturing	Monomethylamine Nitrate Plant	Safety Goggles, Safety hand gloves and Safety shoes (anti-static).
		Nitric Acid Handling and storage	Acid resistant coveralls, Face shield, Safety shoes (anti-static), half face respirator.
		Mixing and Packing	Chemical resistant coveralls, safety goggles, Safety shoes (anti-static), half face respirator.
3	Bulk Emulsion Explosive	Mixing	Chemical resistant coveralls, safety goggles, Safety shoes (anti-static), half face respirator.
		Truck Loading	Chemical resistant coveralls, safety goggles, Safety shoes (anti-static), half face respirator.
4	General	Lab	Chemical resistant coveralls, safety goggles, Safety shoes (anti-static), half face respirator.
		Magazine	Safety shoes(anti-static), Safety hand gloves, N95 mask, safety goggles

106. **Insecticides, fungicides, herbicides and other pesticides industries** - under serial no. 18 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply in respect of all factories or any part thereof in which the process of manufacture and blending of insecticides, fungicides, herbicides and other pesticides hereinafter referred to as the said manufacturing process is carried on.

(2) Instruction to Employees.- Every employee on his first employment shall be fully

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instructed on the properties including dangerous properties of the chemicals handled in the said manufacturing process and the hazards involved. The employees shall also be instructed in the measures shall be taken to deal with any emergency. Such instructions shall be repeated periodically.

(3) Cautionary notice and placards.- Cautionary notices and placards in the form specified in appendix to this standard and printed in the language of the majority of the workers shall be displayed in all work places in which said manufacturing process is carried on so that they can be easily and conveniently read by the workers. Arrangements shall be made by the occupier and the manager of the factory to periodically instruct the workers regarding the health hazards arising to in the said manufacturing process and methods of protection. Such notices shall include brief instructions regarding the periodical clinical tests required to be undertaken for projecting health of the workers.

(4) Prohibition relating to employment of pregnant woman or adolescent.- No pregnant woman or adolescent shall be employed or permitted to work in any room in which the said manufacturing process is carried on or in any room in which insecticides, fungicides, herbicides and other pesticides are stored.

(5) Food, drinks, and smoking prohibition.-

(a) No food, drink, tobacco, pan or supari shall be brought into or consumed by any worker in any workroom in which the said manufacturing process is carried out.

(b) Smoking shall be prohibited in any workroom in which the said manufacturing process is carried out.

(6) Material Safety Data Sheet (MSDS): First aid, safety, health, hygiene, and permissible exposure limits including spill and emergency procedures shall be fully complied with as per the MSDS issued by the manufacturer, supplier, and importer, as the case shall be.

(7) Floors and work-benches.-

(a) Floors in every workroom where insecticides, fungicides, herbicides and other pesticides are manipulated shall be of cement or other impervious material giving a smooth surface.

(b) Floors shall be maintained in good repair, provided with adequate slope leading to a drain and thoroughly washed once a day with the hose pipe.

(c) Work-benches where insecticides, fungicides, herbicides and other pesticides are manipulated shall be made of smooth, non-absorbing material preferably stainless steel and shall be cleaned at least once daily.

(8) *Spillage and waste.-*

(a) If insecticides, fungicides, herbicides or other pesticides during their blending splashes or spills on the work-bench, floor or on the protective clothing worn by a worker, immediate action shall be taken for through decontamination of such areas or articles.

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(b) Cloth, rags, paper or other material soaked or soiled with insecticides, fungicides, herbicides or other pesticides shall be deposited in a suitable receptacle with tight fitting cover. Contaminated waste shall be destroyed by burning at least once a week.

(c) Suitable deactivating agents, shall be kept in a readily accessible place for use while attending to a spillage.

(d) Easy means of access shall be provided to all parts of the plant for cleaning, maintenance and repairs.

(9) Empty containers used for insecticides, fungicides, herbicides or other pesticides.-Containers used for insecticides, fungicides, herbicides or other pesticides shall be thoroughly cleaned of their contents and treated with an inactivating agent before being discarded or destroyed.

(10) Manual handling.-

(a) Any insecticide or fungicide or herbicide or any other pesticide shall not be required or allowed shall be manipulated by hand.

(b) Direct contact of any part of the body with any insecticide or fungicide or herbicide or any other pesticide during its blending shall be avoided.

(11) Ventilation.-

(a) In every workroom or area where any insecticide or fungicide or herbicide or any other pesticide is blended, adequate ventilation shall be provided at all times by the circulation of fresh air.

(b) Unless the process is completely enclosed, the following operations during blending of any insecticide or fungicide or herbicide or any other pesticide shall not be undertaken without an efficient exhaust system:-

(i) emptying a container holding a insecticide, fungicide, herbicide or other pesticide;

(ii) blending a insecticide or fungicide or herbicide or any other pesticide;

(iii) preparing a liquid or powder formulation containing a insecticide, fungicide, herbicide or other pesticide; and

(iv) changing or filling a insecticide, fungicide, herbicide or other pesticide into a container, tank hopper or machine or small sized containers.

(c) In the event of a failure of the exhaust system provided on the above operation, the said operations shall be stopped forthwith.

(12) *Time allowed for washing.-*

(a) Before each meal and before the end of the day's work at least ten minutes in addition to the regular rest interval shall be allowed for washing to each worker engaged in the blending of insecticide or fungicide or herbicide or other pesticide.

(b) Every worker engaged in the blending of any insecticide or fungicide or

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herbicide or any other pesticide shall have a thorough wash before consuming any food and also at the end of the day's work.

(13) Blending not be undertaken.- Manufacture or blending of any insecticide or fungicide or herbicide or any other pesticide shall not be undertaken in any factory unless a certificate regarding its dangerous nature is maintained and kept available.

(14) Medical facilities and records of examinations and tests.-

(a) The occupier of every factory to which this standard applies, shall-

(i) employ a Factory Medical Officer for medical surveillance of the workers employed therein whose employment shall be subject to the approval of the Chief Inspector of Factories; and

(ii) provide to the Factory Medical Officer all the necessary facilities for the purpose.

(b) The record of such examinations carried out by the medical practitioner shall be maintained in a separate, register and the same shall be kept readily available.

(15) PPE Matrix

No.	Activity	Recommended PPE
	Manufacturing and blending of insecticides, fungicides, herbicides, and other pesticides	Protective clothing consisting of long pants and shirts or overalls with long sleeves and head coverings, rubber gloves, gum boots, rubber aprons chemical safety goggles and respirators
	Handling of insecticides, fungicides, herbicides, and other pesticides	Rubber gloves, gum boots, rubber aprons, chemical safety goggles and respirators
	In case of insecticides, fungicides, herbicides and other pesticides containing oil	Gloves, boots, aprons shall be made from synthetic rubber

CAUTIONARY NOTICE

Insecticides, fungicides, herbicides and other pesticides

(a) Chemicals handled in this plant are poisonous substances.

(b) Smoking, eating food or drinking, chewing tobacco in this area is prohibited.

(c) No food stuff or drink shall be brought in this area.

(d) Some of the chemicals used in the manufacturing process shall be absorbed through skin and shall cause poisoning.

(e) Hands shall be washed before meals and shower at the end of the shift.

(f) Protective clothing and equipment supplied shall be used while working in this area.

(g) Containers of insecticides, fungicides, herbicides and other pesticides shall not

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be used for keeping food stuffs.

(h) Spillage of the chemicals on any part of the body or on the floor or work-bench shall be immediately washed away with water.

(i) Clothing contaminated due to splashing shall be removed immediately.

(j) Scrupulous cleanliness shall be maintained in this area.

(k) Do not handle insecticides, fungicides, herbicides and other pesticides with bare hands.

(l) In case of sickness like nausea, vomiting, giddiness, the manager shall be informed who shall make necessary arrangements for treatment.

(m) All workers shall report for the prescribed medical tests regularly to protect their own health.

107. **Synthetic resins and plastics -** under serial no. 19 in the first schedule under clause (za) of sub-section (1) of section 2

(1) Provisions of this standard shall apply to all factories wherein manufacturing and processes incidental thereto carried on with any of synthetic resins such as saturated and unsaturated polyesters, alkyds, epoxies, acrylics, vinyl, Polyacetals, Polyurethanes, Amino resins, Polyamides, Silicones, Hydroxy ethyl cellulose, isocyanates etc. and plastics such as Polyvinyl chloride, Polyethylene, Polypropylene, etc.

(2) Injection Molding Machines:

(a) The injection molding machine and its surrounding environment shall be kept clean and as smooth as possible.

(b) The debris (such as rubber particles) on the Melter cylinder shall be cleaned before turning on the electric heat to avoid fire. If the machine is not overhauled or necessary, the heat shield on the melt cylinder shall not be removed at all.

(c) The emergency button shall be checked whether it is pressed or the safety door is opened during operation.

(d) When the shooting table is moved forward, the molten rubber leaking from the nozzle shall not be removed by hand to prevent the handle from being sandwiched between the shooting table and the mold.

(e) When cleaning the barrel, the temperature of the nozzle shall be adjusted to the most appropriate high temperature to keep the nozzle clear. Then the lower injection pressure and speed shall be used to remove the remaining rubber in the cylinder. Direct contact with the glue just shot to avoid burns.

(f) Leaving heat sensitive and corrosive plastics in the barrel shall be avoided for too

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long. The shutdown and cleaning methods provided by the plastic supplier shall be followed. When replacing plastics, it shall be made sure that the mixing of new and old plastics does not produce chemical reactions, otherwise other plastics shall be used to remove the old materials in the barrel.

(g) Before operating the injection molding machine, it shall be checked whether the mold is firmly installed on the movable platen and the head plate of the injection molding machine.

(h) The ground wire and other wiring of the injection molding machine shall be connected securely.

(i) When installing the mold, the lifting ring shall be completely screwed into the mold lifting hole before lifting. After the mold is installed, the length of the safety rod of the injection molding machine shall be adjusted according to the size of the mold.

(j) When the safety door is opened, the safety stops of the machine shall block the mold clamping of the injection molding machine.

(k) In the normal injection molding process, it shall be strictly prohibited for the operator to open the safety door from above or below the injection molding machine. When servicing the mold or temporarily not producing, the oil pump motor of the injection molding machine shall be turned off in time.

(l) When operating the injection molding machine, it shall be operated by one person, and no multi-person operation shall be allowed. It shall be prohibited for one person to operate the control panel while another person adjusts the mold or performs other operations.

(3) Extrusion Blow Machines:

(a) Work environment shall be maintained free of oil and grease.
(b) Anything that dangles, such as necklaces, braces, watches, rings, or loose clothing shall not be worn.
(c) The guard's safety switches shall not disconnected or by-passed.
(d) Never climb between the tie-bars during hydraulic pump operation.
(e) Protective gloves shall be worn always when adjusting manifolds or components on the hot die head.
(f) Never reach into the machine's throat during granulator operation.
(g) The location of the nearest fire extinguisher shall be well known to the employees.
(h) Steel tools shall not be used on the parting line, mold cores, and cavities.
(i) The location of the nearest first-aid kit shall be well known to the employees.
(j) Safety glasses and steel-toed boots shall always be worn by the employees.

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(k) No employee shall stand directly below a mold suspended in the air.

(l) Electrical cords and air hoses shall be regularly examined.

(m) Proper safety equipment shall be used when lifting heavy workpiece material.

(n) An extrusion blow molding machine shall not be used without authorization and appropriate training.

(4) Chemical Hazards: Hazards associated with Reinforced Plastic Fabrication-

(a) The most important hazards associated with Glass Reinforced Plastic (GRP) fabrication come from:

(i) handling of glass fiber
(ii) handling of resins
(iii) handling of hardeners / initiators
(iv) cutting and sanding of Glass Reinforced Plastic
(v) cleaning solvents; and
(vi) fillers and pigments.

(b) Significant health and safety risk to workers, workplace and the environment posed by the emissions of volatile organic compounds (VOC) from most GRP processors shall be taken care.

(5) Hazards associated with Fiber-

(a) Inhalation of the glass fibres shall be avoided to prevent irritation of the upper respiratory tract and contact with them shall cause skin and eye irritation.

(b) Eye wash and body shower shall be provided to remove the fibres which causes eye irritation and skin itchiness.

(6) Hazards associated with Handling of Resins –

(a) Epoxy resins shall be handled with care as they are caustic and can cause skin burns and dermatitis. Contact with the eyes can cause severe damage. Vapours of epoxies shall irritate the eyes, nose and throat.

(b) Short-term health effects of styrene:

(i) it can cause mild irritation of the eyes, nose and throat at concentrations of around 100 ppm, definite irritation at 350-500 ppm and severe irritation at about 500 ppm;

(ii) symptoms such as headache, dizziness and fatigue can be observed at concentrations of 100-200 ppm;

(iii) other symptoms such as slower reaction times, reduced manual dexterity and

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impaired co-ordination and balance can be observed at concentrations of above 200 ppm;

(iv) prolonged skin exposures can cause chapped skin, rash and dermatitis due to the fat-dissolving properties; and

(v) when splashed to the eyes, it can cause mild to severe irritation.

(c) Long -term health effects of styrene:

(i) repeated exposure can affect the central nervous system;

(ii) slower reaction times have been documented in workers exposed to concentrations of about 55 ppm and even lower over extended periods; and

(iii) it is a possible human carcinogen and chromosomal changes in peripheral lymphocytes of styrene-exposed workers were found.

(7) Hazards associated with Cutting and Sanding of GRP:
Dust associated with cutting and sanding of GRP shall be controlled and prevented.

(8) Hazards associated with cleaning solvents
Solvent vapour shall be absorbed at source.

(9) Hazards associated with fillers and pigments: Pigment and filler dust shall be controlled at source by proving dust extraction system.

(10) General

(a) Effective control measures shall be used in usage of styrene by reducing styrene vapour formation using vapour-suppressed resins and low styrene resins.

(b) The process and equipment shall be modified to minimize the VOC emissions

(c) During rolling operations, rollers shall be fitted with guards to reduce droplet formation and shall help reduce styrene emission

(d) The use of robots shall be considered for proper positioning of the spray gun and ensure optimized coverage

(e) Exhaust ventilation shall be used to prevent accumulation of hazardous chemicals in the atmosphere

(f) The pots or drums of resin shall be kept closed when not in use

(g) The nature and compatibility of the substances shall be carefully studied. Reactive substances shall be adequately separated.

(h) During off-loading and in storage areas, all sources of ignition shall be excluded and no smoking shall be allowed. All hazardous and highly flammable substances shall be clearly labelled.

(i) Containers such as drums, which are unused, shall be carefully stored or disposed

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of, as they shall contain residues that give out flammable vapour.

(11) Personal Protective Control Measures –

(a) Protective clothing protects the skin or personal clothing from contact with hazardous chemicals and prevents spread of contamination. When handling resins or fibre-glass, such as dispensing and storage, and conducting maintenance work, employees shall always wear suitable protective clothing. Employers shall also provide their employees with special clothing for use in emergencies.

(b) Protective clothing includes aprons, gowns and overalls. It is important to choose protective clothing made of materials that resist penetration or damage by the chemicals used.

(c) As GRP fabrication workers frequently have to manipulate many hazardous chemicals by hands, protective gloves have shall be used. For protection from styrene, nitrile rubber gloves are considered most suitable. However, as no gloves shall give long-term protection against any hazardous chemicals, they shall be replaced regularly.

(d) Where there is a reasonably foreseeable risk of eye injury through splashing, suitable eye protectors or face shields shall be worn. Safety spectacles can be fitted with prescription lenses if required, while clear plastic safety goggles that completely enclose the eyes provide superior eye protection. If protection to the whole face including mouth, nose and eyes is required, face shield shall be used

(e) Respiratory protective equipment (RPE) protects workers against exposure to dusts, gases, fumes and vapours, but exposure duration shall be kept short.

(f) RPE shall be used to protect the workers where engineering control shall not be reasonably practicable such as during maintenance, cleaning, or emergencies where hazardous fumes are generated from significant chemical spillage or inadvertent mixing of incompatible chemicals.

(g) Air purifying respirators Most half-face respirators equipped with appropriate filters provide protection against contaminants of concentration up to 10 times, and most full-face respirators up to 50 times its exposure standard (OEL) when fitted correctly. Most powered air purifying respirators have similar efficiency as the latter. They use battery operated motor blower to draws air through filters.

(h) Airline respirators Airline respirators supplying clean air to the mask, helmet or hood with an airline are most suitable for use in the fiberglass industry. The level of protection depends on whether a helmet, hood or mask is used. It can range from below 25 to more than 1000 times the safe exposure standard.

(12) Operational Hazards:

(a) Mixing of Hazardous Chemicals –

(i) Preparation of the materials for GRP fabrication such as resin mixes shall be carried out in place specially set aside for the purpose.

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(ii) Care shall be taken to guard against the accidental mixing of accelerator and initiator, which shall otherwise result in serious physical hazards such as fire and explosion.

(iii) The floor and workbench surfaces shall be kept free from spillage and any build-up of catalyzed resin. To reduce fire risk, non-absorbent material such as polythene sheeting shall be used to cover the floor and workbench to enable easy removal of spilt resins and initiators.

(iv) When mixing hazardous substances, operators shall wear eye protection, gloves and chemical resistant clothing. In the mixing areas, emergency showers and eyewashes shall be provided and located nearby.

(b) Moulding –

(i) Care shall be taken in handling of vapours of styrene or other chemicals released during moulding and curing and the release of initiator in the form of droplets from the spray gun.

(ii) Smoking shall be strictly prohibited and adequate ventilation provided to keep hazardous vapours below their exposure limits.

(iii) When spraying process is conducted in the moulding area, regular inspection and maintenance of airline, gauges, pressure valves and related equipment shall be carried out.

(iv) Resin mixes not in immediate use shall be kept covered to reduce evaporation and avoid contamination.

(c) Curing and Trimming –

(i) Electrical equipment and lighting in these areas shall therefore be properly designed, constructed, installed and maintained to prevent ignition of the flammable atmosphere. In addition, these areas shall be adequately ventilated.

(ii) At sanding booth, local extraction ventilation system shall be installed.

(d) Handling of organic peroxides –

(i) A well-designed and maintained ventilation system shall be installed to remove airborne organic peroxides from the workplace.

(ii) The amount of organic peroxides stored shall be kept as small as practicable.

(iii) Before storing, all incoming containers shall be checked wether they are in good shape and properly labeled. Defective containers shall not be accepted.

(iv) For organic peroxides requiring temperature control, the recommended storage temperature range shall be marked on the container to avoid decomposition at elevated temperature.

(v) Organic peroxides shall be stored in suitable and labeled containers in a cool dry area. Containers shall be protected against impact or other physical damage

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during storage, transfer or use.

(vi) Containers shall be kept tightly closed to avoid contamination.

(vii) Organic peroxides shall be stored away from processing and handling areas. They shall be kept away from incompatible materials such as strong acids and bases, other oxidizing substances, flammable or combustible materials.

(viii) In the course of mixing or dispensing organic peroxides, containers shall be opened and dispensed in a designated room or area outside the storage area. No ignition source is allowed in the vicinity. The organic peroxides shall not be in contact with combustible or other incompatible substances when dispensed.

(ix) Organic peroxides shall not be mixed directly with any accelerators, as it shall lead to violent explosion. If the accelerator is added to the resin mixture first, it shall be thoroughly mixed before adding the organic peroxide.

(13) Isocyanides –

(a) The different forms of Isocyanates are:

(i) MDI (4,4'-Methylene diphenyl Diisocyanate)

(ii) TDI (2,4-Toluene diisocyanate)

(iii) HDI (Hexamethylene Diisocyanate) and IPDI (Isophorone Diisocyanate).

(b) Prevent:

Where possible isocyanate risks shall be eliminated or reduced.

(c) Consider:

(i) using products that do not contain isocyanates or less volatile forms.

(ii) avoiding unnecessary spraying. This causes more isocyanate to get into the air compared to using a brush or roller.

(iii) being aware of anyone who is already sensitized to isocyanates. Keep them away from the work.

(d) Control: Control of isocyanate at work application shall be as below:

(i) Eye protection – eye protection is required (eg. goggles or a face shield) when doing work where splashes / aerosol shall get into the eyes.

(ii) Gloves – gloves shall be right for the products used – single use disposable gloves made of suitable materials (eg nitrile) are preferable. Breakthrough time and permeation rate shall be verified for the type and length of the work. Gauntlet style gloves shall be required to prevent skin exposure.

(iii) Overalls – disposable overalls shall be preferred. Launder significantly contaminated re-usable overalls before wearing them again.

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(iv) Respiratory Protective Equipment (RPE) –RPE shall be required where ventilation does not provide enough control – particularly in enclosed spaces were an aerosol (eg by some rollering work) is created or using products with significant amounts of TDI. Respirators shall be selected based on quantitative exposure assessment. Wearers shall be fit tested where needed. It is particularly important to select the correct filter. For example, particulate filters provide protection against spray mist but do not protect the applicators from vapours. Spraying operation with isocyanates shall use supplied air respirator instead of air purifying respirator depending upon validated exposure assessment results / data base. Respirator cartridges shall be selected based on the type of isocyanate material used.

(e) Occupational personal exposures to isocyanates shall be monitored during brush, roller and spray application.

PLASTIC CONTENTS

SUBSTANCE	**SCOPE**	**REQUIREMENT**
Lead content	Content in Plastic Products	≤ 90 mg/kg (paints and surface coatings) ≤ 300 mg/kg (substrates)
Cadmium content		≤ 75 mg/kg
Benzyl butyl phthalate		≤ 0.1% (sum)
Dibutyl phthalate		≤ 0.1% (sum)
Di(ethylhexyl) phthalate		≤ 0.1% (sum)

108. **Man-made fibre (cellulosic and non-cellulosic) industry -** under serial no. 20 in the first schedule under clause (za) of sub-section (1) of section 2

(1) MAN MADE FIBRE(CELLULOSIC) INDUSTRY

This shall apply for the manufacturing of Man-made fibre (Cellulosic).

(a) Caustic and Pulp handling

(i) While removing of Tarpaulin and rope in the Wood loaded truck, safety belt with fall arrestor system and helmet shall be used at designated place.

(ii) A truck driver shall not remain in the truck during unloading operations after placing the wheel choke below the wheel.

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(iii) Entry shall be restricted and only authorised persons permitted to the unloading area.
(iv) Wire braided hose pipe shall be used for caustic soda unloading
(v) Flange guard shall be provided on all Hazardous chemical pipelines.
(vi) High level alarm system with interlock to the pump shall be provided to Hazardous chemical storage tanks for preventing overflow.
(vii) Periodical physical condition monitoring shall be carried out of the hazardous chemical storage tanks.
(viii) Forklift and any other material unloading equipment used for pulp handling shall be battery operated.
(ix) Safe storage and adequate space of pulp bundles shall be ensured to prevent collapse.
(x) Separation of man and machine movement in ware house shall be ensured.
(xi) Battery charging room shall be segregated from storage area.

(b) Preparation of Viscose

Steeping

(i) Safety Goggles shall be used during the operation of Steeping.
(ii) Ensure that Safety hand gloves shall be used while sampling.
(iii) A warning sign / hazard label shall be affixed on each container containing corrosive chemicals.
(iv) All moving / rotating parts shall be guarded.

(c) Pulper and dissolver and Ripening

(i) All the moving parts shall be provided with 360-degree guard protection.
(ii) Work floor shall be kept free from leakage of viscose to prevent slip, trip, and fall hazard.
(iii) Gas detection and warning, and pipe line integrity monitoring system shall be implemented for NH_3 chillers.

(d) CS2 Plant

(i) Tanks used for storage of carbon disulphide or the equipment in which carbon disulphide is used, shall be kept properly closed and its inlet and outlet valves properly tightened in closed position. The empty CS_2 tank shall be kept filled with water or inert gas.
(ii) Carbon disulphide shall not be filled in any vessel in excess of 85 percent of its capacity and the remaining 15 percent of tank capacity shall be filled with water.
(iii) Liquid CS_2 shall never be transferred by using air pressure and shall be transferred only by using water or inert gas pressing.

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(iv) The CS_2 Storage tank shall be submerged under water or its dyke shall be kept filled with water and the overflow shall be drained to a safe place.

(v) The dyke valves shall be located outside the dyke and operated from a safe distance.

(vi) Monthly monitoring of dyke water shall be carried out for CS_2 presence.

(vii) The storage tank shall be treated as pressure vessel considering increase in pressure above than the atmospheric pressure, which occurs during transfer.

(viii) Only non-sparking tools shall be used in areas where carbon disulphide is stored, handled, and used.

(ix) For long runs of pipelines, there shall be a minimum number of flanged joints to minimize chance of leakage. Screwed joints shall be prohibited.

(x) Lagged or unlagged steam lines or any other hot fluid carrying lines which shall produce surface temperature of 90°C shall not be permitted in the area situated within and around carbon disulphide storage tanks or usage point.

(xi) Leak detection system along the pipeline carrying CS_2 shall be provided.

(xii) No carbon disulphide shall be allowed to escape into any sewer or drain during the loading and unloading from the transport vehicle

(xiii) The engine of the road tanker vehicle shall be stopped during the whole period of the operation of filling or emptying and shall not be run until the carrying tank of the road tanker and any tank in which carbon disulphide is being delivered or from which any carbon disulphide is being taken out have been securely closed.

(xiv) Adequate provision shall be made to prevent the accumulation of a dangerous static charge of electricity by properly earthing the carrying tank during the operation of filling and emptying the tank.

(xv) Usage of Mobile Phones shall be prohibited near storage and handling of CS_2.

(xvi) While transferring of CS_2 through pipeline and equipment's, the earthing connectivity shall be maintained throughout the flange joints by connecting with jumpers.

(xvii) Gas detectors with audio and visual alarm shall be installed around the storage of CS_2 based on the dispersion modeling study.

(xviii) Water curtains shall be provided around the CS_2 storage tank.

(xix) Rupture disc shall be provided to the CS_2 furnace and connected to blow down drum or flare of adequate capacity.

(xx) Work environment monitoring study shall be carried out and recommendation of the study implemented to prevent Charcoal dust, CS_2, SO_2 and H_2S gas exposure to the workers.

(xxi) Charcoal dust explosion shall be prevented by implementing appropriate prevention and control measures.

(xxii) During solid sulfur handling dust cloud formation shall be prevented by

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storing the sulfur in well ventilated areas.

(xxiii) Provide local exhaust ventilation system at solid sulfur handling area for preventing dust accumulation of sulfur.

(xxiv) Friction due to transportation activity shall be avoided at solid sulfur handling and storage by providing anti friction padding at sulfur handling areas.

(xxv) Flare system shall be provided to H_2S leak gas handling.

(xxvi) Sulphur recovery plant shall be provided with adequate and appropriate scrubbing system.

(xxvii) Manufacturing, handling, and storage of CS_2 shall comply with the applicable National Standards.

(e) Xanthation

(i) Gas detectors with audio and visual alarm shall be installed around the CS_2handling based on the dispersion modeling study.

(ii) Ferrous metal detection and arresting system shall be provided and maintained.

(iii) A Dedicated buffer tank for CS_2overflow shall be provided and maintained.

(iv) Static electricity control measures shall be provided as per National Standards.

(v) Rupture disc shall be provided to the xanthator and connected to blow down drum or flare of adequate capacity.

(vi) Alarm system for detecting low/no vacuum shall be provided to stop further addition of CS_2 in xanthator reactor.

(vii) Inert gas blanketing shall be ensured in case of any failure of vacuum in xanthator reactor.

(f) Dissolving / Mixing :

(i) All dissolvers/ Mixing tanks shall be well constructed and shall be subjected to yearly inspection.

(ii) A watch glass shall be provided preferably on top of vessel.

(iii) Eye washer /Shower shall be provided nearby vessels to wash the affected parts in case of corrosive chemicals spill exposure

(iv) The entry to the Dissolver by the workers shall be treated as a confined space entry and accordingly applicable standard shall be complied with.

(g) Filtration :

(i) Safety PPE's shall be provided to the workers handling the filtration media.

(ii) A warning sign / hazard label shall be affixed on area handling the corrosive chemicals.

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(h) Spin bath:

(i) A warning sign / hazard label shall be affixed on area handling the corrosive chemicals.

(ii) The entry to the filter/ storage tank by the workers shall be treated as a confined space entry and accordingly applicable standard shall be complied with.

(iii) Sensors with audible and visible Alarms shall be provided for detecting carbon disulphide and hydrogen sulphide gas leakages for continuous monitoring.

(iv) Concentrated Sulphuric Acid pipelines shall be properly painted as per National Standards. Splash guards shall be provided on each flange joints.

(v) Care shall be taken during maintenance to avoid hot liquor spillage/leakage by way of passing valves or leaking flanges.

(vi) Thermal protection and chemical resistant suite shall be used during isolation of evaporator bodies wherever applicable.

(i) Spinning

(i) Chromic acid bath being a dangerous operation standards prescribed under Section 18 of the Code shall be followed.

(ii) Release and accumulation of CS_2 and H_2S gases in the work area shall be prohibited and permissible exposure limits for this chemical shall be maintained.

(iii) CS_2 and H_2S Gas detectors with audio and visual alarm shall be installed based on the dispersion modeling study.

(iv) Emergency backup Power Supply shall be provided and maintained to exhaust fans.

(v) Alarm system shall be provided and maintained for the exhaust fan trip.

(vi) In rayon grade yarn manufacturing, polycarbonate funnel shall be used.

(j) Washing and Drying:

(i) Earthing and Bonding shall be provided on Dryers and drying equipment.

(ii) A warning sign 'Corrosive' label shall be affixed on area handling the corrosive chemicals.

(iii) "High Temperature Hazard" shall be displayed / painted in English and local language understood by majority of the employees.

(iv) Flange/coupling guards shall be provided for the transfer lines handling corrosive liquids.

(k) CONVERSION OPERATION:

(i) Coning/ winding:

(a) Hearing protection equipment (ear plug/ ear muffs) and safety goggles shall be worn by the Worker and others in the immediate area.

(b) An in running nip point on a roll-type embosser, drum winder or rewinder

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shall be guarded by a barrier interlocked with the drive mechanism in such a manner that the barrier can be raised only when the rolls have stopped.

(c) The barrier shall be constructed so that the worker cannot reach over or around it into the nip point.

(d) Smoking and other sources of fire and spark producing sources shall not be permitted in a Coning area. Warning signs shall be posted.

(ii) Packing:

(a) Cone Boxes shall be removed safely from the conveyor, during any stoppage of conveyor.

(b) Conveyors shall be tested and certified by responsible person appointed by the Factory Manager/ Occupier.

(l) Warehouse:

(i) Battery operated forklift shall be used.

(ii) Forklift operators shall be trained and licensed by the company.

(iii) Inspection of Forklift shall be done once in a six-month time.

(m) Acid Plant

(i) All flange joints of acid transferring line shall be provided with flange guards.

(ii) Periodic thickness testing shall be done for all acid storage tanks.

(iii) Each dyke shall have a sump provision with pump to collect and transfer and disposal of the leaked acid in a safe manner.

(iv) The vents of sulfuric acid storage tanks shall be protected from the ingress of rainwater or moisture.

(v) Level indicator with alarm on High-High shall be provided and maintained for acid storage tanks.

(vi) A dedicated buffer Acid storage tank shall be provided and maintained.

(n) Salt Recovery Section

(i) H_2S Gas detectors with audio and visual alarm shall be installed based on the dispersion modeling study in spin bath area.

(ii) Exhaust facility shall be connected to the spin bath circulation tank.

(iii) Alarm system shall be provided and maintained for the exhaust fan trip.

(iv) Dripping line in exhaust line shall be provided to remove condensate and prevent chocking.

(o) General

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(i) Hazardous area classification shall be carried out and appropriate flame proof equipment shall be provided.

(ii) Periodical Corrosion preventive measures like epoxy painting or any other suitable paint shall be carried out for chemical storage tanks and pipeline.

(p) PPE Matrix

Sl. No	**Activity**		**Prescribed PPE's**
1	Caustic and Pulp handling	Pulp unloading and storage activity	Safety helmet, Safety shoes, Safety hand gloves, safety belt with fall arrestor, and reflective waist.
		Caustic unloading/handling and storage activity.	Safety helmet, Safety Goggles, Safety hand gloves, Chemical Protective Suit, Face shield Safety shoes and safety belt with fall arrestor
2	Pulper and dissolver and Ripening	Pulp feeding and dissolving and filtration activity	Safety helmet, Safety Goggles, Safety hand gloves and Safety shoes.
3	CS_2 Plant	CS_2manufacturing activity	Safety helmet, Half cartridge face mask/ respiratory protection, Self-contained breathing apparatus, Safety Gloves, Safety Shoes, Nose Mask and Safety Goggles.
		CS_2 Refining and storage activity	Safety helmet, Half cartridge face mask/ respiratory protection, Self-contained breathing apparatus, Safety Gloves, Safety Shoes, and Safety Goggles.
4	Xanthation	Reaction of Alkcell, CS_2/Acid and Caustic lye.	Safety helmet, Half cartridge face mask/ respiratory protection, Safety Gloves, Safety Shoes, and Safety Goggles

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5	Spinning	Regeneration of fibre at spinning machine area	Safety helmet, Half cartridge face mask/ respiratory protection, Safety Gloves, Safety Shoes, and Safety Goggles
		Fibre mat washing activity-After treatment section	Safety helmet, Face Shield, Safety Gloves, Safety Shoes, and Safety Goggles
		Fibre Drying activity-Dryer section	Safety helmet, Nose Mask, Safety Gloves, and Safety Shoes,
6	Acid Plant	Acid manufacturing, storage and handling activity	Safety helmet, Safety Goggles, Safety hand gloves, Chemical Protective Suit, Face shield Safety shoes and Half cartridge face mask/ respiratory protection.
7	Salt Recovery Section	Spin bath circulation and Salt recovery activity.	Safety helmet, Safety Goggles, Safety hand gloves, Chemical Protective Suit, Face shield Safety shoes and Half cartridge face mask/ respiratory protection

(2) MAN-MADIE FIBRE (NON-CELLULOSIC)

This shall apply to Man-made fibre (Non-cellulosic) Industry.

(a) POLYESTER

(i) **Handling and Storage of raw materials**

(a) Pure Terephthalic Acid (PTA)

(i) Unloading and storing

(a) Loaded Truck shall be parked at designated place and engine shall be switched OFF and Hand Brake shall be applied.

(b) Electrical Hoist and Forklift used for unloading and stacking operation shall be maintained in good working conditions.

(c) Forklift shall be fitted with audio, light alarms and reverse horn.

(d) Forklift operator shall be trained on safety and medically examined and certified by medical officer.

(e) Appropriate and adequate static electricity protection and discharge system shall be ensured to prevent explosion hazard.

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(f) Dust explosion protection system shall be ensured in the plant.
(g) Area for movement of forklift shall be clearly marked on the floor.
(h) Stacking shall be done such that the bag shall not slide on sides or fall.

(ii) Loading of PTA in Continuous Polymerisation (CP) unit
(a) Forklift shall be fitted with audio, light alarms and reverse horn.
(b) Forklift operator shall be trained on safety and medically examined and certified by medical officer.
(c) Electrical Hoist and Forklift used for unloading and stacking operation shall be maintained in good working conditions.
(d) The empty bags shall be collected and disposed safely without accumulating the same at the loading area.

(b) Mono Ethylene Glycol and Tri Ethylene Glycol

Unloading and storing

(i) Chemical tankers shall be parked close to the unloading point and engine shall be switched OFF and Hand Brake shall be applied.
(ii) Electrical equipment and lighting shall be of flame proof construction conforming to applicable National Standards.
(iii) Unloading area shall be kept clear of unwanted materials.
(iv) Storage tanks used for storing chemicals shall be marked with name of the chemical stored and capacity of the tanks.
(v) Storage tanks shall be constructed as per OEM guidelines.

(ii) **Polymerisation Process**

(a) Esterification of PTA and MEG

(i) Hot surfaces of the reactors and associated system pipelines shall be properly insulated, cladded and maintained.
(ii) Warning signs shall be displayed in English and local language to warn about hazards with hot surface and high temperature.
(iii) Only authorized and trained workers shall be permitted to work in the reactor area.
(iv) Reactors shall be provided safety valve along with rupture disc as per OEM guidelines.
(v) Jacketing of the reactor providing for thermic fluid shall be periodically examined for ensuring mechanical integrity.

(b) Pre-polymerization

Vacuum gauges shall be calibrated and maintained in good working condition.

(iii) **Polyester Stable Fiber (PSF)**

(a) Spinning and Quenching Process

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(i) Only authorized and trained personnel shall be allowed in the quenching process area.

(ii) Interlocks and sensors provided for creel box shall be calibrated, examined and maintained.

(b) Draw line process

(i) Interlocks and sensors provided for creel box shall be calibrated, examined and maintained.

(ii) Only authorized and trained personnel shall be allowed in the draw line process area.

(iii) The workers shall not interfere with automated system in the continuous process of draw line except during shut down and maintenance.

(iv) Hydraulic and pneumatic systems used for automation shall be examined for any leakages.

(iv) **Partially Oriented Yarn (POY)**

(a) Spinning and Quenching Process

(i) Only authorized and trained personnel shall be allowed in the spinning process area.

(ii) Interlocks and sensors provided in spinning shall be maintained in good working conditions.

(b) Take Up process

(i) Interlocks and sensors provided for creel box shall be calibrated, examined and maintained.

(ii) Only authorized and trained personnel shall be allowed in the draw line process area.

(iii) The workers shall not interfere with automated system in the continuous process of draw line except during shut down and maintenance.

(iv) Hydraulic and pneumatic systems used for automation shall be examined for any leakages.

(v) Doffer unit shall be provided and maintained with proximity sensors and audio-visual alarms.

(vi) Area for movement of doffer unit and workers shall be clearly marked on the floor.

(v) **Draw Textured Yarn Plant**

(a) Interlocks and sensors provided in DTY Machine shall be calibrated and maintained.

(b) Only authorized and trained personnel shall be allowed in the quenching process area.

(c) The workers exposed to high noise level shall be medically examined for audiometry.

(d) The workers shall not interfere with automated system in the continuous process

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of draw line except during shut down and maintenance.

(e) Material handling equipment such as forklift, hand truck shall be maintained in good working conditions.

(f) Appropriate PPEs shall be provided to the workers while doing stacking/unstacking of finished products.

(vi) **General**

(a) Good housekeeping shall be maintained in the Factory.

(b) Warning signs shall be provided to indicate Hot surfaces and High temperature operations.

(c) Instruments and gauges used shall be maintained in good working conditions and calibrated periodically.

(d) Access into the Automatic Storage and Retrieval System shall be prohibited, during operation.

(e) Appropriate prevention and control measures shall be implemented to protect workers from getting exposed to coal dusts.

(f) Adequate and appropriate measures including supply and use of PPE's shall be implemented to protect workers against heat stress.

(g) Hearing conservation shall be carried out for the workers exposed to noise in spinning, draw line and Draw Texturized Yarn area.

(vii) **PPE Matrix**

Sl. No.	**Activity**		**Prescribed PPE's**
1	Poly Process	PTA Bags Lifting by Hoist and charging	Safety helmet, Safety goggles and dust mask
		Polymer filter changeover and filter draining	Safety helmet, Safety goggles, Fire suit and Heat resistance hand gloves
		Ejector cleaning	Safety helmet, Safety goggles, Heat resistance hand gloves and Apron
		Hot Mono Ethylene Glycol Pumps isolation/ changeover	Safety helmet, Safety goggles, Heat resistance hand gloves and Fire Suit
		Reactor / Transfer line polymer draining during shut down/Start-up	Safety helmet, Safety goggles, Heat resistance hand gloves and Fire Suit
		Cutter startup / strand taken online	safety helmet, Safety goggles, Heat resistance hand gloves and Apron

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		EG hot wells Cleaning / Causticizing	Safety helmet, Safety goggles, PVC full suit apron and hand gloves
		MEG/Spent EG/FO Tank dip level checking	Safety helmet and Safety belt with fall arrestor
		Monomer sampling	Safety helmet, Safety goggles, Heat resistance hand gloves and Apron
2	POY Process	Transfer of Polymer from Poly to POY Machine	Safety helmet, Safety goggles, Heat resistance hand gloves and Apron
		Hot pack installation in Machine	Safety helmet, face shield, Heat resistance hand gloves, Apron and Ear plug of earmuff
		Pack Change in Machine	Safety helmet, face shield, Heat resistance hand gloves and Apron
		Threading of yarn	Face shield and hand gloves
		Spin finish Preparation	Safety Helmet, PVC hand gloves and Dust Mask
		Spinning Operations	Safety helmet,face shield, Heat resistance hand gloves, Apron and Dust Mask
		Spin finish Oil Preparation	Safety Helmet, Face Shield, PVC hand gloves and Dust Mask
		Baler Operation	Safety Helmet, Face Shield, hand gloves, ear plug and Dust Mask
3	Maintenance	Handling of Chemical like HCL, NaOH	Safety helmet, PVC full suit apron, panorama Goggles/ face shield, PVC gloves and Gum boot
4	Quality Control	Sampling and analysis of Raw material and process chemical	Safety helmet, Safety Belt with fall arrestor, PVC full suit apron, panorama Goggles/ face shield, PVC gloves and Gum boot

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(b) NYLON-6

This shall apply for the manufacturing of Man-made fibre (non-Cellulosic) industry-Nylon 6 fibres.

(i) **Raw Material unloading and storing**

(a) Caprolactam

(i) Raw material in bags shall be unloaded by forklift and handled by using hand pallets.

(ii) Trailer (Container)/truck shall be parked with wheel chock and engine shall be switched 'OFF'.

(iii) Raw material shall be stored in dry, clean and well ventilated store room.

(iv) While stacking raw material in bags, safety for stacking shall be strictly adhered.

(v) Battery charging station shall be segregated from storage area.

(vi) Adequate space for storage to prevent collapse shall be ensured.

(vii) Material handling equipments shall be maintained periodically as per maintenance schedule and maintain in good working condition.

(viii) Handling of Caprolactam in solid state involves no specific hazards. However, lactam is combustible and when heated it decomposes and gives toxic fumes. Appropriate measures shall be taken to protect the workers from these hazards.

(b) Chemicals (Ammonia)

(i) Engine of the vehicle shall be switched OFF while unloading of Gas Cylinders.

(ii) Gas cylinders shall be unloaded by material handling equipment like forklift with cage attachment to arrest the fall of cylinders.

(iii) PPEs shall be supplied and used as per the PPE matrix.

(iv) Storage and handling area shall be provided with automatic gas detectors and alarms, auto water sprinkler system, Safety shower, Eye Wash fountain and Water Pits.

(v) Cylinders shall be always kept in standing position and shall be fastened with belt or rope to arrest fall down of gas cylinders.

(vi) Filled and empty cylinders shall be stored separately at designated places.

(vii) Cylinders shall be stored in cool, clean, dry and well ventilated area.

(viii) Cylinders shall not be stored in direct sun light and shall be kept away from the sources of heat.

(ix) SOPs for handling and storage of gas cylinders shall be prepared and followed.

(x) Workers shall be adequately training in safe handling of gas cylinders.

(xi) Cylinders shall have safety caps in place to avoid damages / leakages.

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(xii) Usage of mobile phone shall be prohibited near storage and handling area.

(xiii) Gas detectors, Water sprinkler system, Safety shower, Eye Wash Fountain shall be maintained in good working condition.

(xiv) Mock drills shall be conducted for emergency in storage and handling area of gas cylinders.

(xv) Flame Proof light fitting shall be provided and used.

(xvi) Emergency leakage Kit along with Self Contained Breathing Apparatus shall be provided and made readily available in case of leakage of ammonia gas.

(xvii) Do's and Don'ts along with cautionary notices in the languages understood by the majority of the workers shall be displayed at the locations where ammonia gas cylinders are handled and stored.

(c) Corrosive Chemicals (Hydrochloric Acid, Phosphoric Acid, Sulphuric Acid, Sodium Hydroxide)

(i) Storage area shall be isolated, ventilated, clean and away from the process area.

(ii) Only training and authorised workers shall be allowed to work in storage and handling area.

(iii) PPE's shall be supplied and used as per the PPE Matrix.

(iv) Spillage Kit shall be made available and maintained in good working condition.

(v) Dyke wall with impervious flooring shall be provided to contain the chemicals in case of leakage.

(vi) Storage tanks shall be designed and constructed as per the relevant National Standards.

(vii) Storage tanks shall be provided with measures for control of overfilling.

(viii) Safe means of access to and working platform on the top of the storage tanks shall be provided.

(ix) SOP shall be prepared and followed for loading and unloading of storage tanks.

(x) Storage tanks shall be maintained always in good condition.

(xi) Appropriate system shall be provided for arresting the fumes of chemicals coming into the work environment.

(xii) Safety shower and eyewash fountain shall be provided at the locations of handling and storage.

(xiii) Storage tanks shall be labeled with the name of the chemicals and nature of hazards.

(xiv) Do's and Don'ts along with cautionary notices in the languages understood by the majority of the workers shall be displayed at the

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locations where chemicals are handled and stored.

(xv) Safe means of prompt collection, treatment and disposal of the chemicals in case of spillage/leakage shall be provided.

(xvi) Smoke detector, Water sprinkler, Fire Hydrant Line, Portable Fire Extinguishers shall be available at storage place.

(xvii) Material Safety Data Sheet(MSDS) for each chemical shall be displayed at storage area

(xviii) Regular training shall be imparted to all workers involved in handling and storing of chemicals.

(xix) Do's and Don'ts along with cautionary notices in the languages understood by the majority of the workers shall be displayed at the locations where the corrosive chemicals are handled and stored.

(ii) **Polymerisation**

(a) Reactor shall be designed and constructed as per the relevant National Standards.

(b) Reactor shall be maintained always in good working conditions.

(c) Reactor shall be tested, inspected and examined by a competent person as per the prescribed standards.

(d) Adequate and appropriate measures shall be provided for the control of excessive temperature, excessive pressure and overfilling.

(e) There shall be adequate provisions for maintaining inert gas atmosphere in the vapour space of the reactor to avoid fire and explosion.

(f) Hot surfaces shall be insulated and adequately protected.

(g) Flame proof electrical lights and fittings shall be provided.

(h) Adequate protection shall be provided for the prevention of fire and explosion due to static charge.

(i) All the critical items (instruments and gauges) shall be periodically inspected and calibrated.

(j) All the rotating parts shall be adequately guarded.

(k) PPEs shall be used as per the PPE matrix.

(l) SOPs shall be prepared and followed.

(m) Cautionary notices shall be displayed at all prominent places.

(n) Workers shall be adequately trained.

(o) Adequate supervision shall be provided.

(p) Direct skin contact and breathing of caprolactam dust shall be avoided. Caprolactam can be easily removable from skin and eyes by washing with normal cold water.

(q) Protective clothing, hand gloves and dust mask shall be used while handling Caprolactam.

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(iii) **Spinning**

(a) Hot surfaces shall be insulated and adequately protected.
(b) Rotating parts shall be adequately guarded.
(c) Appropriate PPE shall be used to avoid electrocution.
(d) Adequate measures shall be provided for excessive pressure and excessive temperature.

(iv) **Winding**

(a) Hot surfaces shall be insulated and protected.
(b) Adequate measures shall be provided for control of excessive temperature.
(c) Rotating parts shall be adequately guarded.
(d) Hearing conservation program shall be planned and implemented to prevent hearing loss to the exposed workers.
(e) Feasible administrative or engineering controls shall be followed to prevent the workers from the prescribed high noise level.
(f) Proper SOP shall be developed and followed.
(g) Workers shall be adequately trained on safety initially and periodically by the occupier.
(h) Interlocking devices and sensors shall be maintained in good working condition.

(v) **After Treatment**

(a) Rotating parts shall be adequately protected
(b) Proper SOPs and SWPs shall be developed and followed
(c) Manual Handling of yarns/cords/fabric packages.

(vi) **Utilities**

(a) Nitrogen Plant

(i) Precautions and safety for handling ammonia gas shall be strictly adhered.
(ii) Adequate measure shall be provided for the control of excessive pressure and temperature in Ammonia Cracker Unit, Deoxy Tower, Pressure Swing Adsorber (PSA) and N2 Dryer.
(iii) Ammonia Cracker Unit, Deoxy Tower, Pressure Swing Adsorber (PSA) and N2 Dryer including connected pipelines shall be tested, inspected and examined by a competent person as per the prescribed periodicity.
(iv) Ammonia Cracker Unit, Deoxy Tower, Pressure Swing Adsorber (PSA) and N2 Dryer including connected pipelines shall be designed and constructed as per the relevant National Standards.
(v) All pipelines shall be color coded as per the National Standards.
(vi) Hot surfaces shall be insulated and protected.
(vii) All Rotating parts of the compressor unit shall be adequately protected

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(viii) Hearing conservation program for the workers shall be planned and implemented.
(ix) SOPs shall be prepared and followed.
(x) All components, instruments, and gauges shall be maintained in good working condition.
(xi) All critical instruments shall be periodically inspected and calibrated.
(xii) Workers shall be adequately training on safety.

(b) Boiler Plant

(i) Effective Monitoring and control of dust at the workplaces in boiler room shall be ensured.
(ii) Adequate measure for arresting the fly ashes from flue gases shall be provided.
(iii) SOPs shall be prepared and followed.
(iv) Workers shall be adequately trained and only authorized workers shall be employed.
(v) Provisions for safe means of collection and disposal of fly ash shall be made and followed.

(vii) **General**

(a) Safe Operating Procedures shall be prepared for each machine and process and the same shall be implemented.
(b) Workers shall be adequately trained for safe operation of the machines.
(c) Machine guarding and Interlock sensors shall be provided and maintained in good working conditions.
(d) Warning signs shall be provided for hot surfaces and high temperature operations.
(e) Noise prevention and control measures shall be implemented at the high noise work areas.
(f) Workplaces shall be adequately ventilated and illuminated as per the applicable National Standards.

(viii) **PPE Matrix**

S. No	Process/Equipment	PPEs shall be used
1	Raw material handling and storage area	Helmet, shoes, gloves, goggles, apron
2	Chemical(ammonia) handling and storage	Helmet, shoes, gloves, goggles, apron, SCBA or ammonia gas canister.

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3	Chemicals (Acids/Alkali)	Helmet, shoes, gloves, goggles, apron, face shield, Rubber gum boots.
4	Polymerisation	Helmet, shoes, gloves, goggles, apron
5	Spinning/Winding	Helmet, shoes, gloves, goggles, apron, ear plug/muff.
6	After treatment	Helmet, shoes, gloves, goggles, apron, ear plug/muff.
7	Utilities	Helmet, shoes, gloves, goggles, apron, ear plug/muff.

(c) ACRYLIC FIBRE

This shall apply for the manufacturing of Man-made fibre (non-Cellulosic) industry-Acrylic fibres.

(i) **Raw material unloading, storage and handling -Acrylonitrile, Vinyl Acetate Monomer and Methyl Acrylate**

(a) Unloading of chemicals

(i) On arrival of tanker and before carry out any activity on tanker or material, tanker shall be connected with static charge dispersion facility to discharge tanker material static charge.

(ii) Non-sparking cutter only shall be used to cut metallic seals, if fixed on tanker nozzles, flanges, covers.

(iii) Chemical conformity and inhibitor content level shall be analyzed and it shall be ensured before tanker martial unloading into storage tanks.

(iv) After placing tanker at unloading station, wheel block shall be fixed to avoid any movement of tanker during unloading.

(v) Double earthing shall be connected to tanker before drawing material sample and / or starting material unloading operations.

(vi) Earthing relay system with unloading pump stop interlock shall be ensured.

(vii) Non-sparking tools shall only be used for tanker material unloading pipeline connection and disconnection and for any other work.

(viii) If tanker is with top unloading provision, as in case of acrylonitrile, pressure regulated nitrogen gas shall be used for pressuring tanker to facilitate material unload through unloading pump or direct to storage tank.

(ix) Positive pressure inside tanker with nitrogen gas shall be maintained during material unloading or connect vapor balancing line with storage tank.

(x) Tanker material receiving storage tank shall be connected with gas scrubbing system during tanker unloading.

(xi) Sampling and tanker material unloading operations shall be carried out

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as per updated standard operating procedure.

(xii) Only trained personnel shall be engaged in hazardous chemicals tanker unloading operations.

(b) Storing of chemicals

(i) Hazardous chemicals such as acrylonitrile, vinyl acetate monomer, methyl acrylate shall be stored in dedicated tank meeting defined safe storage conditions.

(ii) Seal less pump shall be used with storage tank low/ high level alarm pump tripping mechanism.

(iii) Storage tank level transmitters shall be installed with high/low level audio visual alarm and tripping of pumps.

(iv) Storage tank temperature transmitters shall be installed with audio visual alarm.

(v) Fixed gas detectors with audio visual alarm shall be installed for monitoring any leakages.

(vi) All pipeline, fittings, flange joints shall have aluminum or copper jumpers to avoid accumulation of static energy.

(vii) Facility to discharge human body static charge shall be installed before performing any work related to monomers handling.

(viii) Lightning protection shall be installed for flammable materials storage tanks such as monomers storage tanks.

(ix) Only flameproof electrical and instrument fittings shall be used inside and nearby flammable chemicals/ monomers storage tank farm premises.

(x) All storage tanks shall be double earthed.

(xi) Non-sparking tools shall be used for any maintenance activity in hazardous chemicals storage tank farm area.

(xii) No hot work activity shall be carried out in tank farm area without complying work permit system and without ensuring adequate firefighting arrangement.

(xiii) Safe storage conditions like temperature, pressure, polymerization inhibitor level shall be maintained for flammable and toxic chemicals, like monomers acrylonitrile, vinyl acetate, and methyl acrylate.

(xiv) Periodic thickness measurement and inspection of storage tank shall be carried out to ensure storage tank healthiness.

(xv) Adequate size dyke wall with leaked chemical handling facility shall be provided for each hazardous chemical storage tank.

(xvi) Adequately designed breather valve, flame arrester, safety disc or safety valve shall be installed on each storage tank and periodically inspected

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and calibrated.

(xvii) Storage tank vent line shall be connected to gas absorber or scrubber.

(xviii) Entry into hazardous chemicals storage, tank farm shall be restricted.

(xix) Adequate CCTV with recording facility shall be installed for monitoring and supervision of hazardous chemicals storage tank farm area.

(xx) Adequately designed firefighting facilities like system for foam pouring inside monomers (acrylonitrile, vinyl acetate, methyl acrylate) storage tanks, fire hydrant network, foam and water monitors, sand buckets, fire extinguishers shall be installed.

(xxi) Availability of SCBA sets, gas canisters and other PPEs like goggles, gloves, safety shoes, helmet, PVC suit, face shield in tank farm area shall be ensured.

(xxii) Safe operating procedure (SOP), MSDS and other safety precautions shall be displayed in local language.

(xxiii) Suitable antidote kit for acrylonitrile exposure shall be available in unit dispensary.

(xxiv) Updated SOP for different activities, operations involving handling of acrylonitrile, vinyl acetate, methyl acrylate, and hazardous chemicals shall be available.

(xxv) Only trained personnel shall be engaged in handling of acrylonitrile, vinyl acetate, methyl acrylate, hazardous chemicals.

(xxvi) Periodical health checkup shall be conducted for persons performing operations involving handling of acrylonitrile, vinyl acetate, methyl acrylate, hazardous chemicals.

(ii) **Catalyst storage**

(a) Catalyst such as sodium chlorate (oxidizer) and sodium meta-bisulphite (reducer) shall be stored in dedicated separate dry and cool store room because of reactive nature.

(b) No mixing of sodium chlorate and sodium meta-bisulphite powder at any point shall be ensured before final use in liquid form.

(c) Chemicals shall be handled as per SOP and under supervision only.

(iii) **Polymerization**

(a) Reactor

(i) All chemicals shall be fed to reactor in measured quantity and proportion

(ii) Process parameters such as temperature, pressure, pH, reaction rate, shall be maintained within prescribed range with high/low audio visual alarm at control room of polymerization reactor.

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(iii) Considering exothermic reaction, polymerization reactor high temperate audio and visual alarm with auto feed cut off interlock shall be provided.

(iv) Critical process parameters shall be monitored, logged and maintained within prescribed norms.

(v) Dedicated water feeding facility to reactor and or caustic feeding facility to reactor, designed in such a way that can be workable in case of power failure also, shall be provided to avoid any run away reaction situation.

(vi) All the instruments and equipment preventive maintenance and calibration shall be carried out periodically.

(vii) Reactor shall be maintained in good health and shall not put in use if not satisfying pre-defined safe conditions.

(viii) Gas leak detector shall be installed nearby polymerization reactor.

(ix) All the instruments, electrical equipment, fitting shall be of flame proof type.

(x) No hot work activity shall be carried out in tank farm area without complying work permit system and without ensuring adequate fire fighting arrangement.

(b) Monomer recovery and reuse:

(i) To recover un-reacted monomers from polymer slurry and or reactor product and or from reactor, adequately designed monomer recovery system (steam stripper, distillation column with vapor condensers) shall be installed.

(ii) Recovered monomer shall be collected in dedicated tank. Safe temperature, pH and other conditions of recovered monomer shall be maintained to prevent self-polymerization before reuse.

(iii) Unused recovered monomer temperature shall be maintained under safe limit and periodic sample shall be analyze for pH, if pH below safe limit, shall be maintained with addition of ammonium hydroxide.

(iv) Critical process parameters such as level, vacuum, column temperature, steam flow shall be measured and monitored with high/low audio/visual alarm.

(v) Gas leak detector shall be installed nearby monomer recovery facility, collection tank.

(vi) All the instruments and electrical equipment, fitting shall be flame proof type.

(vii) No hot work activity shall be carried out in tank farm area without complying work permit system and without ensuring adequate firefighting arrangement.

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(c) Solvent recovery and reuse

(i) Solvent used for polymer dissolving and coagulation process is prone to health hazard and corrosion and hence shall be handled following safe operating procedure.
(ii) All the safety equipment installed with solvent recovery plant Evaporators and or Distillation columns shall be inspected and calibrated periodically.
(iii) Gas detectors shall be installed at appropriate locations in case of solvent gas hazardous to health.
(iv) All the interlocks and gas detectors shall be inspected and calibrated periodically.
(v) If solvent is flammable in nature, only flameproof electrical and instrument fittings shall be used.
(vi) If solvent is flammable in nature, non-sparking tools shall be used for any maintenance activity.
(vii) Hot surfaces shall be well insulated
(viii) If solvent is flammable in nature, no hot work activity shall be carried out in tank farm area without complying work permit system and without ensuring adequate firefighting arrangement.

(iv) **Spinning**

(a) Appropriate personal protective equipment shall be used for handling coagulant for protection against cold burn, chemical burn and health hazard.
(b) Pull rope stop provision shall be provided for emergency stoppage of moving rollers at spinning machine, tow washing and hot stretch.
(c) Mechanical exhaust system shall be provided for preventing exposure of hot fumes at hot stretching area.
(d) Any maintenance and repair of machine and material shall be carried out after stopping machine.
(e) Automatic machine stop sensor recommended at tow washing and hot stretching machines to avoid physical injury.
(f) Moving rollers shall be protected to avoid direct physical contacts to human.
(g) Local emergency stop switch shall be provided for all moving machines.
(h) All safety devices, sensors and interlocks shall be maintained in good condition, checked and calibrated periodically.
(i) Safe operating procedures shall be followed.

(v) **After treatment - Tow**

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(a) Tow dryers shall be protected with heating media auto cut-off at high temperature.
(b) Steaming vessel shall be equipped with interlocks against high temperature, vacuum and pressure.
(c) Mechanical pressure safety valve shall be provided on steaming vessel.
(d) Automatic machine stop sensor recommended in case of any process interruption in cutter and baler machines.
(e) Photo sensor with machine stop interlock shall be provided to avoid any physical injury from moving machines at baling press.
(f) Moving equipment shall be covered/protected to avoid direct physical contacts to humans.
(g) Local emergency stop switch shall be provided for all moving machines.
(h) All safety devices, sensors and interlocks shall be maintained in good condition, checked and calibrated periodically.
(i) Safe operating procedures shall be followed.

(vi) **Utilities**

(a) Steam Turbine

(i) Turbine stop interlock and mechanical stop shall be provided for turbine over speed.
(ii) Turbine stop interlock shall be provided for lube oil high pressure, control oil low pressure, turbine high vibration and rotor axial high displacement, turbine exhaust high pressure, condenser hot well high level, turbine gear box bearing high temperature, alternator field failure and power control supply failure.
(iii) Master stop shall be provided for turbine.
(iv) Solenoid operated tripping facility shall be provided for turbine emergency stop.
(v) Emergency stop push button and manual trip lever shall be provided for emergency stop.
(vi) Overload protection shall be provided for power plant auxiliary all motors.
(vii) Mechanical safety valve shall be provided on steam extraction line with audio/visual alarm for high extraction steam pressure.
(viii) Mechanical safety valve shall be provided on bleed steam line with audio/visual alarm for high bleed steam pressure.
(ix) Audio/visual alarm shall be provided for lube oil tank low/high level, lube oil temperature high, high temperature of alternator winding, bearing and air, condensate extraction pump trip and turbine generator condenser cooling water low pressure.

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(x) Power plant auxiliary all motors shall be provided with IP 55 enclosure.
(xi) Smoke detection system is recommended for power plant control room and substation.
(xii) All hot lines shall be insulated.
(xiii) Required personal protective equipment shall be used while working in high noise area and with hot surfaces.
(xiv) Safe operating procedure shall be followed.
(xv) Process parameters shall be monitored and controlled within specified range.

(b) Ammonia brine chiller

(i) Compressor stop interlock shall be provided for high discharge pressure and temperature and oil high temperature.
(ii) Mechanical safety valve shall be provided for ammonia high pressure.
(iii) Ammonia gas detection system shall be provided with audio/visual alarm.
(iv) Tongue and groove type flanges are recommended in ammonia pipelines to reduce chances of leakage.
(v) Water sprinklers shall be installed over ammonia receiver tank and pumps.
(vi) Periodical inspection, thickness measurement of ammonia pressure vessels shall be carried out.
(vii) Canister gas masks and SCBA sets shall be made available to carry out work in ammonia leakage situation.
(viii) Safe Operating Procedure shall be followed.

(vii) **PPE Matrix**

S. No	Process/Equipment	PPEs shall be used
1	Raw material handling and storage area	Helmet, safety shoes, gloves, goggles, face shield (gas canister, apron, SCBA set during emergency)
2	Tanker unloading	Safety belt, safety shoes, gloves, face shield, goggles (gas canister, apron, SCBA set during emergency)
3	Polymerization, Solvent recovery	Helmet, safety shoes, gloves, goggles (gas canister, apron, SCBA set during emergency)
4	Chemicals (Acids/Alkalies)	Helmet, shoes, gloves, goggles, apron, face shield, rubber gum boots
5	Spinning and after treatment	Helmet, safety shoes, gloves (gloves, gumboot, goggles during liquid handling)

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6	Utilities - Steam Turbine, brine chiller	Helmet, gloves, goggles, ear plug at high noise area (gas canister, apron, SCBA set during emergency)

(d) SPANDEX YARN

This shall apply for the manufacturing of Man-made fibre (non-Cellulosic) industry-Spandex Yarn fibres.

(i) **Raw Material unloading, storing and handling**

(a) **Spin Finish Oil (SFO Oil), Amine and MDI Drums**

(i) The material shall be unloaded in the Raw Material Store.

(ii) Ramp shall be placed at the rear of the vehicle and ensure that ramp chain is secured properly, and Tyre Stoppers are placed. Vehicle Engine shall be kept OFF during unloading of drums.

(iii) Spill pallet shall be placed below the leaking drum. Try to plug it with epoxy sealing compound.

(iv) If leak is major, Transfer the leaking drum along with the spill pallet to open area. Barricade the area.

(v) Hot work shall not be carried out nearby the drum / area.

(vi) Unauthorized entry and Mobile phone shall be restricted in Amine storage area. Only authorized persons shall enter in amine area with permission of responsible person.

(vii) Security person shall remain available at Amine store and keep the entry in register for all persons going inside the amine store.

(viii) Unloading Area shall be cleaned with absorbent material and dispose the absorbent material into the hazardous waste for safe disposal.

(ix) The material shall be unloaded in the Cold Room where Cold Room temperature (-15^0 C) maintained for storage of MDI.

(x) MDI drums shall be checked physically by the store person before stacking in cold room. After proper checking, stack the Drums in cold room.

(b) **Material receiving by Tanker (DMAC, PTMEG, HSD and HCL)**

(i) Tyre Stoppers shall be placed and Engine shall be kept OFF during unloading of chemicals.

(ii) Earthing shall be provided with tanker before unloading.

(iii) Unloading of chemicals from the tanks shall be as per SOP.

(c) **Storage of Corrosive Chemicals (Hydrochloric Acid, Sulphuric Acid)**

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(i) Storage area shall be isolated, ventilated, clean and away from the process area.
(ii) Dyke wall with impervious flooring shall be provided to contain the chemicals in case of leakage.
(iii) Storage tanks shall be provided and maintained with two independent level gauges interlocked with the pump.
(iv) Safe means of prompt collection, treatment and disposal of the chemicals in case of spillage / leakage shall be provided.

(ii) **Polymerisation**

(a) Adequate and appropriate measures shall be provided for the control of temperature, pressure and filling to prevent run away reaction.
(b) Hot surfaces shall be insulated and adequately protected.
(c) Flame proof electrical lights and fittings shall be provided.
(d) Adequate protection shall be provided for the prevention of fire and explosion due to static charge.
(e) All the critical instruments and gauges shall be identified, periodically inspected and calibrated.
(f) Direct skin contact and breathing of any chemical shall be avoided.

(iii) **Spinning and Packing**

(a) Hot surfaces shall be insulated and adequately protected.
(b) Interlock sensors shall be provided and maintained in good working condition.

(iv) **Utilities**

DM Plant, Compressed air, Instrument Air, Chillers, Nitrogen Plant and ETP cum STP

(a) All pipelines shall be color coded as per the Standards.
(b) Hot surfaces shall be insulated and protected.
(c) All Rotating parts of the compressor unit shall be adequately protected
(d) All critical instruments shall be identified, periodically inspected and calibrated.

(v) **General**

(a) Standard Operating Procedures shall be prepared for each machine and process and the same shall be implemented.
(b) Workers shall be adequately trained for safe operation of the machines.
(c) Machine guarding and Interlock shall be provided and maintained in good working conditions.
(d) Warning signs shall be provided for hot surfaces and high temperature operations.

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(vi) **PPE Matrix**

S. No	Process/Equipment	PPEs shall be used
1	Raw material handling and storage area	Safety Helmet, Safety shoes, gloves, Safety goggles
2	Chemicals handling and storage	Safety Helmet, Gum Boots or Safety shoes, Chemical resistant gloves, Safety Goggles or face shield, Chemical resistant full body suit
3	Polymerization	Safety Helmet, Gum Boots or Safety shoes, Chemical resistant gloves, Safety Goggles or face shield, Chemical resistant full body suit. Air suit for offloading of Amines and MDI, Heat resistant gloves, Cold room suit. Self-Contained breathing apparatus (SCBA)
4	Spinning and Packing	Gum Boots or Safety shoes, Chemical resistant gloves, Safety Goggles or face shield, Chemical resistant full body suit. Ear plug / Ear muff, Heat Resistant gloves and Apron

109. **Manufacture and repair of electric accumulators - under serial no. 21 in the first schedule under clause (za) of sub-section (1) of section 2**

(1) This shall apply to the manufacture or repair of electric accumulators or parts thereof not containing lead or any compound of lead; or to the repair on the premises, of any accumulator forming part of a stationary battery.

(2) Prohibition relating to pregnant women and adolescent - No pregnant women or adolescent shall be employed or permitted to work in any lead process or in any room in which the manipulation of raw oxide of lead or pasting is carried on.

(3) Separation of certain processes. - Each of the following processes shall be carried on in such a manner and under such conditions as to secure effectual separation from one another, and from other processes :-

(a) manipulation of raw oxide of lead;
(b) pasting.
(c) drying of pasted plates.
(d) formation with lead turning (tacking)necessarily carried on in connection therewith; and
(e) melting down of pasted plates.

(4) Work-benches. - The work-benches at which any lead process is carried on

(a) shall have a smooth surface and shall be maintained in sound condition; and
(b) Shall be kept free from all materials or plant not required for, or produced in,

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the process carried on there at; and all such work-benches other than those in grid casting shops.

(c) Shall be cleansed daily either after being thoroughly damped or by means of a suction cleaning apparatus at a time when no other work is being carried on thereat; and, all such work-benches in grid casting shops.

(d) shall be cleansed daily; and every work-bench used for pasting

(e) shall be covered throughout with sheet lead or other impervious material;

(f) shall be provided with raised edges; and

(g) shall be kept constantly moist while pasting is being carried on.

(5) Exhaust draught. -The following processes shall not be carried on without the use of an efficient exhaust draught :-

(a) melting of lead or materials containing lead;

(b) manipulation of raw oxide of lead, unless done in an enclosed apparatus so as to prevent the escape of dust into the workroom;

(c) pasting.

(d) trimming, brushing, filing or any other abrading or cutting of pasted plates giving rise to dust and

(e) lead burning, other than -

(i) tacking in the formation room; and

(ii) chemical burning for the making of lead lining for cell cases necessarily carried on in such a manner that the application of efficient exhaust is impracticable.

Such exhaust draught shall be affected by mechanical means and shall operate on the dust or fume given off as nearly as shall be at its point of origin, so as to prevent it entering the air of any room in which persons work.

(6) Fumes and gases from melting pots.- The products of combustion produced in the heating of any melting pot shall not be allowed to escape into a room in which persons work.

(7) Container for dross.- A suitable receptacle with tightly fitting cover shall be provided and used for dress as it is removed from every melting pot. Such receptacle shall be kept covered while in the workroom, except when dress is being deposited therein.

(8) Container for lead waste. - A suitable receptacle shall be provided in every workroom in which old plates and waste material which shall give rise to dust shall be deposited.

(9) Racks and shelves in drying room.-

(a) The racks or shelves provided in any drying room shall not be more than 2.4 meters from the floor and not more than 60 centimetres in width :

Provided that as regards racks or shelves set drawn from both sides the total width shall not exceed 120 centimetres.

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(b) Such racks or shelves shall be cleaned only after being thoroughly damped unless an efficient suction cleaning apparatus is used for this purpose.

(10) Protective clothing. -

(a) Protective clothing shall be provided and maintained in good repair for all persons employed in -

(i) manipulation of raw oxide of lead;

(ii) pasting; and

(iii) the formation room;

and such clothing shall be worn by the persons concerned.

(b) The protective clothing shall consist of a waterproof apron and waterproof footwear; and, in addition, as regards persons employed in the manipulation of raw oxide of lead or in pasting, head coverings. The head coverings shall be washed daily.

(11) No food, drink, pan and supari or tobacco shall be consumed or brought by any worker into any workroom in which any lead process is carried on.

110. **Glass and ceramics -** under serial no. 22 in the first schedule under clause (za) of sub-section (1) of section 2

(1) Glass Industries

This shall apply for the Glass and Ceramics manufacturing.

(a) **Raw Materials Unloading and storing {Sand (SiO_2), Limestone ($CaCO_3$), Dolomite ($CaCO_3 MgCO_3$), Soda ash ($NaCO_3$), Sodium Sulphate (Na_2SO_4)}**

(i) Truck shall be parked at designated place with wheel chock and engine shall be switched 'OFF'.

(ii) The storage of Jumbo bags shall be upto 3 stack height in pyramidal shape to prevent collapse.

(iii) Hoist operational area shall be clear and movement of workers within that working area shall be prevented.

(iv) Material handling shall be carried out with adequate supervision and trained workers.

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(v) Dust level in handling and storage area shall be continuously monitored and shall be maintained below permissible exposure limit by providing dust extraction system.

(vi) While unloading raw materials from bulkers which are operated at a pressure higher than the atmospheric pressure, appropriate precautions and safety measures shall be developed and followed.

(vii) Conveyor operational area shall be clear from all unwanted materials and Pull cord shall be provided in the conveyor for emergency stop.

(viii) Adequate engineering and administration controls shall be adhered to protect the workers from exposure to dust and high noise level in the raw material handling area.

(b) **Batch processing**

(i) Empty drums and bags shall be removed and good housekeeping shall be maintained at batch processing plant.

(ii) Cullet recycling in to batch processing plant shall be handled in a safe manner to protect against dust, cut injuries and eye injuries.

(iii) Conveyor and its control systems for loading of raw materials into batch processing plant shall be maintained in good working condition.

(iv) Cautionary notices shall be displayed in English and local language understood by the majority of the employees at batch processing plant area for spillage of cullet, tinted and processed glass materials.

(c) **Furnace**

(i) Hot surfaces of the furnace and associated system shall be adequately insulated, cladded and maintained.

(ii) Adequate water jackets and air lances shall be made available to arrest molten glass leakage in the furnace.

(iii) Automatic stop of fuel shall be ensured by providing interlock with the flame detector and combustion air in case of flame failure.

(iv) Mechanical Integrity of the furnace and refractory lining shall be ensured by conducting thermography and other studies periodically as per the OEM guidelines.

(v) OEM guidelines shall be followed Operation of Bubblers and Boost Electrodes.

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(vi) Cautionary notices shall be displayed in English and local language, in furnace area for high temperature and its hazards.

(vii) Pipelines and metallic braided hoses used for transporting heavy fuel oil, Natural Gas and LPG shall be pressure tested and maintained as per the applicable National Standards.

(viii) Workers in the furnace area shall be protected from heat stress by implementing appropriate, adequate prevention and control measures.

(ix) Adequate preventive and protective measures shall be ensured to prevent fire and explosion during furnace operation.

(x) Insulating wool material shall be handled in a safe manner without permitting inhalation of wool dust by the workers and exposure and inhalation of wool dust shall be prevented.

(d) **Float Bath**

(i) Blowers used shall be periodically maintained to ensure float bath casing temperature is below the melting point of tin to prevent leakage through casing.

(ii) Hot surfaces of the float bath and associated system shall be adequately insulated, cladded and maintained.

(iii) Pressure in the float bath shall be continuously monitored to avoid explosion due to excessive pressure.

(iv) Inert atmosphere shall be maintained in the float bath under all circumstances.

(e) **Annealing Lehr**

(i) Blowers used shall be periodically maintained and the noise level shall be kept within the permissible level as per OEM.

(ii) Hot surfaces of the Annealing Lehr and associated system shall be adequately insulated, cladded and maintained.

(iii) SO2 level in the annealing area shall be monitored and be kept within the permissible exposure limits specified under the Standards framed under Section 18 of the Code.

(f) **Cutting Line**

(i) Adequate protection system shall be provided and used by the workers to protect them from getting exposed to X-Ray and LASER Beams, and the standards laid under Radium or Radioactive Substances shall be adhered to.

(ii) Cutting Oil and brandling inks shall be protected against fire and explosion

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hazards.

(g) **Warehouse**

(i) Finished glasses from small to jumbo in size shall be stacked such that they do not fall due to improper stacking angle. Stacking angle of 3-5 degree shall be maintained always.

(ii) Glass falling zones shall be identified and marked on the floors and access control shall be ensured for the movement of equipment and workers in such identified zones.

(iii) Glass shall be transported by using web lashings and vibration and shock absorbers in a safe manner.

(h) **Utilities - Furnace Fuels (Heavy Oil, Natural Gas and LPG)**

(i) Furnace Fuels shall be handled and stored in designated places and storage area shall be kept away from the main processing area.

(ii) Dyke wall conforming to standards, shall be provided for fuel oil storage tanks, to contain it in case of leakage from the storage tanks.

(iii) Pipelines carrying heavy oil, Natural Gas, LPG shall be painted, marked, bonded, earthed and color coded as per the National Standards.

(iv) Storage tanks for furnace fuels shall be constructed and maintained as per the relevant National Standards.

(i) **General**

(i) Standard Operating Procedures shall be prepared for raw material handling, operation of furnace, Float Bath, annealing Lehr, cutting line, warehouses and the same shall be implemented.

(ii) To avoid collision of material handling equipment and pedestrians, area for movement of material handling equipment and path for pedestrians shall be clearly demarcated on the floor and cautionary notices shall be displayed in English and Local language understood by majority of the employees at conspicuous places inside the factory.

(iii) Interlocks shall be tested, examined and certified once in a period of every six months.

(iv) All safety critical equipment shall be identified, documented and tested periodically once in every six months.

(v) Hydrogen safety shall be ensured throughout the Plant to prevent hydrogen fire and explosion.

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(vi) Earthing and Bonding shall be provided for pipelines carrying hydrogen mixture.

(vii) Appropriate prevention and control measures shall be implemented to prevent exposure of siliceous dust to the workers.

(viii) Warning signs shall be provided for hot surfaces and high temperature operations.

(j) **PPE Matrix**

OH&S Hazard Expected due to the task /activity	**Prescribed PPEs**
Exposure to Raw Materials, Batch and Cullet Dust	Goggles, Dust mask, Gloves
Manual Glass handling	Cut Resistant Gloves, Cut Resistant Sleeves, Leg Guard, Arm Guard
Heat Stress	Heat Resistant Jacket, face hood, Aluminum Cap, Kevlar Gloves

(2) CERAMICS INDUSTRIES

(a) **Efficient exhaust draught**

The following processes shall be carried on with the use of an efficient exhaust draught:

(i) All processes involving the manipulation or use of a dry and unfitted lead compound;

(ii) The fettling operations of any kind, whether on green ware or biscuit, provided that this shall not apply to the wet fettling, and to the occasional finishing of pottery articles without the aid of mechanical power;

(iii) The sifting of clay dust or any other material for making tiles or other articles by pressure, except where

(a) this is done in a machine so enclosed as to effectively prevent the escape of dust; or

(b) the material to be sifted is so damp that no dust can be given off;

(iv) The pressing of tiles from clay dust, an exhaust opening shall be connected with each press. This sub-para shall also apply to the pressing from clay dust of articles other than tiles, unless the material is so damp that no dust is given off;

(v) (a) The fettling of tiles made from clay dust, by pressure. except where the fettling is done wholly on, or with, damp material;

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(b) The fettling of other articles made from clay dust, unless the material is so damp that no dust is given off;

(vi) The process of loading and unloading of saggars, where handling and manipulation of ground and powdered flint, quart, alumina or other materials are involved;

(vii) The brushing of earthenware biscuit, unless the process is carried on in a room provided with efficient general mechanical ventilation or other ventilation.

(viii) Fettling of biscuit ware which has been fired in powdered flint or quartz except where this is done in machines so enclosed as to effectively prevent the escape of dust;

(ix) Ware cleaning after the application of glaze by dipping or other process;

(x) Crushing and dry grinding of materials for pottery bodies and saggars, unless carried on in machines so enclosed as to effectively prevent the escape of dust or is so damp that no dust can be given off;

(xi) Sieving or manipulation of powdered flint, quartz, day grog or mixture of these materials unless it is so damp that no dust can be given off;

(xii) Grinding of tiles on a power-driven wheel unless an efficient water spray is used on the wheel;

(xiii) Lifting and conveying of materials by elevators and conveyors unless they are effectively enclosed and so arranged as to prevent escape of dust into the airin or near any place in which persons are employed;

(xiv) The preparation or weighing out of flow material, awning of dry colours, colour dusting and colour blowing;

(xv) Mould making, unless the bins or similar receptacles are used for holding plaster of paris and provided with suitable covers ;

(xvi) The manipulation of calcined materials unless the material has been made and remain so wet that no dust is given off.

(b) Each of the following processes shall be carried on in such a manner and under such conditions so as to secure effectual separation from one another, and from wet processes:

(i) Crushing and by grinding or sieving of materials, fettling, pressing of tiles, drying day and green ware, loading and unloading of saggars; and

(ii) all processes involving the use of a dry lead compound.

(c) No glaze which is not a leadless glaze or a low solubility glaze shall be used in a factory in which pottery is manufactured.

(d) No pregnant woman or adolescent shall be employed or permitted to work in any of the operations specified in para 2, or at any place where such operation is carried on.

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(e) The potter's wheel (Jolly and Jiggar) shall be provided with screens or so constructed as to prevent clay scrapings being thrown off beyond the wheel.

(f) Prevention of dust

(i) All practical measures shall be taken by damping or otherwise to prevent dust arising during cleaning of floors.

(ii) Damp saw dust or other suitable materials shall be used to render the moist method effective in preventing dust rising into the air during the cleaning process which shall be carried out after work has ceased.

(g) The floors of potters' shops, slip houses, dipping houses and ware cleaning rooms shall be hard, smooth and impervious. Sand shall be thoroughly cleaned daily by a moist method by an adult male.

(h) Protective equipment

(i) The occupier shall provide and maintain suitable overalls and head coverings for all persons employed in any process specified in para 2.

(ii) The occupier shall provide and maintain suitable aprons of water-proof or similar material, which can be sponged daily for the use of the dippers, dippers' assistants, throwers, jolly workers, casters, mould makers and filter press and pug mill workers.

(iii) Aprons provided in pursuance of sub- para (2) shall be thoroughly cleaned daily by the wearers by sponging or other wet process. All overalls and head coverings shall be washed, cleaned and mended at least once a week and the occupier shall provide facilities for such washing, cleaning and mending.

(iv) No person shall be allowed to work in emptying sacks of dusty materials, weighing out and mixing of dusty materials and charging of ball mills and blungers without wearing a suitable and efficient dust respirator.

111. **Grinding or glazing of metals - under serial no. 23 in the first schedule under clause (za) of sub-section (1) of section 2**

(1) Nothing in this standard shall apply to any factory in which only repairs are carried on except any part thereof in which one or more persons are wholly or mainly employed in the grinding or glazing of metals.

(2) Nothing in this standard except para 4 shall apply to any grinding or glazing of metals carried on intermittently and at which no person is employed for more than 12 hours in any week.

(3) Equipment for removal of dust. - No racing, dry grinding or glazing shall be performed without -

(a) a hood or other appliance so constructed per applicable National Standard,

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arranged, placed and maintained as substantially to intercept the dust thrown off.

(b) a duct of adequate size, air tight and so arranged as to be capable of carrying away the dust, which duct shall be kept free from obstruction and shall be provided with proper means of access for inspection and cleaning, and

(c) a fan or other efficient means of producing a draught sufficient to extract the dust :

Effective measure shall be adopted to dispose or discharge the dust collected from provision provided under sub-para (b).

(4) Restriction on employment on grinding operations. - Not more than one person and under the age of 18 years shall at any time perform the actual process of grinding or glazing upon a grindstone, abrasive wheel or glazing appliance :

Provided that this para shall not prohibit the employment of persons to assist in the manipulation of heavy or bulky articles at any such grindstone, abrasive wheel or glazing appliance.

(5) Glazing. - Glazing or other processes, except processes incidental to wet grinding upon a grindstone shall not be carried on in any room in which wet grinding upon a grindstone is done.

(6) Hacking and rodding.- Hacking or rodding shall not be done unless during the process either an adequate supply of water is laid on at the upper surface of the grindstone or adequate appliances for the interception of dust are provided in accordance with the requirements of para 3.

The employer shall ensure that the effective means of guards are available on all grinding, abrasive wheel and grindstone etc.

(7) Examination of dust equipment. -

All equipment for the extraction or suppression of dust shall be examined at least once in every six months and tested by competent person, and any defect disclosed by such examination and test shall be rectified immediately.

(8) 10.Personal Protective Equipment: -

(a) It is the responsibility of employer to provide adequate Personal equipments to avoid any physical injury.

(b) The Personal Protective equipments shall be conforming to applicable National Standard or EU/ANSI standard. Other than these standards, Personal protective equipments must be tested and certified by DGFASLI/ NABL lab.

112. **Manufacture, handling and processing of asbestos and its products -** under serial no. 24 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all factories involving manufacture, handling and processing of

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asbestos and its products.

(2) (a) The occupier of the factory wherein asbestos or substances containing asbestos are in use, shall prepare work procedures and practices, in the light of scientific research and technological progress.

(b) Notwithstanding anything mentioned in sub-para (a) use of asbestos is prohibited in the manufacturing process as shall be notified by the appropriate Government in this behalf.

(c) (i) spraying of all forms of asbestos is prohibited in a factory.

(ii) The prohibition in respect of spraying of asbestos referred to in sub-para (i) shall be exempted by the Chief Inspector-cum-Facilitator if the Occupier represents that such spraying is inevitable certain purposes provided adequate measures for ensuring the safety and health of workers are undertaken by the occupier to the satisfaction of the Chief Inspector-cum-Facilitator.

(3) Demolition of plants or structures –

No person shall carry out any demolition of plants or structures containing friable asbestos insulation material and removal of asbestos from building or structures in which asbestos is liable shall become air-borne, unless he is recognized and duly empowered by the Chief Inspector–cum- Facilitator of Factories as qualified to carry out such work in accordance with the provisions of this standard.

(4) Tools and equipment.-

Any tools or equipment used in processes to which this standard applies shall be such that they do not create asbestos dust above the permissible limit or are equipped with efficient exhaust draught.

(5) Exhaust draught.-

(a) An effective exhaust draught shall be provided and maintained to control dust from the following processes and machines as per the relevant National Standards -

(i) manufacture and conveying machinery namely -

(a) preparing, grinding, or dry mixing machines;
(b) carding, card waste and ring spinning machines, and looms;
(c) machines or other plant fed with asbestos;
(d) machines used for the sawing, grinding, turning, drilling, abrading or polishing; in the dry state, of articles composed wholly or partly of asbestos;

(ii) cleaning, and grinding of the cylinders or other parts of a carding machine;

(iii) chambers, hoppers or other structures into which loose asbestos is delivered or passes;

(iv) work-benches for asbestos waste sorting or for other manipulation or

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asbestos by hand;

(v) workplaces at which the filling or emptying of sacks, skips or other portable containers, weighing or other process incidental thereto which is effected by hand, is carried on;

(vi) sack cleaning machines;

(vii) mixing and blending of asbestos by hand; and

(viii) any other process in which dust is given off into the work environment.

(6) Exhaust ventilation equipment provided in accordance with sub-para (1) shall, while any work of maintenance or repair to the machinery, apparatus or other plant or equipment in connection with which it is provided is being carried on, be kept in use so as to produce an exhaust draught which prevents the entry of asbestos dust into the air of any work place.

(7) Arrangements shall be made to prevent asbestos dust discharged from exhaust apparatus being drawn into the air of any workroom.

(8) The asbestos bearing dust removed from any workroom by the exhaust system shall be collected in suitable receptacles or filter bags which shall be isolated from all work areas.

(9) Testing and examination of ventilating systems.-

(a) All ventilating systems used for the purpose of extracting or suppressing dust as required by this standard shall be as per the relevant National Standards, examined and inspected once every week by a responsible person. It shall be thoroughly examined and tested by a competent person once in every period of 12 months. Any defects found by such examinations or test shall be rectified forthwith.

(b) A register containing particulars of such examination and tests and the state of the plant and the repairs or alternations (if any) found shall be necessary shall be kept and shall be available for inspection by an Inspector-cum-Facilitator.

(10) Segregation in case of certain process.-

Mixing or blending of asbestos by the hand, or making or repairing of insulating mattresses composed wholly or partly of asbestos shall not be carried on in any room in which any other work is done.

(11) Storage and distribution of loose asbestos.-

All loose asbestos shall, while not in use, be kept in suitable closed receptacles which

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prevent the escape of asbestos dust there from. Such asbestos shall not be distributed within a factory except in closed receptacles or in a totally enclosed system of conveyance.

(12) Asbestos sacks –

(a) All sacks used as receptacles for the purpose of transport of asbestos within the factory shall be constructed of impermeable materials and shall be kept in good repair.

(b) A sack which has contained asbestos shall not be cleaned by hand beating but by a machine, complying with para 4.

(c) Asbestos sacks or receptacles which contain asbestos shall be disposed off in a safe manner.

(13) Maintenance of floors and workplaces.-

(a) In every room in which any of the requirements of this standard apply -

(i) the floors, work-benches, machinery and plant shall be kept in a clean state and free from asbestos debris and suitable arrangements shall be made for the storage of asbestos not immediately required for use; and

(ii)the floors shall be kept free from any materials, plant or other articles not immediately required for the work carried on in the room, which shall construct the proper cleaning of the floor.

(b) The cleaning as mentioned in sub-para (a) shall so far as is practicable, as carried out by means of vacuum cleaning equipment so designed and constructed and so used that asbestos dust neither escapes nor is discharged into the air of any work place.

(c) When the cleaning is done by any method other than that mentioned in sub-para (b), the persons doing cleaning work and any other person employed in that room shall be provided with respiratory protective equipment and protective clothing.

(d) The vacuum cleaning equipment used in accordance with provisions of sub-para (b), shall be properly maintained and after each cleaning operation, its surfaces kept in a clean state and free from asbestos waste and dust.

(e) Asbestos waste shall not be permitted to remain on the floors or other surfaces at the work place at the end of the working shift and shall be transferred without delay to suitable receptacles. Any spillage of asbestos waste occurring during the course of the work at any time shall be removed and transferred to the receptacles maintained for the purpose without delay.

(14) The occupier shall replace asbestos or of certain types of asbestos or products

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containing asbestos by other materials or products or shall use alternative technology, scientifically evaluated as harmless or less harmful, wherever this is possible.

(15) The occupier shall take all the measures to prevent or control the release of asbestos in to the air and to ensure that the exposure limits or other exposure criteria are complied with and also reduce exposure to as low as a level as is reasonably practicable.

(16) Breathing Apparatus, Personnel Protective Equipment and Clothing:

(a) The occupier of every factory to which this standard applies shall provide to workers personnel protective equipments such as hand gloves shoes helmets, goggles earplug, aprons safety belt, overall suit, etc. as per the relevant National Standards as shall be required.

The approved breathing apparatus and appropriate work clothing as per the relevant National Standards in consultation with the workers representatives and maintained in good conditions for use of every person employed -

(i) in chambers containing loose asbestos.

(ii) in cleaning, dust settling or filtering chambers of apparatus;

(iii) in cleaning the cylinders, including the defer cylinders, or other parts of a carding machine by means of hand-stickles;

(iv) in filling, beating, or levelling in the manufacture or repair of insulating mattresses; and

(v) in any other operation or circumstances in which it is impracticable to adopt technical means to control asbestos dust in the work environment within the permissible limit.

(b) Suitable accommodation in conveniently accessible position shall be provided for the use of persons when putting on or taking off breathing apparatus and protective clothing provided in accordance with this standard and for the storage of such apparatus and clothing when not in use.

(c) All breathing apparatus and protective clothing not in use shall be stored in the accommodation provided in accordance with sub-para (b) above.

(d) All protective clothing in use shall be de-dusted under an efficient exhaust draught or by vacuum cleaning and shall be washed at suitable intervals. The cleaning schedule and procedure shall be such as to ensure the efficiency in protective the wearer.

(e) All breathing apparatus shall be cleaned and disinfected at suitable intervals and thoroughly inspected once every month by a responsible person.

(f) A record of the cleaning and maintenance and of the condition of the breathing apparatus shall be maintained in a register provided for that purpose which shall be readily available for inspection by an Inspector-–cum- Facilitator.

(g) No person shall be employed to perform any work specified in sub-para (a) for

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which breathing apparatus is necessary shall be provided under that sub-para unless he has been fully instructed in the proper use of that equipment.

(g) No breathing apparatus provided in pursuance of sub-para (a) which has been worn by a person shall be worn by another person unless it has been thoroughly cleaned and disinfected since last being worn and the person has been fully instructed in the proper use of that equipment.

(h) No worker shall take home any work clothing or special protective clothing, or personal protective equipment provided to him for protection against exposure to asbestos.

(17) Prohibition relating to smoking.-

No person shall smoke in any area where processes covered by this standard are carried on. A notice in the language understood by majority of the workers shall be posted in the plant prohibiting smoking at such areas.

(18) Pictorial Cautionary notices.-

Cautionary notices in the form specified in appendix and printed in the language easily read and understood by the majority of the workers shall be displayed in prominent places in the workrooms where asbestos or substances containing asbestos are manufactured, handled or used.

(19) Air monitoring. -

To ensure the effectiveness of control measures in continuous or repetitive processes, the monitoring of asbestos fibres in air as well as personal monitoring of workers shall be carried out at least once in every shift and the result so obtained shall be entered in register and

(a) There shall be no substantial change in workplace conditions.

(b) The results of the two (2) preceding measurements have not exceeded half the relevant control limit.

(c) All factories shall adopt membrane filter test as per the relevant National Standards without fail.

Pictorial cautionary notice

(a) Asbestos/asbestos dust which is used, handled or manipulated in this factory is a very hazardous to health.

(b) Prolonged exposure to asbestos dust shall lead to serious diseases like lung fibrosis (Asbestosis) and lung cancer.

(c) Entry is prohibited without protective equipment.

(d) Wear the Protective Equipments to safeguard your health.

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(e) No food stuffs or drinks shall be brought into this area.
(f) Smoking, eating food or drinking and chewing tobacco in this area is prohibited.
(g) Scrupulous cleanliness shall be maintained in this area.
(h) Dry sweeping in this area is prohibited. Any spillage of asbestos shall be cleaned by vacuum cleaning only.
(i) A sack or container contaminated with asbestos shall not be cleaned by hand and is shall be disposed off by an appropriate method.
(j) All protective equipments and clothing shall be re-dusted by vacuum cleaning and stored in an appropriate place provided for the purpose.
(k) Entry of unauthorized persons or authorized persons without proper protective equipments is prohibited.
(l) Report for the prescribed medical examinations and tests regularly to protect your own health.
(m) Report to your doctor immediately if you suffer from persistent breathlessness, chest tightness, or cough.

113. **Extraction of oils and fats from vegetable and animal sources -** under serial no. 25 in the first schedule under clause (za) of sub-section (1) of section 2

(1) Location and layout.-

(a) No solvent extraction plant shall be permitted, constructed or extended to within a distance of 30 meters from the nearest residential locality.
(b) A 1.5 meter high continuous wire fencing shall be provided around the solvent extraction plant upto a minimum distance of 15 meters from the plant.
(c) No person shall be allowed to carry any matches or an open flame or fire inside the area bound by the fencing.

(d) Boiler houses and other buildings where open flame processes are carried on shall be located at least 30 meters away from the solvent extraction plant;
(e) If godowns and preparatory processes are at a distance of less than 30 metres from the solvent extraction plant, these shall be at least 15 meters distant from the plant, and a continuous barrier wall of non-combustible material 1.5 meters high shall be erected at a distance of not less than 15 meters from the solvent extraction plant so that it extends to at least 30 meters of vapour travel around its ends from the plant to the possible sources of ignition.

(2) Electrical installations.-

(a) All electrical motors and wiring and other electrical equipment installed or housed insolvent extraction plant shall be of flame proof construction.
(b) All metal parts of the plant and building including various tanks and containers

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where solvents are stored or are present and all parts of electrical equipment not required to be energised shall be properly bonded together and connected to earth so as to avoid accidental rise in the electrical potential of such parts above the earth potential.

(3) Restriction on smoking.-

Smoking shall strictly prohibited within 15 meters distance from solvent extraction plant. For this purpose, "NO smoking" sings shall be permanently displayed in the area.

(4) Precautions against friction.-

(a) All tools and equipment including ladders, chains and other lifting tackle required shall be used in solvent extraction plant shall be of non-sparking type.

(b) No machinery or equipment in any solvent extraction plant shall be belt driven, unless the belt used is of such a type that it does not permit accumulation of static electricity to a dangerous level.

(c) No person shall be allowed to enter and work in the solvent extraction plant if wearing clothes made of nylon or such other fibre that can generate static electrical charge, or wearing footwear which is likely to cause sparks by friction.

(5) Precautions against power failure.- Provision shall be made for the automatic cutting off of steam in the event of power failure and also for emergency overhead water-supply for feeding water by gravity to condensers which shall come into play automatically with the power failure.

(6) Magnetic Separators.- Oil cake shall be fed to the extractor by a conveyer through a hopper and a magnetic separator shall be provided to remove any pieces of iron during pressure in the event of fire.

(7) Venting.-

(a) Tanks containing solvents shall be protected with emergency venting to relieve excessive internal pressure in the event of fire.

(b) All emergency relief vents shall terminate at least 6 meters above the ground and be so located that vapours shall not re-enter the building in which solvent extraction plant is located.

(8) Waste water.- Process waste water shall be passed through a flash evaporator to remove any solvent before it is discharged into a sump which shall be located within the fenced area but not closer than 8 meters to the fence.

(9) Ventilation.- The solvent extraction plant shall be well ventilated and if the plant is housed in a building, the building shall be provided with mechanical ventilation with

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provision for at least six air changes per hour.

(10) Housekeeping.-

(a) Solvents shall not be stored in an area covered by solvent extraction plant except in small quantities which shall be stored in approved safety cans.

(b) Waste materials such as oily rags, other wastes and absorbents used to wipe off solvent and paints and oils shall be deposited in approved containers and removed from the premises at least once a day.

(c) Space within the solvent extraction plant and within 15 meters from the plant shall be kept free form any combustible materials and any spills of oil or solvent, shall be cleaned up immediately.

(11) Examination and repairs.-

(a) The solvent extraction plant shall be examined by the competent person to determine any weakness or corrosion and wear once in every 12 months. Report of such examination shall be supplied to the Inspector-cum-Facilitator with his observation as to whether or not the plant is in safe condition to work.

(b) No repairs shall be carried out to the machinery or plant except under the direct supervision of the competent person.

(c) Facility shall be provided for purging the plant with inert gas or steam before opening for cleaning or repairs and before introducing solvent after repairs.

(12) The operation of the plant and machinery in the solvent extraction plant shall be in the charge of such duly qualified and trained persons as are certified by the competent person to be fit for the purpose and no other person shall be allowed to operated the plant and machinery.

(13) Vapour detection.-A suitable type of flameproof and portable combustible gas indicator shall be provided and maintained in good working order and a schedule of routine sampling of atmosphere at various location as approved by the chief Inspector-cum-Facilitator shall be drawn out and entered in a register maintained for the purpose.

114. **Manufacture, handling and usage of benzene and substances containing benzene -** under serial no. 26 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply in respect of factories or parts thereof in which benzene or substances containing benzene are manufactured, handled or used.

(2) Prohibition and substitution.-

(a) Use of benzene and substances containing benzene is prohibited in the following

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processes :-

(i)manufacture of varnishes, paints and thinners; and

(ii)cleaning and degreasing operations.

(b) Benzene or substances containing benzene shall be used as a solvent or diluent unless the process in which it is used is carried on in an enclosed system or unless the process is carried on in a manner which considered equally safe as if it were carried out in an enclosed system.

(c) Where suitable substitutes are available, they shall be used instead of benzene or substances containing benzene. This provision, however, shall not apply to the following processes:-

(i) production of benzene;

(ii) process where benzene is used for chemical synthesis;

(iii) motor spirits (used as fuel).

(3) Protection against installation.-

(a) The process involving the use of benzene or substances containing benzene shall be as far as practicable be carried out in an enclosed system.

(i) Where, however, it is not practicable to carry out the process in an enclosed system, the workroom in which benzene or substances containing benzene are used shall be equipped with an efficient exhaust draught or other means for the removal of benzene vapours to prevent their escape into the air of the workroom so that the concentration of benzene in the air does not exceed 10 parts per million by volume or 30 milligrams per cubicmeter.

(ii) Air analysis for the measurement of concentration of benzene vapours in air shall be carried out every 8 hours and the concentration measured shall be below PEL.

(b) Workers who for special reasons are likely to be exposed to concentration of benzene in the air of the workroom exceeding the maximum referred to in sub-para (ii) shall be provided with suitable respirators or face masks. The duration of such exposure shall be limited as far as possible.

(4) Measures against skin contact.-

a. Workers who are likely to come in contact with liquid benzene or liquid substances containing benzene shall be provided with suitable gloves, aprons, boots and where necessary vapour tight chemical goggles, made of material not affected by benzene or its vapours.

b. The protective wear referred to in sub-para (a) shall be maintained in good condition and inspected regularly.

(5) Prohibition relating to employment of women and adolescents.- No pregnant woman or adolescent shall be employed or permitted to work in any workroom involving

exposure shall benzene or substances containing benzene.

(6) Labelling.- Every container holding benzene or substances containing benzene shall have the word "Benzene" and approved danger symbols clearly visible on it and shall also display information on benzene content, warning about toxicity and infallibility of the chemical.

(7) Improper use of benzene.-

(a) The use of benzene substances containing benzene by workers for cleaning their hands or their work clothing shall be prohibited.

(b) Workers shall be instructed on the possible dangers arising from such misuse.

(8) Prohibition of consuming food, etc. in workrooms.-

No worker shall be allowed to store or consume food or drink in the workroom in which benzene or substances containing benzene are manufactured, handled or used. Smoking and chewing tobacco or pan shall be prohibited in such workrooms.

(9) Instructions as regards risks.- Every worker on his first employment shall be fully instructed on the properties of benzene or substances containing benzene which he has to handle and of the dangers involved. Workers shall also be instructed on the measures shall be taken to deal with in an emergency.

(10) Cautionary notices.- Cautionary notices in the form specified in appendix and printed in the language easily read and understood by the majority of the workers shall be displayed in prominent places in the workrooms where benzene or substances containing benzene are manufactured, handled or used.

(11) Washing facilities, cloakroom and mess room.- In factories in which benzene or substances containing benzene are manufactured, handled or used, the occupier shall provide and maintain in a clean state and in good repair -

(a) washing facilities under cover, of the standard of at least one tap for every 10 persons having constant supply of water with soap, and a clean towel provided individually to each worker if so ordered by the Inspector-cum-Facilitator;

(b) a cloakroom with lockers for each worker, having two compartments - one for street-clothing and one for work-clothing; and

(c) a mess room furnished with tables and benches with means for warming food, provided that where a canteen or other proper arrangements exist for the workers to take their meals, the requirements of mess room shall be dispensed with.

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CAUTIONARY NOTICE

Benzene and substances containing benzene

(a) **Hazards:**

(i) Benzene and substances containing benzene are harmful.

(ii) Prolonged or repeated breathing of benzene vapours shall result in acute or chronic poisoning.

(iii) Benzene can also be absorbed through skin which shall cause skin or other diseases.

(b) **Preventive measures:**

(i) Avoid breathing of benzene vapours.

(ii) Avoid prolonged or repeated contact of benzene with the skin.

(iii) Remove benzene soaked or wet clothing promptly.

(iv) (d) If any time you are exposed to high concentration of benzene vapours and exhibit signs and symptoms such as dizziness, difficulty in breathing, excessive excitation and losing of consciousness, immediately inform your factory manager.

(v) Keep all the containers of benzene closed

(vi) Handle, use and process benzene and substances containing benzene carefully in order to prevent their spillage on floor.

(vii) Maintain good housekeeping.

(c) **Protective equipment:**

(i) Use respiratory protective equipment in places where benzene vapours are present in high concentration.

(ii) In emergency, use self generating oxygen mask or oxygen or air cylinder masks.

(iii) Wear hand gloves, aprons, goggles and gum boots to avoid contact of benzene with your skin and body parts.

(d) **First-aid measures in case of acute benzene poisoning :**

(i) Remove the clothing immediately if it is wetted with benzene.

(ii) If liquid benzene enters eyes, flush thoroughly for at least 15 minutes with clean running water and immediately secure medical attention.

(iii) In case of unusual exposure shall benzene vapour, call a physician immediately. Until he arrives, do the following :-

(a) If the exposed person is conscious -

(aa) Move him to fresh air in open.

(bb) Lay down without a pillow and keep him quiet and warm.

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(b) If the exposed person is unconscious -

(aa) Lay him down preferably on the left side with the head low.

(bb)Remove any false teeth, chewing gum, tobacco or other foreign objects which shall be in his mouth

(cc)Provide him artificial respiration in case difficulty is being experienced in breathing.

(dd)In case of shallow breathing or cyanosis (blueness of skin, lips, ears, finger nail beds), he shall be provided with medical oxygen or oxygen carbon dioxide mixture. If needed, he shall be given artificial respiration. Oxygen shall be administered by a trained person only.

115. **Manufacturing process or operation involving carbon disulphide** - under serial no. 27 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all electric furnaces in which carbon disulphide is generated and all other plants where carbon disulphide after generation, is condensed, refined and stored.

(2) Construction, installation and operation.-

(a) The buildings in which electric furnaces are installed and carbon disulphide after generation is condensed and refined shall be segregated from other parts of the factory and shall be of open type to ensure optimum ventilation and the plant layout shall be such that only a minimum number of workers are exposed to the risk of any fire or explosion at any one time.

(b) Every electric furnace and every plant in which carbon disulphide is condensed, refined and stored with all their fittings and attachments shall be of good construction, sound material and of adequate strength to sustain the internal pressure to which the furnace or the plant shall be subjected to and shall be so designed that carbon disulphide liquid and gas are in closed system during their normal working.

(c) The electric furnace supports shall be firmly grouted about 60 centimetres in concrete or by other effective means.

(d) Every electric furnace shall be installed and operated according to manufacturers' instructions.

(e) The instructions regarding observance of correct furnace temperature, sulphur dose, admissible current or power consumption and periodical checking of charcoal level shall be strictly complied with.

(3) Electrodes.-

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(a) Where upper ring electrodes made of steel are used in the electric furnace, they shall be of seamless tube construction and shall have arrangement for being connected to cooling water system through a siphon built in the electrodes or through a positive pressure water-pump.

(b) The arrangement for cooling water referred to in sub-para (a) shall be connected with automatic alarm system which shall actuate in the event of interruption of cooling water in the electrodes and give visible and audible alarm signals in the control room and simultaneously stop power supply for the furnace operation and to stop the further supply of water. The alarm system and the actuating device shall be checked every day.

(4) Maintenance of charcoal level.-

When any electric furnace is in operation, it shall be ensured that the electrodes are kept covered with charcoal bed.

(5) Charcoal separator.-

A cyclone type of charcoal separator shall be fitted on the off take pipe between the electric furnace and sulphur separator to prevent entry of pieces of charcoal into the condensers and piping.

(6) Rupture discs and safety seal.-

(a) At least two rupture discs of adequate size which shall blow off at a pressure twice the maximum operating pressure shall be provided on each furnace and shall either be mounted directly on the top of the furnace or each through an independent pipe as close as possible to the furnace.

(b) A safety water seal shall be provided and tapped from a point between the charcoal separator and the sulphur separator.

(7) Pyrometer and manometers.-

(a) Each electric furnace shall be fitted with adequate number of pyrometers to give an indication of the temperature as correctly as reasonably practicable at various points in the furnace. The dials for reading the temperatures shall be located in the control room.

(b) Manometers or any other suitable devices shall be provided for indicating pressure -

(i)in the off take pipe before and after the sulphur separator; and

(ii) in primary and secondary condensers.

(8) Check valves.-

All piping carrying carbon disulphide shall be fitted with non return valves at suitable

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positions so as to prevent gas from flowing back into any electric furnace in the event of its shut down.

(9) Inspection and maintenance of electric furnaces.-

(a)Every electric furnace shall be inspected internally by a competent person.

(i) before being placed in service after installation;
(ii) before being placed in service after reconstruction or repairs; and
(iii) periodically every time the furnace is opened for cleaning or for replacing electrodes.

(b)When an electric furnace is shut down for cleaning

(i) the brick lining shall be checked for continuity and any part found defective removed;
(ii)after removal of any part of the lining referred to in (i) the condition of the shell shall be inspected and closely
(iii) any plates found corroded to the extent that safety of the furnace is endangered shall be replaced.

(10) Maintenance of records.- The following hourly records shall be maintained in a log book.

(a)gas temperature indicated by pyrometers and all other vital points near the sulphur separator and
primary and secondary condensers;
(b)water temperature and flow of water through the siphon in the electrodes; and
(c)primary and secondary voltages, current and energy consumed.

(11) Electrical apparatus, wiring and fittings.- All buildings in which carbon disulphide is refined or stored shall be provided with electrical apparatus, wiring and fittings which shall afford adequate protection from fire and explosion.

(12) Prohibition relating to smoking.- No person shall smoke or carry matches, fire or naked light or other means of producing a naked light or spark in buildings in which carbon disulphide is refined or stored, and a notice in the language understood by a majority of the workers shall be posted in the plant prohibiting smoking and carrying of matches, fire or naked light or other means of producing naked light or spark into such rooms.

(13) Means of escape.- Adequate means of escape shall be provided and maintained to enable persons to move to a safe place as quickly as possible in case of an emergency. At least two independent staircases of adequate width shall be provided in every

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building housing the furnaces at reasonable intervals at opposite ends. These shall always be kept clear of all obstructions and so designed to afford easy passage.

(14) Warnings in case of fire.- There shall be adequate arrangements for giving warnings in case of fire or explosion which shall operate on electrically and in case of failure of electricity by some mechanical means.

(15) Bulk Sulphur.-

(a) Open or semi-enclosed spaces for storage of bulk sulphur shall be sited with due regard to the dangers which shall arise from sparks given off by nearby locomotives, etc., and precautions shall be taken to see that flames, smoking and matches and other sources of ignition do not come in contact with the clouds of dust arising during handling of bulk sulphur.

(b) All enclosures for bulk sulphur shall be of non-combustible construction, adequately ventilated and so designed as to provide a minimum of ledges on which dust shall lodge.

(c) The bulk sulphur in the enclosures shall be handled in such a manner as to minimise the formation of dust clouds and no flame, smoking and matches or other sources of ignition shall be employed during handling and non-sparking tools shall be used whenever sulphur is shovelled or otherwise removed by hand.

(d) No repairs involving flames, heat or use of hand or power tools shall be made in the enclosure where bulk sulphur is stored.

(16) Liquid sulphur.- Open flames, electric sparks and other sources of ignition, including smoking and matches, shall be excluded from the vicinity of molten sulphur.

(17) Unauthorised persons.- Only maintenance and repair personnel, persons directly connected with the plant operation and those accompanied by authorised persons shall be admitted into the plant.

(18) Personal protective equipment.-

(a) Suitable goggles and protective clothing consisting of overalls without packets, gloves and foot-wear shall be provided for the use of operatives -

(i) when operating valves or cocks controlling fluids etc.,

(ii) drawing off a molten sulphur from sulphur pots;

(iii) handling charcoal or sulphur.

(b) Suitable respiratory protective equipment shall be provided and stored in the appropriate place for use during abnormal conditions or in an emergency.

(c) Arrangements shall be made for proper and efficient cleaning of all such protective equipment.

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116. **Dyes and dyestuff including their intermediates** - under serial no. 28 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to dyes and dyestuff including their intermediates.

(2) **Prohibited substances.-** For the purpose of this standard, the following chemical substances shall be classified as "prohibited substances" except when these substances are present or are formed as a by-product of a chemical reaction in a total concentration not exceeding one percent :-

(a) beta-naphthylamine and its salts;
(b) Benzedrine and its salts;
(c) 4-amino biphenyl and its salts;
(d) 4-nitro diphenyl and its salts; and
(e) any substance containing any of these compounds.

(3) Controlled substances.- For the purpose of this standard, the following chemical substances shall be classified as "controlled substances" :-

(a)alpha-naphthylamine or alpha-naphthylamine containing not more than one percent of beta-
naphthylamine either as a by-product of chemical reaction or otherwise, and its salts;
(b) ortho-tolidine and its salts;
(c)dianisdine and its salts;
(d)dichlorobenzidine and its salts;
(e)auramine; and
(f) magneta.

(4) Requirements for processing or handling controlled substances.-

(a) Wherever any of the controlled substances referred to in para 4 are formed, manufactured, processed, handled, or used, all practical steps shall be taken to prevent inhalation, ingestion or absorption of the said controlled substance by the workers while engaged in processing that substance, and its storage or transport within the plant, or in cleaning or maintenance of the concerned equipment, plant, machinery and storage areas.

(b) As far as possible all operations shall be carried out in a totally enclosed system. Wherever such enclosure is not possible, efficient exhaust draught shall be applied

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at the point where the controlled substances are likely to escape into the atmosphere during the process.

(c) The controlled substances shall be received in the factory in tightly closed containers and shall be kept so except when these substances are in process or in use. The controlled substances shall leave the factory only in tightly closed containers of appropriate type. All the containers shall be plainly labelled to indicate the contents.

(5) Personal protective equipment.-

(a)The following items of personal protective equipment shall be provided and issued to every worker employed in the said processes :-

(i)long trousers and shirts or overalls with full sleeves and head coverings. The shirt or overall shall cover the neck completely; and

(ii) rubber gum-boots.

(b) The following items of personal protective equipment shall be provided in sufficient numbers for use by workers employed in the said processes when there is danger of injury during the performance of normal duties or in the event of emergency :-

(i) rubber hand-gloves;

(ii) rubber aprons; and

(iii) airline respirators or other suitable respiratory protective equipment.

(c) It shall be the responsibility of the manager to maintain all items of personal protective equipment in a clean and hygienic condition and in good repair.

(6) Floors of workroom.- The floor of every workroom in which the said processes are carried on shall be

(a)smooth and impervious to water provided that asphalt or tar shall not be used in the composition of the

floor,

(b) maintained in a state of good repair**,**

(c)with a suitable slope for easy draining and provided with gutters and

(d) thoroughly washed daily with the drain water being led into a sewer through a closed channel.

(7) Disposal of empty containers.- Empty containers used for holding controlled substances

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shall be thoroughly cleaned of their contents and treated with an inactivating agent before being discarded.

(8) Manual handling.- Controlled substances shall not be allowed to be mixed, filled, emptied or handled except by means of a scoop with a handle. Such scoop shall be thoroughly cleaned daily.

(9) Every worker on his first employment in the said processes shall be fully instructed on the properties of the toxic chemicals to which he is likely shall be exposed to, of the dangers involved and the precautions shall be taken. Workers shall also be instructed on the measures shall be taken to deal with an emergency.

(10) Cautionary placards.- Cautionary placards in the form specified in appendix attached to this standard and printed in the language of the majority of the workers employed in the said processes shall be affixed in prominent places frequented by them in the factory, where the placards can be conveniently read. Arrangements shall be made by the manager to instruct periodically all such workers regarding the precautions contained in the cautionary placards.

(11) Obligations of the workers.- It shall be the duty of the persons employed in the said processes to submit themselves for the medical examination including exfoliative cytology of urine by the Factory Medical Officer as provided for under these standards.

APPENDIX

CAUTIONARY PLACARD/NOTICE

Carcinogenic dye intermediates

1.Dye intermediates which are nitro amino derivatives or aromatic hydrocarbons are toxic. You have to handle these chemicals frequently in this factory.

2.Use the various items of protective wear to safeguard your own health.

3.Maintain scrupulous cleanliness at all times. Thoroughly wash hands and feet before taking meals. It is essential to take a bath before leaving the factory.

4.Wash off any chemical falling on your body with soap and water. If splashed with a solution of the chemical, remove the contaminated clothing immediately. These chemicals are known to produce cyanosis. Contact the Factory Medical Officer immediately and get his advice.

5.Handle the dye intermediates only with long handled scoops, never with bare hands.

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6.Alcoholic drinks shall be avoided as they enhance the risk of poisoning by the chemicals.

7.Keep your food and drinks away from work place. Consuming food, drinks or tobacco in any form at the place of work is prohibited.

8.Serious effects from work with toxic chemicals shall follow after many years. Great care must be taken to maintain absolute cleanliness of body, clothes, machinery and equipment.

117. **Highly flammable liquids and gases -** under serial no. 29 in the first schedule under clause (za) of sub-section (1) of section 2

(1) These standards shall be applicable to all factories where highly flammable liquids or flammable compressed gases are manufactured, stored, handled or used.

(2) Storage. -Every flammable liquid or flammable compressed gas used in every factory shall be stored in suitable fixed storage tank, or in suitable closed vessel located in a safe position under the ground, in the open or in a store room of adequate fire resistant construction in conformance with National Standards. The wind characteristics shall also be taken into consideration which reduce the hazard of flammable liquids or vapors.

(3) Hydrostatic Testing - All vessels storing highly flammable liquid or flammable compressed gas shall be hydraulically tested by a competent person at a pressure marked on the vessel at intervals of not more than five years.

(4) Enclosed systems for conveying highly flammable liquids. - Wherever it is reasonably practicable, highly flammable liquids shall be conveyed within a factory in totally enclosed systems consisting of pipelines, pumps and similar appliances from the storage tank or vessel to the point of use. Such enclosed systems shall be so designed, installed, operated, and maintained as to avoid leakage or the risk of spilling.

(5) Preventing formation of flammable mixture with air. –

(a) Where an underground pipeline must cross any existing underground water or gas line, cable, drain or other services, the pipeline shall be laid at least thirty centimetres below such services in a manner that will not obstruct access to such services for inspection repair, or maintenance.

(b) The route of underground sections of a pipeline shall be a indicated by markers and

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not less than two such markers shall be visible from any point along the route.

(6) Prevention of Ignition – In every room, workplace or other location where highly flammable liquid or flammable combustible gas is stored, conveyed, handled, or used or where there is danger of fire or explosion from accumulation of highly flammable liquid or flammable compressed gas in air, all practicable measures shall be taken to exclude the sources of ignition. Such precautions shall include the following:

(a)All electrical apparatus shall either be excluded from the area of risk, or they shall be of such construction and so installed and maintained as to prevent the danger of their being a source of ignition.

(b) effective measures shall be adopted for prevention of accumulation of static charges to a dangerous extent. Bonding and grounding shall be provided by most effective means of preventing the build up of static charges.Effective measures shall be adopted to discharge the static current on human body before entry into the specified area.

(c)no person shall wear or be allowed to wear any footwear having iron or steel nails or any other exposed ferrous materials which is likely to cause sparks by friction.

(d)smoking, lighting, or carrying of matches, lighters or smoking materials shall be prohibited.

(e)transmission belts with iron fasteners shall not be used.

(f)all other precautions, as are reasonably practicable, shall be taken to prevent initiation of ignition from all other possible sources such as open flames, frictional sparks, overheated surfaces of machinery or plant, chemical or physical-chemical reaction and radiant heat.

(g)Gas storage area must be protected against a direct lightning strike to the tank or strike near the tank.

(h)Provision shall be made for leak detection system.

(7) Prohibition of smoking. - No person shall smoke in any place where highly flammable liquid or flammable compressed gas is present in circumstances that shall take all practicable measures to ensure compliance with this requirement including display of a bold notice indicating prohibition of smoking at every place where this requirement applies.

(8) Fire Fighting. - In every factory where highly flammable liquid or flammable compressed gas is manufactured, stored, handled, or used, appropriate and adequate means of fighting a fire shall be provided. The adequacy and suitability of such means which expression includes the fixed and portable fire extinguishing systems, extinguishing material, procedures, and the process of fire fighting, shall be to the standards and levels prescribed by the applicable National Standards. All persons employed at such locations shall be conversant with the use of such fire extinguishing

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system.

(9) All vessels used for the storage of flammable compressed gases shall be protected against fire hazards as defined in Section 26 of the Static and Mobile Pressure Vessels (Unfired) Rules 2016 framed under the Explosive Act, 1884.

(10) Classification of hazardous area. –

A hazardous area shall be deemed shall be.-

(a) A zone "0" area, if inflammable gas or vapours are expected shall be continuously present in the area; or

(b) A zone "1" area, if inflammable gases or vapours are likely shall be present in the area under normal operating conditions; or

(c) A zone "2" area, if inflammable gases or vapours are likely shall be present in the area only under abnormal operating conditions or failure or rupture of equipment.

(d) If any question arises as to whether hazardous area is a zone "0" area or a zone "1" or a zone"2"area, the decision thereon of the chief Inspector-cum-Facilitator of Factories shall be final.

(11) Ancillary Equipment - In storage installations the main types of ancillary equipment are pumps, refrigeration compressors and vaporizers. A pump shall be provided with a bypass discharge line back to the storage, to prevent any abnormalities during operation of the pump if pumping against a closed valve. Pumps shall be located outside the bund wall.

(12) The room, workplace or other location where highly flammable liquid or flammable combustible gas is stored shed shall be kept clean and free from all vegetation, waste material and rubbish. No storage shed where highly flammable liquid or flammable compressed gas are kept shall be open and no work in any installation or storage shed shall be permitted between sunset and sunrise except where approved electric lights.

(13) Precautions shall be taken during maintenance of storage vessel containing flammable vapours

(a) Non sparking safety tools shall be used during all maintenance and preventive activities on storage vessels and its accessories. Materials of non-sparking safety tools must have chemical composition as per National Standard.

(b) Emergency preparedness plan for uncontrolled leakage of flammable materials shall be prepared and implemented.

118. **Printing and dyeing on fabrics in textiles and plywood and laminate manufacturing process -** under serial no. 30 in the first schedule under clause (za) of sub-section (1) of section 2

(1) Dyeing and Printing on Fabrics

This standard shall be applicable for the Dyeing and Printing on Fabrics in Textile Industries.

(a) Storage and handling of raw materials

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(i) Grey Fabric

(a) Grey Fabric shall be stored in dry area and neatly arranged.

(b) Storage area shall be adequately ventilated.

(c) While shifting of grey fabric from one floor to another floor using transfer duct, hooter warning system shall be provided for prevention of accidents due to fall of grey fabric bundle on the workers. In addition, cautionary notice shall be displayed in languages understood by the majority of the employees.

(d) Proper supervision shall be provided at the place where grey fabric bundled transferred from one floor to another floor.

(e) Fall of employees through openings of duct shall be adequately protected.

(f) Movement area of material handling equipment shall be clearly marked on the floor.

(ii) Chemicals (Casustic Soda, Soda Ash, Sodium Sulphate, Hydrochloric Acid)

(a) Adequate precautionary measures shall be taken for the prevention of spillages/leakage of chemicals while handling and storage.

(b) Safe means of prompt collection, treatment and disposal of chemicals shall be adopted.

(c) Dyke wall shall be provided around the storage tanks of chemicals for containing the spillage, if it occurs.

(d) Safety eye wash fountain and showers shall be provided at the location where chemicals are handled and stored.

(e) Storage tanks shall be properly designed, constructed, and maintained as per the relevant National Standards.

(f) SOPs shall be prepared and followed while handling and storing of chemicals.

(g) Chemicals shall be handled at the store in dry, ventilated, and clean area.

(h) The containers, storage tanks shall be clearly marked and labeled with the name of the content and hazard symbol.

(i) Dos and don’ts shall be displayed in the location where chemicals are handled.

(b) Drum and Jet machine

(i) Interlock mechanism shall be provided for prevention of accident due to rotation of the bucket while feeding grey fabric bundle inside the drum.

(ii) Hot surfaces shall be adequately insulated for protection of workers from hot surface.

(iii) Adequate measures shall be provided for the protection against excessive pressure, excessive temperature, and overfilling.

(iv) SOPs shall be prepared and followed.

(v) Workers shall be adequately trained on safe operation of drum. Only authorized and trained workers shall be allowed to operate the machines.

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(vi) Proper platform and railing shall be provided at workstation to prevent fall of workers during loading or unloading of grey fabric.

(vii) There shall be maintenance of proper housekeeping.

(viii) Drum shall be tested, inspected, and examined periodically by the competent person.

(ix) Drum shall be designed, constructed, and maintained as per relevant National Standards.

(x) Safety valves shall be tested and maintained in good working conditions.

(xi) To avoid electric shock while working on / near machine, rubber mate shall provided at electric panel and proper earthing shall be ensured.

(c) Continuous Weight Reduction (CWR) Machine

(i) Static Charge Eliminator shall be provided and maintained to avoid fire.

(ii) Good housekeeping shall be ensured to slip, trip and fall of workers. Floor areas shall be kept in dry condition.

(iii) The machine shall be properly earthed to protect the workers from electrocution.

(iv) SOPs for chemical handling shall be prepared and followed.

(v) To avoid electric shock while working on / near machine, rubber mate shall provided at electric panel and proper earthing shall be ensured.

(vi) Good housekeeping shall be ensured to slip, trip and fall of workers while handling Fabric Bundles. Floor areas shall be kept in dry condition

(vii) Emergency switch shall be provided for any emergency during operation.

(d) Stenter Machine

(i) Static Charge Eliminator shall be provided and maintained to avoid fire.

(ii) Adequate measure for prevention and protection of fire shall be provided.

(iii) 'Auto cut off' shall be provided for protection from overheating in Thermic Fluid Heating System.

(iv) Leakage of Thermic Fluid shall be strictly prevented to avoid fire.

(v) Exhaust duct shall be maintained free from oil and fluff to avoid fire.

(e) Printing Machine (Rotary and Flat Bed)

(i) Static Charge Eliminator shall be provided and maintained to avoid fire.

(ii) To avoid electric shock while working on / near machine, rubber mate shall be provided at electric panel and proper earthing shall be provided.

(iii) Dyes shall be handled in a proper container at each stage of the printing machine to avoid spill of dyes on the workplace.

(iv) Emergency switch shall be provided for any emergency during operation

(v) Proper platform shall be provided at the feed end of the machine to avoid fall of

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fabric roll on the workers.

(vi) Adequate care shall be taken while feeding fabric roll in to the printing machine to avoid hit injury, caught between rollers.

(vii) To avoid hit injury, caught in machine, trained and experienced person shall operate machine safety Guards shall be provided.

(f) Looping Process

(i) Static Charge Eliminator shall be provided and maintained to avoid fire.

(ii) To avoid electric shock while working on / near machine, rubber mate shall be provided at electric panel and proper earthing shall be provided.

(iii) Cautionary Board shall be displayed for high temperature to prevent burn injury and only authorized workers shall be allowed to work on the machine.

(iv) Adequate and proper ventilation shall be provided at each location.

(v) Emergency switch shall be provided for any emergency during operation.

(g) Washing Machine

(i) To avoid electric shock while working on / near machine, rubber mate shall be provided at the electric panel and proper earthing shall be ensured.

(ii) Washing machine has very high temperature water for washing of fabric, so to avoid burn injury, signage shall be provided and only authorized and trained workers shall be allowed to work.

(h) Rope Opener

(i) Static Charge Eliminator shall be provided and maintained to avoid fire.

(ii) To avoid electric shock while working on / near machine, rubber mate shall be provided at electric panel and proper earthing shall be ensured.

(iii) Only authorized and trained workers shall be allowed to work.

(i) Zero-Zero Machine

(i) Static Charge Eliminator shall be provided and maintained to avoid fire.

(ii) To avoid electric shock while working on / near machine, rubber mate shall be provided at electric panel and proper earthing shall be ensured.

(iii) Only authorized and trained workers shall be allowed to work.

(j) Utilities

(i) SOPs shall be prepared for safe operation of the Boiler, Thermic Fluid Heater, Effluent Treating Plant (ETP) and high pressure compressor unit.

(ii) Contaminated water shall be treated in ETP and shall be disposed as per the applicable National Standards.

(iii) Electrostatic Precipitators (ESP) and Bag Filters shall be used in flue gas discharge system for boiler and thermic fluid heater.

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(k) General

(i) Safe Operating Procedures shall be prepared for each machine and process and the same shall be implemented.

(ii) Workers shall be adequately trained for safe operation of the machines.

(iii) Machine guarding and Interlock sensors shall be provided and maintained in good working conditions.

(iv) Warning signs shall be provided for hot surfaces and high temperature operations.

(v) Noise prevention and control measures shall be implemented at the high noise work areas.

(vi) Workplaces shall be adequately ventilated and illuminated as per the applicable National Standards.

(vii) The process specific Personal Protective Equipment (PPEs) are given in the Annexure and the same shall be supplied, used, maintained, stored, and disposed as per the procedures.

(2) Plywood and laminate manufacturing process

This standard shall be applicable for Plywood, Particle board and pre-laminated board industries.

(a) Plywood Manufacturing

(i) Unloading and stacking of timber

(a) The truck driver shall not remain inside the truck during unloading operations.

(b) The crane boom operation shall be checked before starting of material handli process.

(c) Stacking of timber shall be done in a criss-cross fashion and the height shall r exceed 6 metres.

(d) Access shall be restricted to the timber unloading area.

(ii) Cross Cutting/Resize of Logs

(a) Chain saw shall be of push-button type and shall be provided with full guarding.

(b) PPEs like Hand gloves, goggles, ear-plugs and dust mask shall be worn by t Workers handling Chain saw.

(iii) Peeling Operations

(a) While removing and re-fixing of peeling knives, cut resistant hand glov conforming to National Standard shall be worn.

(b) While transferring the peeling Knife to the knife grinding area, its edges shall covered.

(iv) Drying Operations

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(a) The surrounding of the dryers shall be empty and sufficient free space shall provided around it.

(b) Inside of the Dryer shall be periodically cleaned to remove the dust and deb accumulation.

(c) In case of any mechanical breakdown/ Jamming of veneer, the heating mediu circulation line shall be closed and fan shall be stopped immediately by providi interlock arrangement.

(v) Core Composing/Chopping

(a) Composer / Chopper knives shall be handled in the same way as peeling knive Chopping guards shall be provided to prevent accidents.

(b) All paddle switches shall be operated on 24 volts.

(vi) Assembling and Hot Press

(a) Workmen involved in assembling of plywood must wear rubber hand gloves a cloth apron.

(b) Adequate ventilation shall be maintained.

(c) All pressure gauges, temperature indicators and cut-off switches provided at 'H Press' shall be calibrated once in every six months.

(d) While unloading plywood from hot press, the workmen to wear heat resistant ha gloves.

(vii) Resin and Glue Preparation

(a) All pressure gauges and temperature indicators of the reactors shall be calibrat once in every six months.

(b) All loading, unloading and transfer of chemicals shall be within closed pipelines.

(c) All chemical storage tanks shall be kept away from the working areas.

(d) Chemical resistant (Rubber) hand gloves, Nose mask, Safety Goggle and safe shoes shall be used during preparation of Catalyst and other solutions.

(viii) Sanding machine

(a) Belt changing process shall be started after complete stoppage of belt rotation.

(b) During saw changing the machine shall be stopped completely and isolated fro the energy source.

(b) Particle Board and Pre-laminated Board Manufacturing

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Particle Board Manufacturing

(i) Chipping

(a) Chipper knives shall be transported in a safe manner by using proper carrier a the manual handling of the Chipper knives prohibited.

(b) Hearing protection equipment (ear plug or earmuffs) and safety goggles shall worn by the Workers while working in the chipping area.

(c) Where it is necessary for a worker to stand near a conveyor for the purpose clearing a log jam, the conveyor shall be stopped and locked out (LOTO – Lock C and Tag Out) before the work is started.

(ii) Resin Blending

Workers shall wear the dust free nose mask, rubber hand gloves, safety shoe, aprc safety goggle conforming to National Standard while handling chemical resin.

(iii) Hot press/loader/un-loader

(a) During Gauge bar change all workers shall wear heat- resistant gloves.

(b) During hydraulic system maintenance it shall be ensured that internal hydrau pressure be zero by opening the drain valve.

(iv) Sanding and trimming machine

(a) Belt changing process shall be started after complete stoppage of rotating belt

(b) During saw changing the machine shall be stopped completely and isolated frc the energy source.

(c) Pre-laminated Board Manufacturing - Press and trimming

(i) While cutting paper by using hand tools, workers shall wear cut-resistant ha gloves.

(ii) Safety curtain system shall be provided in the Pre-lam Press.

(iii) In impregnator machine, workers shall wear the dust free nose mask, rubber ha gloves, safety shoe, apron, safety goggle conforming to National Standard wh handling chemical resin.

(d) General

(i) Earth Leakage Circuit Breaker or Residual Current Operated Circuit-Breaker conforming to National Standard shall be provided and maintained.

(ii) Bag filters, cyclones and dust silos shall have explosion windows and internal water spraying system in case fire.

(iii) The generation and accumulation of wood dust in the work areas shall be prevented by

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providing appropriate and adequate dust collection and disposal system.

(iv) The resins and other flammable chemicals shall be provided with necessary safeguards to prevent fire and explosion.

(v) Good housekeeping and safe access shall be ensured in the plant.

119. **Process involving usage of radium or radioactive substances -** under serial no. 31 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to the following aspects in factories:

(2) Industrial Radiography: Metal Fabrication

(3) Nucleonic Gauge: Paper and Film Industry, Cement Industry, Chemical Industry, Bottling Industry Steel Industry ,Coal Washeries, Electronic Industries and Cigarette Industries .

(a) Industrial Radiography: Atomic Energy Regulatory Board (AERB) Safety Code No. AERB/RF-IR/SC-1 (Rev. 1) as amended time to time, shall be implemented and adhered.

(b) Nucleonic Gauges: Atomic Energy Regulatory Board (AERB) Safety Guidelines No. AERB/RF-IGD/SG-1, as amended time to time, as applicable to Nucleonic Gauges utilised in factories shall be implemented and adhered.

120. **Stone crushing industry -** under serial no. 32 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all factories or parts of factories in which the above said manufacturing activity containing free silica is carried on. The following Manufacturing Process shall be considered as Manipulation of Stone or other material containing free Silica:

(a) Stone Crushing
(b) Gem and Jewellery making
(c) Slate Pencil Making
(d) Agate manufacturing
(e) 5.Cement manufacturing
(f) Pottery
(g) Glass Manufacturing

(2) Preventive Control Measures

No manipulation shall be carried out in a factory or part of a factory unless the following preventive control measures are adopted, namely

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(3) Engineering Control Measures to prevent exposure of workers to silica dust

(a)Wet Methods:

(i) Airborne Silica Dust shall be minimized or suppressed by applying water to the process or clean up.

(ii) Water shall be provided for drilling or sawing of concrete or masonry.

(b) Ventilation:

(i) An effective Local exhaust system shall be provided and maintained to control/remove silica dust from industrial processes.

(ii) In addition to Local Exhaust Ventilation at the source of dust generation, Dilution/ventilation shall be used to reduce free silica dust concentration shall below the permissible limits in large areas.

(iii) Dust collectors /HEPA filter shall be set up so that dust shall be removed from the source and all transfer points to prevent contaminating work areas.

(iv) Ventilation systems shall be kept in good working conditions.

(c) Isolation:

(i) Containment methods shall be used while carrying out sand blasting.

(ii) Cabins of vehicles or machinery cutting and drilling that might contain free silica shall be enclosed and sealed.

(d) Dust Control:

(i) Vacuum System with High Efficiency Particle Air (HEPA) filter shall be used to remove dust from work areas and at all transfer points.

(ii) The belt conveyors transferring crushed material shall be totally enclosed throughout its length.

Provided that such control measures as above said are not necessary if the process or operation itself is such that the level of dust created, and prevailing does not exceed the permissible limit of exposure specified by the State Government.

(4) Administrative Control Measures

(a) Personal Exposure Monitoring: The occupier to ensure personal exposure monitoring shall be performed to determine magnitude of exposure/ concentration to evaluate engineering controls, selecting respiratory protection, work practices and the need for medical surveillance.

(i) Exposure/ concentration measurements shall be made in the employee's actual breathing zone.

(ii) Total sampling time shall be at least 7 hours.

(iii) Personal Exposure Monitoring shall be repeated quarterly

(iv) The report of dust sampling by occupier shall be made available to the public.

(b) Training and awareness: Workers shall be trained in the following:

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(i) Health effects of free silica dust exposure.
(ii) Operations and material that produce free silica dust hazards.
(iii) Engineering controls and work practice controls that reduce dust concentration.
(iv) The importance of good housekeeping and cleanliness.
(v) Proper use of personal protective equipment such as respirators etc.
(vi) Personal hygiene practices to reduce exposure.

(5) House Keeping: Maintenance of floors-

(a) All floors or places where fine dust is likely to settle on and whereon any person has to work or pass shall be of impervious material and maintained in such condition that they can be thoroughly cleaned by a moist method or any other method which shall prevent dust being airborne in the process of cleaning once at least during each shift.

(b) For this purpose, Dry sweeping shall be used for cleanup of dust ensuring minimization of airborne dust cloud formation or other preferable methods such as wet cleaning methods or vacuum system with a HEPA filter shall be used.

(c) Dust on over head ledges and equipment shall be removed before it becomes air borne due to vibration, traffic and random air current.

(6) Display of Notices:

(a) Warning signs/ Posters shall be displayed conspicuously in a prominent place.

(b) The warning signs/poster shall contain the Hazards and precautions shall be taken.

(c) The display of notice shall be in the local language and in the language understood by the majority of the workers.

(7) Personal Protective Equipment

The occupier of every factory to which this standard apply shall provide the following PPEs as per relevant National Standards and as applicable to a given workplace.

(a) Dust respirator (Selection shall be based on Personal Exposure Monitoring results).

(b) HEPA filter respirator or Particulate respirator.

(c) HEPA filter respirator with full face piece.

(d) Self-contained breathing apparatus (SCBA)(Selection shall be based on Personal Exposure Monitoring results and Work Activity).

(e) Supplied air respirator with a full-face piece, helmet, or hood (Selection shall be based on Personal Exposure Monitoring results and Work Activity).

(f) SCBA with full face piece (Selection shall be based on Personal Exposure Monitoring results and Work Activity).

(g) Powered air purifying respirator with a HEPA filter (Selection shall be based on

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Personal Exposure Monitoring results and Work Activity).

(8) Prohibition relating adolescent - No adolescent shall be employed or permitted to work in any of the operations involving manipulation or at any place where such operations are carried out.

121. **Extraction of oil and raw material from the scrap tyres -** under serial no. 33 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply in respect of factories or parts thereof wherein extraction of oil and raw material is carried out from the scrap tyres.

(2) Work Environment Monitoring: Work Environment Monitoring shall be carried out once in every six months. Further, the recommendations of the work environment monitoring study shall be implemented.

(3) Hazard Evaluation and Risk Management: Hazard Evaluation and Risk Assessment shall be carried out for all operations involving hazardous chemicals.

(4) Reactor safety measures:

(a) On completion of the pyrolysis process, the reactor shall be allowed to cool down to room temperature before opening it.

(b) Adequate instrumentation with alarm shall be provided to monitor the temperature and pressure inside the reactor.

(c) The process shall be continuously monitored during the heating of the material for temperature and pressure in the reactor.

(d) Explosion proof local exhaust and ventilation shall be provided to maintain airborne concentrations below the applicable exposure limits.

(e) Fencing and 360 degrees guarding of reactor chamber shall be provided.

(f) Safety Valve or rupture disc shall be checked daily before starting the process.

(g) At the time of cooling of the reactor, when the temperature reaches below 80°C, all air vents on the gas tank and oil storage tank shall be left open to release heat and gases present inside the Reactor.

(h) Ash shall be removed only after reactor is at room temperature.

(i) Nitrogen purging shall be provided throughout the carbon discharge activity. Purging shall be ensured with the help of appropriate gauge or other means on the purging line.

(j) The carbon discharge door of the reactor shall be interlocked such that the door shall not open in case the reactor temperature is below room temperature.

(k) The carbon discharge door of the reactor shall be interlocked such that the door shall not open in case there is no/ low Nitrogen pressure on the purge line.

(l) Alarm indicating high temperature shall be provided for the reactor.

(m) Flare including ground level flare shall be made available before start of the reactor process.

(n) Appropriate insulation shall be ensured to prevent contact with hot surfaces.

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(o) Hot surface signage shall be displayed at appropriate places.

(p) Discharge from the rupture disc/ safety valve shall be routed to a collection tank away from the operation.

(5) Handling and storage

(a)Handling of Extracted oil

(i) Handling of extracted oil shall be carried out in well ventilated areas.

(ii) Container shall be kept closed when not dispensing product.

(iii) Grounding and bonding devices shall be used when transferring material.

(iv) Appropriate mitigating procedures shall be followed for safe discharge of accumulated electrostatic charge.

(v) Contact with acids and oxidizing agents shall be avoided.

(vi) Spill control and management system shall be implemented by formulating specific Safe Operating Procedures (SOPs).

(b) Storage

(i) Extracted oil shall be stored in sealed container at ambient temperature in well ventilated areas away from flame or heat.

(ii) A dedicated storage area shall be provided and maintained for storage of tyre for reactor, extracted oil and other extracted raw materials from scrap tyres inside the factory premises.

(iii) Labelling as per the National Standards shall be provided to the storage tank and pipelines.

(iv) Tyre Pile Size and Separation Distances

(a) Storage pile sizes shall be minimized to restrict the available fuel in the event of a fire.

(b) Long and narrow tyre piles shall be employed in preference to large square piles.

(c) A minimum separation distance shall be maintained between piles.

(d) Storage pile heights shall be determined by the stability of the pile, both for normal storage conditions and in the event of a fire.

(e) Separation distance of the storage piles to buildings will depend on the building construction. For buildings without appropriate fire-resistant construction, this distance shall be as per National standards and shall have fire fighter access.

(f) Separation distance between the edge of storage piles to other boundaries shall be as per National Standards.

(6) Ignition Source Control

Procedures to control possible ignition sources on site shall be developed and documented, which shall include as a minimum:

(a) A hot work permit procedure shall be followed to carry out any hot work near

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the storage and reactor area.

(b) Smoking or no open flames shall not be permitted near tyre storage, reactor building and other hazardous material storage.

(7) Cautionary notice

A cautionary notice in English and the language which the majority of the workers employed understand shall be displayed prominently at all the places involving hazardous substances depicting hazards, dos and don'ts and safety precautions.

122. **Cigarette manufacturing industries -** under serial no. 34 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This standard on Occupational safety and health shall be applicable for Cigarette Manufacturing Industries.

(2) Raw Material Handling and Storage

(a) Safety harness with fall arrestor system and helmet shall be worn by personnel involved in loading/unloading operations on the truck such as removing/fixing of Tarpaulin and rope, as well as boxes of raw materials

(b) Adequate fire detection and fighting system shall be installed and kept in readiness for dealing with any emergency.

(c) Only trained and authorized person shall operate Material Handling Equipment (MHE). All safety devices such as reverse horn, flasher light, no unauthorized riding, seat belt etc. shall be maintained in proper working condition.

(d) Pathway shall be demarcated with suitable signage preferably auto glow to segregate man-machine movement as far as practicable.

(e) Adequate ventilation and temperature control through mechanical means shall be provided.

(3) Tobacco Processing

(a) Adequate safety mechanisms such as fixed guarding, electrical interlocks in access doors, Lock-Out-Tag-Out (LOTO) systems, discharging of static energy shall be provided to eliminate hazards from rotating part.

(b) All the nip points of rotating parts shall be adequately guarded.

(c) Periodical maintenance system shall be established for and checking of all the guards for ensuring proper protection and records shall be maintained.

(d) Adequate fire prevention and fighting measures shall be provided as per applicable standards.

(e) All electrical installations shall be designed and maintained as per National Standards. Adequate protection devices such as, earthing, Electric Leakage Circuit

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Breaker (ELCBs), Miniature Circuit Breaker (MCBs), RCCBs shall be provided and maintained in good operating condition.

(f) Adequate insulation shall be provided for all steam lines and hot surfaces and caution signs displayed including local languages to prevent any direct contact that can cause burn injuries.

(g) Proper slope shall be provided, and regular cleaning of the floor shall be done in areas such as flavour handling where there are chances of slippery floor.

(h) The storage shall be done in demarcated areas and provided with bunds for containment of any leakages.

(i) If Robot operation is involved, then Robotic Safety shall be followed.

(j) Dust masks shall be worn by workers in this area at all times, to prevent inhalation of tobacco dust.

(4) Cigarette Manufacturing

(a) Adequate safety mechanisms such as fixed guarding, interlock guarding, electrical interlocks in access doors, Lock-Out-Tag-Out (LOTO) systems shall be provided to eliminate hazards from rotating part.

(b) All the nip points of rotating parts shall be adequately guarded.

(c) Periodical maintenance system shall be established and checking of all the guards for ensuring proper protection. Records shall be maintained

(d) Adequate fire prevention and fighting measures shall be provided as per applicable standards. Proper training on usage of Fire protection system shall be given.

(e) Permit to Work system shall be implemented as appropriate.

(f) Adequate Emergency Lights as per National Standards shall be provided in case of power failure.

(5) Finished Goods Handling and Storage

(a) Safety harness with fall arrestor system and helmet shall be worn by personnel involved in loading operations on the truck such as removing/fixing of Tarpaulin and rope. Health certificates of such truck and drivers license etc must be checked before entry in plant

(b) Adequate fire detection and fighting system shall be installed and kept in readiness for dealing with any emergency.

(c) Only trained and authorized person shall operate MHE. All safety devices such as reverse horn, flasher light, etc. shall be maintained in proper working condition.

(d) Pathway shall be demarcated with suitable signage to segregate man-machine movement as far as practicable.

(6) Ancillary Processes

Fumigation

(a) Fumigation process shall be undertaken by approved/registered fumigation

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companies under the supervision of fumigation operator. PTW Permit to work must be initiated as appropriate

(b) Warning signs and MSDS Material Safety Data Sheet shall be displayed, communicated and adequate safety precautions taken during fumigation.

(c) Fumigation shall be done in an isolated space/ godown with restricted access. Suitable gas mask or SCBA shall be made available as appropriate.

(d) Fumigation dose shall be determined based on the volume of the space shall be fumigated

(e) The area shall be covered with a tarpaulin sheet made from plastic sheeting which allows fumigant shall be contained to the treated material only. The said tarpaulin sheet shall be periodically checked and maintained.

(f) The operator shall wear appropriate personal protective equipment (PPEs) before introducing fumigant such as respiratory protective equipment to prevent inhalation, PVC hand gloves, rubber boots and overalls of cotton-blended material to reduce absorption through the skin, Eye protection to avoid dust from loose tablet formulations entering eyes.

(g) The fumigation operator shall monitor and detect gas leakage if any, and take appropriate measures to seal leakage, monitor gas concentration and aeration of fumigated commodities. Calibrated Gas monitor / Gas tester shall be carried by him.

(h) Any remaining pellets/ empty containers of fumigants shall be disposed in safe manner

(i) Proper records on stock and use of fumigant shall be maintained.

(7) Fuel Storage

Secondary containment shall be provided while handling of fuel. MSDS of fuel shall be available in local language

(8) Compressor Operations

(a) Suitable engineering controls measures shall be taken to limit the noise level within applicable limits as prescribed.

(b) Earmuff or ear plug or a combination of both shall be used wherever noise level exceeds the limit.

(c) Periodic maintenance of compressors and pressure tests of air receivers shall be done by Competent person

(d) Adequate safety mechanisms such as pressure relief valves, fixed guarding, electrical interlocks in access doors, Lock-Out-Tag-Out systems and Permit to Work shall be provided to eliminate hazards from rotating part.

(e) All the nip points of rotating parts shall be adequately guarded.

(f) Periodical maintenance system shall be established for and checking of all the guards for ensuring proper protection and records shall be maintained.

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(9) Dust Removal Operation (DRF) Operation

(a) Suitable engineering controls measures shall be taken to limit the noise level within applicable limits prescribed. Administrative controls like warning signage shall be provided in Local languages along with other languages.

(b) Worker engaged in DRF operation shall wear appropriate personal protective equipment such as dust mask, hand gloves, ear protection.

(c) Periodic cleaning and maintenance of filters shall be done and ensured. Pressure tests shall be done for air receivers. Records shall be maintained.

(d) Adequate safety mechanisms such as fixed guarding, electrical interlocks in access doors, Lock-Out-Tag-Out systems shall be provided to eliminate hazards from rotating part.

(e) All the nip points of rotating parts shall be adequately guarded.

(f) Periodical maintenance system shall be established and checking of all the guards for ensuring proper protection.

(g) Appropriate Health check up shall be done for all involved in this operation including contractors

(10) Waste handling and storage

(a) Wrapping or packing material wastes shall be recycled/ reused through suitable agencies.

(b) Proper segregation and storage facility shall be maintained to avoid mix-up different kinds of wastes.

(c) E-wastes shall be disposed-off through authorised agencies, and as prescribed under the Code.

(d) Suitable personal protective equipment shall be used while handling heavy or sharp wastes.

123. **Ship breaking industry -** under serial no. 35 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to all operations in Ship Breaking Industry

(2) Inventory of Hazardous Substance-

(a) Every Ship beached for recycling in the ship recycling facility shall have on board an Inventory of Hazardous Materials and the same shall be made available to the Factory Inspector-cum-Facilitator on demand. The Inventory of Hazardous Materials shall be specific to each ship.

(b) The Ship Recycler shall ensure that all Hazardous Materials detailed in the Inventory are identified, labeled, packaged and removed to the maximum extent possible prior to cutting by properly trained and equipped workers. The hazardous material includes the following:

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(i) hazardous liquids, residues and sediments.
(ii) substances or objects containing heavy metals such as lead, mercury, cadmium and hexavalent chromium.
(iii) paints and coatings that are highly flammable and/or lead to toxic releases;
(iv) asbestos and materials containing asbestos.
(v) Polychlorinated Biphenyls (PCBs) and materials containing PCBs, ensuring that heat inducing equipment is avoided during such operations.
(vi) Chloro Fluoro Carbons (CFCs) and halons; and
(vii) Other Hazardous Materials not listed above and that are not a part of the ship structure.

(3) Ship Breaking Plan-

Each Ship recycling facility shall have an approved ship-specific recycling plan and shall recycle the ship only after such Plan is available with them and the same shall include on establishment and utilization procedures towards prevention of unsafe working conditions, prevention of accidents, injuries, occupational diseases, other adverse effects to human health and the environment.

(4) Ship Breaking Facilities -

(a) Ship **Breaking** Facilities shall be designed, constructed, and operated in a manner for safe and ensuring environmentally sound recycling of ship.
(b) **Breaking** Recycling Facilities shall provide adequate measure for worker safety and training in accordance with guidelines laid down by the national authority.
(c) Ship **Breaking** Facilities shall establish and maintain an emergency preparedness and response plan as laid down by the national authority. The Emergency Plan shall be kept in the Ship **Breaking** Facility and shall be produced to the Inspector-cum-Facilitator on demand.
(d) The Ship **Breaking** Facilities shall establish and implement the Safety Management Systems to ensure that the procedures and techniques used for recycling, do not pose health risks to the workers concerned or to the population in the vicinity of the Ship **Breaking** Facility and which will prevent, reduce, minimize and to the extent practicable eliminate adverse effects on the environment caused by Ship **Breaking.**
(e) The Ship **Breaking** Facilities shall have proper waste management plan. All wastes generated from the recycling activity shall be kept separate from recyclable materials and equipment, labeled, stored in appropriate conditions such that it do not pose a risk to the workers, human health or the environment and only transferred to a waste management facility authorized to deal with their treatment and disposal in a safe and environmentally sound manner.
(f) Ship **Breaking** Facilities shall provide and ensure the use of personal protective

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equipment for operations requiring such use, including:

(i) head protection;
(ii) face and eye protection;
(iii) hand and foot protection;
(iv) respiratory protective equipment;
(v) hearing protection;
(vi) protectors against radioactive contamination;
(vii) protections from falls; and
(viii) appropriate clothing.

(g) The Ship **Breaking** Facilities shall establish and utilize procedures to:

(i) prevent explosions, fires, and other unsafe conditions by ensuring that Safe-for-hot work conditions and procedures are established, maintained and monitored throughout Ship Recycling;
(ii) prevent harm from dangerous atmospheres and other unsafe conditions by ensuring that Safe-for-entry conditions and procedures are established, maintained, and monitored in ship spaces, including confined spaces and enclosed spaces, throughout Ship Recycling;
(iii) prevent other accidents, occupational diseases and injuries or other adverse effects on human health and the environment;
(iv) prevent spills or emissions throughout Ship **Breaking** which shall cause harm to human health and/or the environment, taking into account guidelines developed by the Organization.; and
(v) The pre and periodical medical examination of the workers working in the Recycling yard shall be carried out annually, by the Factory Medical Officer, for preventing occupational diseases and adverse effects on human health.

124. **Hazardous waste and e-waste processing plants -** under serial no. 36 in the first schedule under clause (za) of sub-section (1) of section 2

(1) **Hazardous Waste Processing Plant**

(a) This shall apply for collection, processing, sorting, transport, storage and disposal of Hazardous Wastes within the premises of the factory.

(b) Prohibition relating to pregnant women and adolescent: No pregnant women or adolescent shall be permitted or allowed to work in the Collection, processing, sorting, transport, storage and disposal of Hazardous Wastes and in Battery recovery area in E-waste Processing factories.

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(c) Safety and health program

(i) The occupier shall develop and implement a written safety and health program for their workers involved in hazardous waste and E-waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards.

(ii) The safety and health program shall address the safety and health hazards of each phase of operation and include the requirements and procedures for employee protection.

(d) Hazard Prevention and Control

(i) All suspected conditions that shall pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that shall cause death or serious harm shall be identified during the preliminary survey. The identified hazards shall be prevented and controlled, and further evaluated during the detailed survey.

(ii) A dedicated, exclusive and sufficient storage area shall be provided and maintained for the intermediate and final storage of hazardous wastes and E-wastes inside the factory premises. The storage area shall be prevented from seepage and leachate hazards.

(iii) The hazardous wastes and E-wastes shall be stored only in the designated areas.

(iv) Labelling as per the National Standards shall be provided to the storage bins, drums and containers of hazardous wastes and E-wastes.

(e) Personal protective equipment

(i) Positive pressure self-contained breathing apparatus or positive pressure air-line respirators equipped with an escape air supply shall be used when chemical exposure levels present will create a substantial possibility of immediate death, immediate serious illness or injury, or impair the ability to escape.

(ii) If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary evaluation, an escape self-contained breathing apparatus of at least five minute's duration shall be carried by the workers.

(f) Monitoring

Levels of ionizing radiation and air quality inside the factory shall be carried out once in every three months with appropriate direct reading test equipment for IDLH and other conditions.

(g) Risk Prevention and Control

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(i) Emergency response procedures shall be laid down for the emergencies related to hazardous wastes and E-waste.

(ii) Food, drinks etc., shall be prohibited in the hazardous wastes and E-waste storage and handling areas.

(h) Engineering controls and work practices

(i) Engineering controls and work practices shall be instituted to reduce and maintain exposure to or below the permissible exposure limits specified in the OSH&WC Code, 2020 and the Standards framed thereunder.

(ii) Smoking shall be prohibited in the work areas involving hazardous wastes and E-wastes containing flammable and explosive substances.

(j) Handling drums and containers

(i) Hazardous substances and contaminated liquids, and other residues shall be handled, transported, labelled, and disposed of in a safe manner.

(ii) Damaged drums and containers that cannot be moved without rupture, leakage, or spillage shall be emptied into a sound container using a device classified for the material being transferred.

(k) Material handling equipment

(i) Material handling equipment used to transfer drums and containers shall be selected, positioned and operated to minimize sources of ignition related to the equipment from igniting vapours released from ruptured drums or containers.

(ii) Material handling equipment shall be provided with explosive containment devices or protective shields to protect equipment operators from exploding containers.

(iii) Drums and containers shall be identified and classified prior to packaging for shipment.

(l) Decontamination

(i) Decontamination procedure shall be developed, communicated to employees and implemented before any employees or equipment shall enter areas where potential for exposure to hazardous substances exists.

(ii) Standard operating procedures shall be developed to minimize worker's contact with hazardous substances or with equipment that has contacted hazardous substances.

(iii) All workers leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a

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contaminated area shall be appropriately disposed off or decontaminated.

(iv) All equipment and solvents used for decontamination shall be decontaminated or disposed off by following the established procedures.

(v) Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain their effectiveness.

(vi) Workers whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove that clothing and proceed to shower. The clothing shall be disposed off or decontaminated before it is removed from the work zone.

(vii) Showers and change rooms shall be provided outside the contaminated area for the use of workers.

(m) Cautionary Notice

A cautionary notice in English and the language which majority of the workers employed understand shall be displayed prominently at all the places involving hazardous wastes, depicting hazards, dos and don'ts and safety precautions.

(2)**E-Waste Processing Plants**

(a) This shall apply to factories or parts thereof in which e-wastes are handled or processed.

(b) Prohibition relating to pregnant women or adolescent: No pregnant women or Adolescent shall be permitted or allowed to work in the E-waste Processing factories.

(c) Work Environment Monitoring: Work Environment Monitoring shall be carried out once in every six months to ensure that the permissible limits of exposure prescribed under the standards framed under section 18 of the Code are never exceeded. Further, the recommendations of the work environment monitoring study shall be implemented.

(d) Collection and Storage of E-Waste

(i) During storage of e-waste care shall be taken:

(a) To avoid damage to refrigerators and air-conditioner so as to prevent release of refrigerant gases such as CFC, HFS, HCFC etc. and to prevent spillage of oils (mineral or synthetic oil) and other emissions.

(b) To avoid damage to Cathode Ray Tube

(c) To avoid damage to fluorescent and other mercury containing lamps

(d) To avoid damage to equipment containing asbestos or ceramic fibres to avoid release of asbestos or ceramic fibres in the environment.

(ii) The storage area shall have adequate fire protection system in place as

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required under the OSH and WC Code,2020.

(iii) Storage areas shall be covered areas for storage of e-waste till such time that the waste is recycled or treated.

(iv) Appropriate containers shall be used for storing different e-waste items separately and there shall be no mixing of different kinds of e-waste.

(v) The occupier shall maintain a record o

(vi) collection, transfer and storage and disposal of wastes and maintain the records.

(vii) A dedicated, exclusive and sufficient storage area shall be provided and maintained for the intermediate and final storage of E-wastes inside the factory premises. The storage area shall be prevented from seepage and leachate hazards.

(viii) The E-wastes shall be stored only in the designated areas.

(ix) Labelling as per the National Standards shall be provided to the storage bins, drums and containers of E-wastes.

(x) Food, drinks etc., shall be prohibited in the E-waste storage and handling areas.

(xi) Smoking shall be prohibited in the work areas involving E-wastes containing flammable and explosive substances.

(e) Dismantling of E-Waste

(i) Unloading of Cathode Ray Tubes (CRT) display, Liquid Crystal Display, LED display, plasma TV, refrigerator, air conditioners and fluorescent and other mercury containing lamps shall be carried out under supervision in such a way to avoid accident to workers.

(ii) Manual dismantling operations shall be carried out over the dismantling table with dust extraction system conforming to applicable National Standards.

(iii) Manual dismantling operations shall be carried out by Operators trained in safe use of hand and portable power tools

(iv) During dismantling operations, the workers shall be provided proper personal protective equipments conforming to applicable national standards.

(v) Manual Dismantling shall only involve the of used electronic and electrical equipments where there is no likelihood for being in contact with hazardous substances

(vi) Mechanical dismantling facility shall be provided to dismantle e-waste containing hazardous substances.

(vii) Where materials are shredded or heated, appropriate measures shall be provided to protect workers and the working environment from hazardous dusts and emissions. Such measures shall include adaptations in equipment design or operational practices, air flow controls, personal protective devices

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for workers, work environment monitoring equipment or a combination of these measures

(viii) The occupier shall prepare an up to date, written hazardous materials identification and management plan that specifically addresses at least the following:

(ix) "Lead, mercury, beryllium, cadmium, batteries, toner, phosphorous compounds, PCBs, and brominated flame retardants and other halogenated materials, with particular focus on possible generation of by-product dioxins and furans".

(x) The occupier shall prepare an up-to-date, written plan for reporting and responding to exceptional dangerous occurrences such as accidents, spills, fires, and explosions.

(xi) Facilities shall have a regularly implemented and documented monitoring and recordkeeping program that tracks key process parameters, compliance with relevant safety procedures, effluents and emissions, and incoming, stored, and outgoing materials and wastes.

(xii) In case of dismantling refrigerators and air conditioners, only skilled manpower having required tools and personal protective equipment must be deployed to manually separate compressors. Prior to dismantling the compressors, adequate facilities shall be provided for collection of coolant/refrigerant gases and compressor oil.

(xiii) Dismantled circuit boards, capacitors, batteries, capacitors containing PCBs (Polychlorinated biphenyls) or PCTs (Polychlorinated terphenyls) etc. shall not be stored in open.

(xiv) Adequate facilities for managing leakage of compressor oils, coolant/refrigerant gases such as CFCs/HCFCs and mercury from end of life fluorescent and other mercury containing lamp etc shall be provided.

(xv) The premise for dismantling operation shall be provided with

(a) Waterproof roofing and impermeable surfaces.

(b) Storage space for dissembled spare parts.

(c) Separate containers for storage of batteries, capacitors containing PCBs (Polychlorinated biphenyls) or PCTs (Polychlorinated terphenyls)

(f) Recovery and Recycling Process

(i) The occupier shall ensure that the received e-waste do not contain any radioactive materials.

(ii) Dust extraction system shall be installed where manual dismantling is carried out.

(iii) Fume hoods connected with bag dust collectors followed wet (chemical) scrubbers and carbon filters shall be installed for control of emissions from furnaces or reactor.

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(iv) The workers involved in recycling operations shall be provided proper personal protective equipment such as goggles, masks, gloves, helmet, earmuff or earplugs and gumboot etc.

(v) Adequate facilities for onsite collection and storage of bag filter residues, floor cleaning dust and other hazardous material shall be provided and collected residues shall be sent to secure landfill for disposal in accordance with statutory guidelines.

(vi) For recycling of Cathode Ray Tube (CRT) monitor and TVs care shall be taken to contain release of harmful substances.

(vii) The steps for processing of CRT are as below:

(a) The internal phosphor coating from the inner side of panel glass shall be removed with exhaust ventilation and the extracted air shall be cleaned through high efficiency bag-filter system and the waste generated shall be collected in appropriate labelled containers and then disposed off as per statutory guidelines.

(b) Manual shredding, cutting, and segregation operations for CRTs shall be carried out in low vacuum (650 mm of Hg) chambers where the dust is extracted through cyclones, bag filters, induced draught fan and a suitable chimney.

(c) Segregated CRTs can also be shredded in mechanical/automatic shredding machines connected with dust control systems. The mixed shredded glass is separated into leaded glass and glass cullet using electro-magnetic field or by density separation.

(viii) For LCD and Plasma TV a recycler shall have sealed vacuum dismantling platform for dismantling of LCD / Plasma panels.

(ix) For fluorescent and other mercury containing lamp recycling, the unit shall have at least followed:

(a) Mercury spill collection system.

(b) Lamp crushing system shall be under negative pressure to avoid release of any pollutant, including mercury vapor.

(c) System for segregation of mercury vapour from the phosphor powder through a distillation system for separation and recovery of mercury.

(d) Air pollution control system shall include HEPA (High Efficiency Particulate Arrestor) filter system or activated carbon filter system or any other equivalent efficient system for separation/ removal of mercury vapor from mercury contaminated phosphor powder'.

(x) Online mercury monitoring system, to have check on emission of mercury, and shall conform to statutory requirements.

(xi) The fluorescent and other mercury containing lamp recycling unit shall conduct work environment quality monitoring, particularly, in reference to mercury

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levels with a frequency of once in a month through a recognized laboratory, for third party verification.

(g) Crushing and pressing of E-waste:

(i) It shall be ensured that no batteries reach to the crushing, shredding or grinding machine to avoid fire or explosion.

(ii) The operator shall be well-versed with the safe operating procedures of the machine and trained in this aspect.

(iii) Dust arrestor or extraction system shall be provided where pressing or crushing activities are carried out.

(iv) The collecting sack shall be used to avoid dust accumulation and suspension in the air.

(v) Crushed waste shall be stored in plastic containers with proper lid.

(h) Handling of E-waste:

(i) Battery recovery area shall be well ventilated and provided with adequate fire fighting arrangement as prescribed under the Code.

(ii) Waste Batteries which are non-recyclable or non-recoverable shall be discharged by immersing in saline water or any other suitable method before disposing them.

(iii) Battery recovery area shall be separate from other process and provided with flame proof electrical fittings.

(iv) Recovered batteries shall be stored in shaded areas to protect them from causing fire due to rise in temperature.

(i) Cautionary Notice

A cautionary notice in English and the language which majority of the workers employed understand shall be displayed prominently at all the places involving hazardous wastes, depicting hazards, dos and don'ts and safety precautions.

125. **Semiconductor manufacturing -** under serial no. 37 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This standard on occupational safety and health shall be applicable for the Silicon Device Manufacturing - Semiconductor manufacturing industry

(2) **Semiconductor Wafer Fabrication Process**

(a) Oxidation

(i) Exhaust gas shall be identified, and appropriate exposure control

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measures shall be taken.

(ii) There shall be no open flames in areas where hydrogen is used.

(iii) All equipment and piping used with hydrogen shall be grounded.

(iv) Non-conductive or plastic tubing shall not be used. Static charge shall be dissipated when hydrogen gas is flowing by electrically bonding and grounding metal piping and apparatus being used.

(v) Pressurized system shall be checked periodically for leaks.

(vi) In case of gas leakage appropriate emergency preparedness response plan have shall be followed.

(b) Cleaning

(i) Use of respiratory protection, when necessary, shall be ensured to further reduce exposure and protect employees.

(ii) Chemicals shall be used only in the wet bench.

(iii) Compatibility shall be ensured while mixing chemicals.

(c) Photolithographic Operation

(i) PR Coating

(i) Chemical hazards shall be identified, and exposure evaluations must be carried out.

(ii) Special processing, material handling, and storage equipment shall be used to properly contain chemicals.

(iii) Emergency facilities shall be installed to provide immediate treatment in the event of an accidental exposure to corrosive materials. Suitable facilities must be provided for quick drenching or flushing of the eyes and body for immediate emergency use whenever the eyes or body shall be exposed to corrosive materials.

(iv) In case of chemical spillage, appropriate prevention and control measures shall be implemented.

(ii) Mask Alignment and Ultra Violet (UV) Exposure

(i) UV exposure evaluation shall be carried out when applicable.

(ii) Operations with UV emissions shall be properly enclosed; Shielding and interlocks shall be provided, if necessary.

(iii) Adequate ventilation and fume extraction shall be provided to control ozone concentrations.

(iv) Preventive maintenance shall be implemented to inspect and replace Mercury lamps routinely.

(v) Proper work practices shall be implemented to ensure that lamps are replaced carefully to avoid accidental breakage.

(vi) UV Lamps shall be stored and disposed properly.

(vii) Mercury spills shall be addressed and cleaned up properly.

(d) Baking

Guarding and/or insulation shall be provided to protect against accidental contact with hot surfaces.

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(e) Developing

(i) Hazards associated with solvents shall be identified and appropriate exposure evaluations shall be performed.
(ii) Respiratory protection shall be provided.
(iii) Special processing, chemical handling, and Safety chemical storage rack shall be used to properly contain chemicals.

(f) Wet Etching

Fluoride solutions shall be used only in plastic beakers or petri-dishes etc. and other acids shall be used only in glass beakers.

(g) Dry etching

(i) Appropriate ventilation and fume extraction shall be provided to reduce gas concentration levels in the air.
(ii) Respiratory protection has shall be used when necessary to further reduce exposure and protect employees.
(iii) Gas monitoring systems have shall be used with automatic shut-offs and alarm systems, as appropriate.
(iv) Special processing, gas handling, and Safety Gas storage Cabinets with Gas Leak detectors and monitoring systems shall be used to properly monitor gases.

(h) Photo Resist Stripping

(i) Use of respiratory protection when necessary, shall be ensured to further reduce exposure and protect employees.
(ii) Chemicals shall be used only in the Wet Bench.
(iii) Compatibility shall be ensured while mixing chemicals.

(i) Doping

(i) Respiratory protection shall be used when necessary to further reduce exposure and protect employees.
(ii) Emergency facilities shall be installed to provide immediate treatment in the event of an accidental exposure to corrosive materials.
(iii) Gas monitoring systems shall be installed with automatic shutoffs and alarm systems, as appropriate.
(iv) Gas cylinder inventories and quantity of gas per cylinder shall be reduced, when possible.
(v) The regulator shall be inspected for damage before use.
(vi) Damaged regulators, piping, etc. shall not be used. After the regulator is attached, the cylinder valve must be opened just enough to indicate pressure on the regulator gauge and all connections must be checked.
(vii) Spindle key must always be placed at an easily accessible location, for closing the valve in case of emergency.
(viii) The cylinder valve shall be closed whenever work is finished /cylinder is empty

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(ix) For ion implantation, the operator shall always wear thermo luminescent dosimeter (TLD) badges to monitor the exposure to secondary x-ray emission.

(j) Metallization

(i) Metal hazards shall be identified, and appropriate exposure evaluations shall be performed.

(ii) Maintain adequate housekeeping to remove unwanted metals and reduce concentration levels.

(iii) For metal etching, related safety hazards refer to cleaning and etching steps.

(vi) Passivation

i. Operator shall check that the pressurized system does not leak 3% Silane with soap solution.

(3) **Semiconductor Device Assembly Process:**

Below mentioned are the general processes followed for the assembly of silicon semiconductor devices.

(a) Wafer level testing and die sorting

(i) Equipment shall be installed and operated according to electrical codes and manufacturer's instructions.

(ii) Insulated tools and PPE shall be provided during maintenance and service operations.

(b) Wafer Dicing

(i) Silicon dust hazards shall be identified, and appropriate exposure evaluations shall be performed.

(ii) Personal Exposure shall be measured for the solvents used.

(c) Chip Attach

i. Guarding and/or insulation shall be provided to protect against accidental contact with hot surfaces.

(d) Wire Bonding

i. Adequate housekeeping to remove unwanted metals and reduce concentration levels shall be maintained

ii. Noise exposure level from ultrasonic emitter shall be routinely monitored and controlled by the following procedures:

a. Reduce the amount of sound energy released by the noise source.
b. Divert the flow of sound energy away from the worker.
c. Maintenance of equipment properly
d. Formulate proper operating procedures.
e. Wear personal protective equipment.

iii. Ergonomics shall be addressed as part of a safety and health program.

iv. Automated inspection equipment shall be used wherever feasible.

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(e) Sealing

i. Appropriate ventilation shall be provided to reduce encapsulant concentration levels in the air.

(4) General

a) Indoor Air Quality Monitoring shall be done to identify airborne contaminants and appropriate measures shall be taken to control the hazardous fumes and gases.

b) Exhaust ventilation and fume extraction shall be provided to ensure that the gas concentration levels in the work area are within permissible exposure limits.

c) Skin exposures shall be addressed and treated immediately.

(5) PPE Matrix

Sl. No.	**Activity**	**Prescribed PPE's**
1	Oxidation	Safety shoes, chemical resistant aprons, safety glasses, sleeves, face shield and gloves (Heat resistant)
2	Cleaning	Safety shoes, chemical resistant aprons, safety glasses, sleeves, face shield and gloves (Acid resistant) Chemical Mask with Respirator
3	Photolithography	Safety shoes, chemical resistant aprons, Safety glasses, Sleeves, face shield and gloves (solvent and organic chemical resistant) and chemical Mask with Respirator
4	Doping	Safety shoes, Chemical resistant aprons, Safety glasses, Sleeves, face shield and gloves (Acid resistant)
5	Metallization	Safety shoes, Chemical resistant aprons, Safety glasses, Sleeves, face shield and gloves (Acid resistant)
6	Transport of Chemicals/ Gas Cylinders	Chemical resistant gum boots, Aprons, Safety glasses, and gloves (Chemical resistant)
7	Assembly	Safety shoes, Chemical resistant aprons, Safety glasses and gloves

126. **Styrene manufacturing, handling and processing industry -** under serial no. 38 in the first schedule under clause (za) of sub-section (1) of section 2

1. This shall apply in respect of factories or parts thereof in which styrene is manufactured, handled, and processed.

2. Storage of Styrene:
    a) The tank shall have a floating valve circulation or any other technology to provide circulation for Styrene, which will ensure homogeneous mixing.
    b) There shall be provision for other mixing systems in case of failure of the circulation system.
    c) The material of construction of the tank shall be carbon steel with conductive coating inside or stainless steel. If the tank is coated, the same shall be examined once in two years by responsible person and shall be assessed for recoating. Recoating shall be done as per the recommended shelf life prescribed by coating manufacturer or as per the outcome of the examination carried out by the responsible person whichever is earlier.
    d) Tank life shall be clearly defined and examined once in two years by the responsible person by emptying the tank to check polymer deposit and rust formation.
    e) Tank cleaning shall be carried out once in two years and documentation in this regard shall be kept available.
    f) The roof of the tank shall be supported with outside structures. There shall not be crevasse inside the tank to avoid polymerization and deposition.
    g) The number of nozzles in the tank shall be kept to the minimum as per the requirement.
    h) All Styrene monomer tanks shall have flare system or cryogenic system or condenser so that there is no Styrene vapour release even under normal circumstances.
    i) It shall be ensured that there will not be any reverse pumping from the reactor / pre-mixing tank to the main storage tank.
    j) The following actions shall be implemented to prevent corrosion and rust formation inside the walls and tank tops of the mild steel tanks.
        i) Conductive epoxy lining for tank walls and tank tops. Bottom of tank shall not provide with epoxy lining for dissipation of static charges.
        ii) Tanks tops shall be replaced with stainless steel tops since maximum accumulation of polystyrene happens at the top of the tank.
        iii) Internal Coating shall be done with conductive coating conforming to applicable National Standards.
        iv) Monitoring of vent or nozzles shall be done to check and remove possible choke.
        v) It shall be noted that the frequency of formation of polystyrene will vary on multiple factors including environment, material of construction, ambient temperature, inhibitor content, recirculation, consumption of styrene and chilling capacity.
        vi) Ensure re-circulation of Styrene during non-operation of the plant.

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vii) Even if there is any stagnation of Styrene for 24 hours due to ambient conditions, automatic styrene re-circulation shall be done.

viii) Polymer Content check shall be done twice a week irrespective of the concentration of inhibitor TBC.

ix) Polymer content in styrene monomer shall be maintained at a value less than 10 ppm. If the polymer content is more than 5 ppm, appropriate control measures and corrective actions implemented.

3. Refrigeration system:

(a) There shall be multiple continuous temperature measurement probes at different levels of the tank linked to the control room.

(b) Temperature monitors and refrigeration system shall be interlinked in such a way to maintain temperature of the entire tank below 20°C at any point of time.

(c) The standards for the refrigeration system in terms of pumping capacity and cooling capacity shall be clearly defined for the different mass of styrene, duly considering the local ambient condition.

(d) In case of failure of the operating refrigeration system, standby refrigeration system shall be started automatically.

(e) Refrigeration system of the styrene tank shall be provided with backup power supply

4. Shutdown procedures

a. During shutdowns and non usage for a longer time, the tank temperature shall be maintained between 15-17 deg. Celsius

b. All pipelines need shall be drained during shutdowns.

c. A checklist shall be prepared covering all points having potential to hold up of styrene, which requires shall be drained.

d. Before any shutdown of production operations, following shall be complied with,

(i) the temperature of the tank shall be brought down to 15 degrees Celsius

(ii) the inhibitor content increased to upper level of the permissible range

(iii) polymer content shall be checked every alternate day and found shall be within limits (less than 10ppm)

(iv) sufficient stock of inhibitor (enough to last for next 6 months of weekly dosage) shall be available in the plant

(v) the temperature probe point checked and found shall be without any blockages or material deposits.

(vi) the level sensors, pressure transmitters, breather valves, heat exchanger, recirculation pump shall be checked.

(vii) breather valve vent shall be checked for blockages.

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(viii) back-up chiller unit shall be deployed in case of emergency.

(ix) back-up recirculation pump shall be available in case of emergency

(x) the styrene tank shall be free of all obstructions for personnel and equipment movement.

(xi) the emergency alarm system for temperature and pressure rise shall be checked.

(xii) the collection pit for Styrene in the tank yard empty.

(xiii) the sprinkler system of the styrene tanks shall be checked.

5. Restarting Procedure: Following points shall be complied with during restarting.

(a) Checking shall be done to identify any choking deposition of the polymer has happened in the vents, PVRV, flame arrestor, if required.

(b) Before starting the pump for withdrawal, any vent of the tank or air vent on the pump shall be kept open to avoid implosion of the tank.

(c) All earthing and jumpers on the lines shall be checked along with continuity and earth resistance as per the National Standards.

(d) Ensure nitrogen purging of the nozzle of level sensor to avoid the polymer accumulation.

(e) It is recommended to have spare set of PVRV (Pressure vacuum release valve) and flame arrestor. When checking and cleaning shall be done, Replace with spare set.

6. **Styrene processing**

(a) Pumping shall be done with flow switch arrangement to avoid dry run leading to fire

(b) All pipelines shall be covered with industrial flange guards

(c) Velocity of the styrene flow shall be maintained less than 2 m/s

(d) Backflushing shall be done in case the line not in use for more than 24 hrs.

(e) Bonding shall be ensured on the flange guards.

(f) Pipelines entering the reaction vessel shall have J bend or dip pipe as per the standards.

(g) Any spillages arising out during the processing or transfer, spill clean up shall be done as per the predefined procedure. Spill management kits shall be provided at strategic places.

7. General safety requirements:

(a) Automatic monitoring / monitoring of inhibitor content (in ppm) twice a week and measurement at different levels of the tank with data recording and alert facility in the control room shall be provided. Further, the quantity of inhibitor shall be added depending upon the ppm level of the inhibitor content

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at various levels shall be clearly defined. Similarly, the action shall be taken in case the inhibitor content increases above the threshold level shall be defined.

(b) Dissolved Oxygen and polymer content measurement system shall be available. Further, action shall be taken in case of deviations in the Dissolved Oxygen and polymer content, actions shall be taken shall be prescribed and followed.

(c) Safety protocol for factories storing/ processing Styrene Monomer shall include vapour release, apart from the possibility of fire and explosion in the Emergency Plans. Besides, the possibility of leakage/spillage of liquid Styrene monomer shall also be a part of the safety protocol and Emergency Plans.

(i) Self-contained Breathing Apparatus (SCBA) and other equipment needed for dealing with chemical disasters shall be procured and maintained. The concerned workers shall be trained on the use of these PPEs on regular basis.

(ii) Vapour Detectors shall be provided at the boundary of the factory, to indicate in Distributed Control System (DCS) onthe Styrene vapour escape outside the factory premises.

(iii) Hydrocarbon detectors shall be provided at unloading point, near all the vents, downwind, upwind directions and within the factory boundary, and the same shall be connected to the Control room with alert facility. In the case of exceedance, audio and visual alarm shall be sent to the control room and emergency control room.

(iv) Plant Control rooms shall be located at the strategically safe location and shall be made easily accessible and shall be made gas-tight and accident proof to the extent feasible.

(v) Appropriate and adequate sprinkler system shall be provided to the Styrene tank as per the applicable standards. The sprinkler system shall be interlocked with tank internal temperature measuring devices. The sprinkler system shall start automatically whenever there is an unacceptable thermal profile (both internal tank temp as well as external ambient temperatures).

(vi) All employees and people in the vicinity of the factory shall be made aware of the MSDS of Styrene.

(vii) Competency-based safety and health training needs shall be identified, and training modules shall be developed and imparted.

(viii) Adequate number of sensors shall be attached with hooter system to identify the release of toxic / hazardous gases which are harmful to the human beings and property and the same shall be installed not only inside

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the factory but also outside the factory within the identified impact zone, based on consequence modelling study. The sensitivity of the above sensors shall be to the level of relevant National standards.

(ix) The workers handling and processing Styrene shall wear full body suit, organic full face mask, chemical resistance gloves and gum boots conforming to applicable National Standard.

127. **Nano-particles utilising industry -** under serial no. 39 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to both engineered and incidental nano-materials. Engineered Nanomaterials are materials approximately 1 to 100 nanometres in at least one dimension and incidental nanoparticles (also called ultrafine particles) are usually by-products of processes, such as from combustion or welding.

(2) It shall be ensured that, as far reasonably practicable, manufactured Nanomaterials maintain a safe working environment; workers are provided the occupational health and safety requirements to protect their own health and safety.

(3) The processes involving nano materials shall be fully enclosed or contained to prevent the release of airborne particles.

(4) Correctly designed and implemented extraction ventilation and filtration for processes involving engineered nanomaterials shall be provided and maintained.

(5) The following administrative controls shall be ensured:

(a) limiting access to areas.

(b) reducing time spent in possible exposure areas.

(c) reducing the number of personnel that shall be potentially exposed.

(d) Periodic training on safety and health with nanomaterials shall be conducted.

(e) Safety precautions and operating instructions shall be prepared and displayed in English and local language.

(f) The operations involving Nanomaterials shall be ensured following safety requirements and protocols:

(i) a formal review of all risks associated with new processes prior to any work being started with these to involve subject matter experts and a well-defined description of the work,

(ii) the mixing, sonicating, weighing, or agitation of dry nanomaterials or any fluids containing nanomaterials must be done in a glove box. Fumes or gases containing nanomaterials must be exhausted within a currently certified

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chemical fume hood or dedicated exhaust duct

(iii) maintain nanomaterials in sealed containers during transportation or storage and ensure exterior surfaces are free of nanomaterials and containers are labelled.

(iv) spilled Nanomaterials shall be cleaned up as per the standard procedures.

(v) explosion and fire concerns shall be reviewed for processes producing airborne dusts or processes that use materials that have high reactivity.

(vi) work area design and ventilation preferences (including high efficiency particle air "HEPA" filtration'.

(vii) a chemical hygiene plan, and specific housekeeping methods.

(viii) waste disposal particles/management, handling practices, transportation and spills management,

(ix) PPE and clothing requirements,

(x) labelling and signage, and

(xi) exposure assessments and health surveillance.

(g) A competent person shall undertake visual checks and periodically carries out thorough examinations of equipment once in six months to ensure they are being maintained adequately.

(h) The following suggested Benchmark Exposure Levels(BEL) shall never be exceeded: -

Sl No	Nanoparticle characteristics	Suggested Benchmark Exposure Level(BEL)	Some types of engineered nanomaterials in each group
1	Fibrous Nanomaterial	0.01 fible/ml	Carbon nanotubes, nanowires
2	CMAR nanomaterials	0.18*WEL bulk head	Ni nanoparticle
3	Insoluble nanomaterials	0.066*WEL bulk material	Nanocrystal, quantum dots, ceramic oxides, metal
4	Soluble nanomaterial	0.5*WEL	Lipid-type nano emulsion, dendrimer-type drug delivery system

(i) Appropriate Respiratory protective equipment with respirator fit, Clothing, Goggles, Gloves and Shoe; conforming to the applicable standards shall be provided and used

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during lhe entire working hours to protect from exposure to Nanomaterials. Appropriate storage facility for the personal protective equipment shall be provided and periodically maintained and replaced as per the standard procedures.

(j) Thorough cleaning of the workplace shall be performed on a regular basis using vacuum cleaner fitted with HEPA filters, or wet wipes if the use of vacuum cleaners is not possible.

(k) Pre - medical and periodical post medical examination once in a year shall be conducted for the workers by the Factory Medical officer /Certifying surgeon to ensure medical and health surveillance.

(l) Handling, storage and disposal of waste nanomaterials shall be ensured safety, health and environmental protocols.

128. **Manufacturing, processing, preparation and utilisation of mercury or compounds of mercury, lead tetra-ethyl, manganese, arsenic, chrome, aliphatic series, beryllium, phosgene and isocyanates -** under serial no. 40 in the first schedule under clause (za) of sub-section (1) of section 2

(1) This shall apply to the manufacturing process involved in use of:

(a) Mercury or Compounds of Mercury;
(b) Lead Tetra-ethyl;
(c) Manganese;
(d) Arsenic;
(e) Chrome;
(f) Aliphatic series:
(g) Beryllium;
(h) Phosgene; and,
(i) Isocyanates.

(2) MERCURY AND ITS COMPOUNDS

(a) Safety Precautions:

(i) Workers handling mercury shall be trained on the Material Safety Data Sheet (MSDS), spill controls and management procedures of mercury.

(ii) All operations involving open sources of liquid mercury or any mercury-containing organic/inorganic compounds must be carried out in a chemical fume hood.

(iii) Work-area shall be well-ventilated.

(iv) Absolutely no eating, drinking or chewing gum shall be allowed where mercury is

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used.

(v) The area must be equipped with an eyewash station, and an emergency shower, mercury spill kit, and a first aid kit.

(b) Personal Protective Equipment:

(i) Eye Protection:

(a) Safety glasses, when handling solid mercury-containing organic/inorganic compounds or materials, and

(b) Chemical goggles or a face shield, handling liquid mercury.

(ii) Gloves:

(a) Highly resistant, flexible, plastic-laminate gloves shall be worn when handling dimethyl mercury and other similarly dangerous substances, and

(b) Where increased protection is considered necessary, thin gloves as in (i) shall be worn under long-cuffed, heavy-duty outer gloves made of neoprene.

(iii) Protection Clothing: A full-sleeved lab coat, and full-length pants, and closed-toe shoes shall be worn when handling mercury and other mercury-containing compounds.

(iv) Respiratory Protection:

(a) Workers shall be trained and fit-tested for the respiratory protection as per the National standards.

(b) Only mercury (Hg) vapor cartridges shall be used with half-face and full-face respirators.

(c) Handling and Storage:

(i) Mercury shall be stored in a tightly closed container at all times in a cool, well-ventilated areaaway from acids, oxidizers and metals as per the Standards.

(ii) Mercury shall not be stored at above temperatures of 25°C.

(iii) Mercury storage area shall be clearly labelled as 'MERCURY STORAGE AREA – HIGHLY TOXIC'.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

(i) While liquid mercury itself is non-flammable, to extinguish any surrounding fire, water spray, dry chemical, carbon dioxide or appropriate foam shall be used.

(ii) Proximity of ground mixtures of sodium carbide and mercury, aluminium, lead, or iron shall be prevented to avoid vigorous reactions.

(iii) Mercury shall not be allowed to contact or be in proximity with the following incompatible chemicals: acetylinic compounds, ammonia, boron di-iodophosphide, ethylene oxide, metals (aluminium, potassium, lithium, sodium, rubidium, calcium), metal oxides, methyl azide, methylsilane, oxidants (bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonynickel, tetracarbonylnickel, nitromethane, silver perchlorate, chlorates, sulphuric acid, nitrates), and oxygen.

(iv) Severe corrosion problems shall be avoided by preventing contact of mercury with metals, such as copper and copper alloy materials.

(v) Water shall never be added to mercury.

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(e) Waste Handling:

(i) Mercury-contaminated material shall never be put into or with regular waste.

(ii) Mercury waste shall be placed in a chemically compatible container with a sealed lid separated from other chemical waste, as it is treated differently than other types of hazardous waste.

(3) LEAD TETRA-ETHYL

(a) Safety Precautions:

The exposures and control measures shall include:

(i) Enclosing chemical processes for severely irritating and corrosive chemicals,

(ii) Using local exhaust ventilation at the source,

(iii) Avoiding skin contact with Tetra-ethyl Lead, and

(iv) Before entering a confined space where Tetra-ethyl Lead shall be present, checking to make sure that an explosive concentration does not exist.

(b) Personal Protective Equipment:

(i) Workers shall be imparted training on use of the PPEs and respirator fit testing as per the applicable National Standards.

(ii) Where the potential exists for exposure over 0.075 mg/m^3(as Lead), a supplied-air respirator with a full-face piece operated in a pressure-demand or other positive-pressure mode, or Self-Contained Breathing Apparatus conforming to National Standards shall be used.

(c) Handling and Storage:

(i) Air temperatures around Tetra-ethyl Lead shall be monitored, to sound explosive mixture alarm when nearing 93°C.

(ii) Tetra-ethyl Lead shall be stored in tightly closed containers in a cool, well-ventilated area away from sunlight to prevent its decomposition.

(iii)Sources of ignition, such as smoking and open flames, shall be prohibited where Tetra-ethyl Lead is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

(i) Sufficient precautions shall be taken against:

(a) Poisonous gases such as Lead Oxides produced in the fire,

(b) Vapours travelling to a source of ignition and flashing back, and,

(c) Explosions of containers.

(ii) Sources of ignition, such as smoking and open flames, shall be prohibited where Tetra-ethyl Lead is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

(iii)Tetra-ethyl Lead shall be kept away from:

(a) Oxidizing Agents (such as Perchlorates, Peroxides, Permanganates, Chlorates, Nitrates, Chlorine, Bromine and Fluorine) and strong acids (such as Hydrochloric, Sulphuric and Nitric) to avoid fires and explosions by reactions.

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(b) Incompatibles like rust, Sulphuryl Chloride, Potassium Permanganate, metals, metal Oxides, and combustibles; and,
(c) Rubber, some plastics, and coatings, to avoid damage to them.

(e) Waste Handling:

(i) Tetra-ethyl Lead waste shall be kept in vapour tight plastic bags.
(ii) Tetra-ethyl Lead waste shall be handled and stored in a safe manner as per the Standards.

(4) MANGANESE

(a) Safety Precautions:

(i) The following acute health effects immediately or shortly after exposure to Manganese shall be considered and appropriate interventions implemented:
(a) Irritation of the skin and eyes due to contact.
(b) Irritation of the nose, throat and lungs due to inhalation, causing coughing, wheezing and/or shortness of breath.
(c) "Metal fume fever", a flu-like illness, with symptoms appearing early or delayed for several hours after exposure,

(ii) Continued and long-term attentions shall be paid to the chronic health effects, the effects appearing early, or some time after exposure to Manganese, and can last for months or years, causing changes in speech, balance, mood, muscle coordination, anaemia, etc., decreasing male fertility, permanent lung and brain damage, and even possibly cancer.

(iii) Sources of ignition, such as smoking and open flames, shall be prohibited where Manganese powder is used, handled, or stored.

(iv) When transferring Manganese powder, the containers shall be grounded and bonded.

(v) Only non-sparking tools and equipment shall be used, especially when opening and closing containers of Manganese powder.

(vi) Control measure shall include:
(a) Enclosure of chemical processes for severely irritating and corrosive chemicals,
(b) Use of local exhaust ventilation for chemicals that shall be harmful with a single exposure, and,
(c) Use of general ventilation to control exposures to skin and eye irritants.

(vii) The following work practices shall be checked and implemented as appropriate:
(a) Monitoring of airborne chemical concentrations.
(b) Washing hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.
(c) Before entering a confined space where Manganese powder and dust shall be present, checking to make sure that an explosive concentration does not exist.
(iv) Vacuum or a wet method shall be used during clean-up and dry sweeping prohibited.

(b) Personal Protective Equipment:

The following personal protective equipment conforming to the National Standards shall be

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supplied and worn:

(i) Personal protective equipment shall be made of a material that cannot be permeated and/or degraded by this substance.

(ii) Protective glove materials for Manganese shall be Nitrile and Neoprene,

(iii) Where the potential exists for exposure over 0.02 mg/m^3 (as the respirable fraction) or0.2 mg/m^3 (as the inhalable fraction), a negative pressure, air-purifying, particulate filter respirator with an N, R or P95 filter as per the applicable National Standards shall be used.

(iv) If the possibility of exposure above 500 mg/m^3 exists, a supplied air respirator with a full-facepiece operated in a pressure demand or other positive-pressure mode shall be used; for increased protection the respirator shall be used in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

(c) Handling and Storage:

(i) Personnel required to work with Manganese shall be trained on its proper handling and storage.

(ii) Manganese shall be kept away from:

(a) Dust, to avoid spontaneous combustion in air;

(b) Strong acids (such as hydrochloric, sulphuric and nitric), water or steam (more slowly than with acids), to produce flammable and explosive Hydrogen gas; and,

(c) Oxidizing agents (such as perchlorates, peroxides, permanganates, chlorates, nitrates, chlorine, bromine and fluorine); nitrogen dioxide; phosphorus; and sulphur dioxideto avoid ignition and/or violent decomposition.

(iii)Manganese shall be stored in tightly closed containers in a cool, well-ventilated area away from water and moisture.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

(i) Employees required to fight Manganese fires shall be trained and equipped as per applicable standards, using sand or dry chemicals appropriate for extinguishing metal fires.

(ii) Manganese powder shall not be placed in closed tanks or containers, as it shall form an ignitable vapor/air mixture with dust.

(iii)Water spray shall be used to keep fire-exposed containers cool.

(e) Waste Handling:

Manganese waste shall be handled and stored in a safe manner as per the Standards.

(5) ARSENIC

(a) Safety Precautions:

(i) Precautions shall be taken to minimise exposure and eliminate the risk of Arsenic poisoning.

(ii) Work shall be undertaken with a fit-for-purpose dust extraction system for crushed

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ores.

(iii) Good housekeeping shall be practiced to avoid dust accumulation on surfaces.

(iv) Vacuum or wet method of cleaning shall be adopted, to reduce dust during clean- up; there shall be no dry sweeping.

(v) A high efficiency particulate air (HEPA) filter shall be used when vacuuming, and a standard shop vacuum shall not be used.

(vi) Arsenic work shall be undertaken in a dedicated fume hood.

(vii) Regular hand washing and showers on the completion of the workday shall be mandated, to ensure dust and solutions are removed from the skin surface before leaving the work area.

(viii) All clothing which has been wetted or otherwise been exposed to these substances shall be laundered separately.

(ix) Workers shall change into clean clothes between each work session and showering.

(x) Earphones or ear buds shall not be worn while handling Arsenic and its compounds.

(xi) Hair shall be tied back and/or secured in a hair cap, while handling these compounds.

(xii) The integrity of all containers shall be checked regularly, and proper storage and sealing of containers after each use shall be ensured.

(b) Personal Protective Equipment:

Respirator conforming to National Standards shall be worn to protect against exposure to Arsenic dust.

(c) Handling and Storage:

Arsenic and its compounds shall be stored in tightly closed containers in a cool, well-ventilated area away from combustibles and heat, and never in metal tanks.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

(i) Arsenic shall not be allowed shall be in proximity of or contact with the following chemicals:

(a) Oxidizing agents (such as perchlorates, peroxides, permanganates, chlorates, nitrates, chlorine, bromine and fluorine) to avoid potential fires and explosions.

(b) Acids (such as hydrochloric, sulphuric and nitric) and hydrogen gas, to avoid production of toxic arsine gas.

(c) Incompatibles such as powdered metals (e.g. zinc, lithium, rubidium and platinum), bromine azide, lead monoxide, and mercury oxide.

(ii) Arsenic dust or fine powder shall not be exposed to heat, flame or hot surfaces to prevent explosion.

(iii) Appropriate prevention and control measures shall be implemented to prevent exposure to arsenic oxide in case of fire involving arsenic.

(iv) Water spray system shall be provided and maintained to keep fire-exposed containers cool.

(e) Waste Handling:

Arsenic waste shall be handled and stored in a safe manner as per the Standards.

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(6) CHROME

(a) Safety Precautions:

(i) Access to and work in areas producing or susceptible to exposure to airborne concentrations of Chromium is or is likely shall be above PEL, shall be established a regulated area and appropriately marked and cordoned off from other work zones.

(ii) All PPE shall be provided and worn correctly at all times the worker is in the exposure zone for Chrome metal or its compounds.

(iii) Eye wash fountain shall be provided to address accidental contact or exposure of face to Chrome metal or its compounds.

(iv) Quick-drench shower shall be provided to address accidental contact or exposure of other parts of the body to Chrome metal or its compounds.

(v) All clothing, when wet or otherwise contaminated by Chrome metal or its compounds shall be immediately removed, and sent for laundering in a separate container.

(vi) Workers shall not be rotated in their assignments to different jobs to achieve compliance with the PEL.

(b) Personal Protective Equipment:

The following PPE shall be provided to prevent corresponding contact or exposure:

(i) Eye contact: Safety goggles for eye protection, face-shield.

(ii) Skin contact: Full body overalls, or long-sleeved shirts and full-length trousers, together with gloves and socks and shoes, leaving no portion of the skin exposed to contact.

(iii) Inhalation: When and where worker exposure is, or is likely shall be, above PEL, as during setting up or for short periods (less than 30 days) when engineering controls are not in place, they shall be provided with appropriate respirators.

(c) Handling and Storage:

(i) Workers shall wear and use the PPE given to them in the proper manner as long as they are in the regulated area.

(ii) Workers shall remove all protective clothing and equipment contaminated with Chromium or its compounds at the end of the work shift or at the completion of their tasks involving Chromium exposure, whichever comes first.

(iii) Chromium-contaminated protective clothing or equipment shall be removed from the workplace, only by those employees whose job it is to launder, clean, maintain, or dispose of such clothing or equipment.

(iv) Contaminated protective clothing or equipment removed for laundering, cleaning, maintenance, or disposal, shall be stored and transported in sealed, impermeable bags or other closed, impermeable containers, each labeled appropriately.

(v) Removal of Chromium or its compounds from protective clothing and equipment by blowing, shaking, or any other means that disperses Chromium or its compounds into the air or onto the body of the worker or others in the vicinity shall be strictly prohibited.

(vi) Storage facilities for contaminated clothing and for other clothes out of or into which

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the workers change shall be strictly separated.

(vii) Eating, drinking, smoking or any other inhalation or ingestion activity shall be done only outside the regulated area, after proper washing of hands and faces following work with Chromium or its compounds.

(viii) Surfaces in the regulated area shall be cleaned by HEPA-filter vacuuming or other methods that minimize the likelihood of exposure to Chromium; dry shoveling, dry sweeping, and dry brushing shall be used only where HEPA-filtered vacuuming or other methods that minimize the likelihood of exposure to chromium have been tried and found not shall be effective.

(ix) Compressed air shall not be used to remove Chromium or its compounds from any surface unless no alternative method is feasible, and then, only in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

Chrome or its compounds shall not be allowed shall be in proximity of or contact with the following chemicals:

(i) Strong oxidizers (such as hydrogen peroxide) and alkalis;

(ii) Combustibles such as phosphorus and turpentine, organic, or other readily oxidizable materials (such as paper, wood, sulphur, aluminium, plastics, etc.); and,

(iii) Water, as contact with water will produce a violent reaction, leading to formation of chromic acid, chromic chloride, hydrochloric acid, and chlorine, and further to corrosion of metals.

(e) Waste Handling:

(a) Waste, scrap, debris, and any other materials contaminated with Chromiumor its compounds and consigned for disposal shall be collected and disposed off in sealed, impermeable bags or other closed, impermeable containers.

(b) Bags or containers of waste, scrap, debris, and any other materials contaminated with Chromiumor its compounds that are consigned for disposal shall be labeled according to relevant Standards to avoid cross-contamination or alternate use.

(7) ALIPHATIC SERIES

(a) Safety Precautions:

(i) For Alkanes, the following precautions shall be adopted:

(a) Strictly no smoking.

(b) Display 'NO SMOKING OR OPEN FLAME' signs at storage and use areas.

(ii) For Alkenes, such as Ethylene and Propylene, if irritation or other symptoms are experienced, appropriate respirators shall be used.

(iii) For Alkynes such as Acetylene, the following precautions shall be adopted:

(a) Do not discharge at pressures above 103 kPa.

(b) Beware that vapor from such products shall linger and travel long distances and catch fire or explode when coming to contact with any flame, pilot light, or static spark far away from the product handling area.

(c) Check atmosphere with appropriate device before entering area, particularly

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confined spaces.

(d) Avoid impact on containers.

(b) Personal Protective Equipment:

(i) The following PPE shall be provided, and correctly worn by all workers for the entire duration of their work with Alkanes and its mixtures.

(a) Eye Protection: Full-face piece respirators, safety glasses, or chemical safety goggles;

(b) Face shields shall be used to augment chemical safety goggles and safety glasses where full facial protection is needed.

(c) Respiratory Protection: While engineering controls are being installed, or where the installed controls are inadequate to maintain alkane concentrations below the recommended environmental limits, or during non-routine maintenance or repair is being done, or during emergencies, respirators shall be selected, properly fitted and used, as appropriate for the concentration of Alkane.

(d) Skin Protection: Protective clothing, including gloves, aprons, suits, boots, or face shields.

(ii) For Alkenes and Alkynes, while not as hazardous as Alkanes, normal industrial conventional PPE for handling chemicals shall be provided, including protective chemical-safety glasses, gloves, and (if required), respirators to avoid breathing in dust.

(c) Handling and Storage:

(i) The following measures shall be adopted in areas where there is occupational exposure to Alkanes, and areas where there is bulk storage of Alkanes:

(a) Post warning signs labeled appropriately.

(b) Do not dispense bulk quantities into metal containers unless the nozzle and the container are electrically bonded, and both are grounded properly.

(c) If a leak in a container occurs during the loading or unloading process, the operation shall be stopped and resumed only after necessary repair or replacement has been completed.

(ii) For Alkenes, such as Ethylene and Propylene, the following measures shall be adopted:

(a) Wash thoroughly after handling, remove and wash contaminated clothing, and minimize dust generation.

(b) Ensure adequate ventilation.

(c) Keep containers tightly closed in a dry, cool, and well-ventilated place.

(iii) For Alkynes, the following measures shall be adopted:

(a) Do not permit any part of containers to reach higher than 52°.

(b) Ensure high-pressure relief valves on containers are functional.

(c) Protect cylinders from damage and impact, firmly securing them against falling or rolling, and using hand-truck instead of rolling, dragging, dropping, etc.

(d) Ground all cylinders and associated equipment.

(e) Ensure all electrical equipment is non-sparking and explosion-proof.

(f) Use only steel or wrought-iron pipes, never copper.

(g) Open cylinder valves the minimum necessary, never more than 1½ turns.

(h) Never use acetylene at pressures exceeding 103.5 kPa.

(i) Display ‘NO SMOKING OR OPEN FLAME’ signs at storage and use areas.

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(j) Provide self-contained breathing apparatus for rescue workers, conforming to National Standards.
(k) Keep away from drains, surface and ground water.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

(i) For Alkanes, the following considerations shall apply:
(a) Keep product and empty container away from heat, sparks and open flame.
(b) Where spark- and flame-generating operations are necessary, start them only after a competent person signs a permit declaring the operation shall be safe.

(ii) For Alkenes, such as Ethylene and Propylene, the following considerations shall apply:
(a) Avoid contact with incompatible materials such as strong oxidizing agents.
(b) In case product includes or comes into contact with toxic, shock- or light-sensitive Alkenes such as Diethyl-Azodicarboxylate, a competent person shall approve handling and storage.

(iii)For Alkynes, such as Acetylene, the following considerations shall apply:
(a) Evacuate all personnel from danger area.
(b) Immediately cool containers with water spray from maximum distance, taking care NOT to extinguish the flames, to avoid explosive re-ignition, continuing until all gas burns out.
(c) If possible without risk, stop flow of gas, and remove all containers from danger area, while continuing to cool with water spray.
(d) Avoid contact or proximity with incompatible materials such as Copper, Mercury, Silver, Zinc, and their alloys, Oxygen and other oxidizing agents such as Halogens, to avoid formation of explosive acetylide compounds with copper, mercury, silver and brasses (containing more than 66% copper).
(e) Separate Acetylene cylinders from other containers with flammable materials such as Oxygen and Chlorine, either by a horizontal distance of 6 m, or a vertical non-combustible barrier 1.5 m high, with fire rating of at least ½ hour.

(e) Waste Handling:

Aliphatic Series waste shall be handled and stored in a safe manner as per the Standards.

(8) BERYLLIUM

(a) Safety Precautions:

(i) Enclose operations and use local exhaust ventilation at the site of chemical release.
(ii) Where possible, automatically transfer Beryllium from drums or other storage containers to process containers.
(iii)Before entering a confined space where Beryllium powder shall be present, check to make sure that an explosive concentration does not exist.
(iv)Do not eat, smoke, or drink where Beryllium is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.
(v) Use a vacuum to reduce dust during clean-up. DO NOT DRY SWEEP.

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(vi) When vacuuming, a high efficiency particulate air (HEPA) filter shall be used, not a standard shop vacuum.

(b) Personal Protective Equipment:

(i) The following PPE shall be used when there is a possibility of exposure, conforming to National Standards:
  (a) Respirator.
  (b) Protective gloves and clothing.
  (c) Eye protection with side shields or goggles.

(ii) Contact lenses shall not be worn when working with Beryllium.

(c) Handling and Storage:

(i) Prior to working with Beryllium workers shall be trained on its proper handling and storage.

(ii) A regulated, marked area shall be established where Beryllium is handled, used, or stored.

(iii) Store in tightly closed containers in a cool, dry, well- ventilated area away from Heat and Combustibles.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

The following incompatibles shall be guarded againstwhere Beryllium powder is used, handled, or stored:

(i) Moisture, to avoid reaction producing heat;

(ii) Oxidizing Agents (such as Perchlorates, Peroxides, Permanganates, Chlorates, Nitrates, Chlorine, Bromine and Fluorine); Strong Acids (Such as Hydrochloric, Sulphuric and Nitric); Strong Bases (such as Sodium Hydroxide and Potassium Hydroxide); Phosphorus; Chlorinated Hydrocarbons (Such as Carbon Tetrachloride and Trichloroethylene); Metals; and Molten Lithium.

(iii) Sources of ignition, such as smoking and open flames, to avoid potential fire or explosion hazard.

(e) Waste Handling:

Beryllium waste shall be handled and stored in a safe manner as per the Standards.

(9) PHOSGENE

(a) Safety Precautions:

(i) To contain release of phosgene all the phosgene carrying equipment, pipelines etc. shall be under completely contained chamber equipped with phosgene sensors and connected with phosgene scrubbing system.

(ii) Phosgene carrying equipment, pipelines etc. shall be surrounded with water-ammonia curtain system to decompose the phosgene during release.

(iii) Fully jacketed equipment and piping systems shall be used preferably with nitrogen as jacketing media.

(iv) All process vents and pressure-relieving devices shall be routed to phosgene scrubbing system, and all the rotary equipment of this scrubbing system shall have

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back up of emergency power supply.

(v) No brittle material shall be allowed in phosgene service.

(vi) Threaded connections shall not be used for process connection, to minimize risk of phosgene leakage, and flange connections shall be used instead.

(vii) For ventilation systems in rooms that are manned with personnel on a continuous basis or for extended periods of time, a phosgene analyzer installed with the sample point in the fresh air inlet duct shall be considered advisable.

(viii) Audible alarms and warning systems shall be ensured shall be operational at all times so that they are always available during emergencies.

(ix) Phosgene destruction systems shall be functional during both normal operations and shutdown operations, as long as there is phosgene in the plant.

(b) Personal Protective Equipment:

(i) Workers shall be provided with and required to use impervious clothing, full face piece respirator, gloves, face shields (eight-inch minimum), and other appropriate protective clothing where skin contact with liquid phosgene shall occur.

(ii) Non-impervious clothing which becomes wet with liquid phosgene shall be removed immediately while using quick drenching facilities and not re-worn until the phosgene is removed from the clothing.

(iii)Workers shall be provided with and required to use splash-proof safety goggles where there is any possibility of liquid phosgene contacting the eyes.

(iv)Phosgene badge shall be provided to worker to monitor the phosgene exposure.

(c) Handling and Storage:

(i) Phosgene hold-up or inventory shall be at its minimum at any given condition of plant.

(ii) Pure Phosgene shall not be condensed and stored at any stage of plant operation, and instead condensation of phosgene into a solvent to prepare a defined phosgene solution for the phosgene reaction substituted.

(d)Fire, Incompatibilities and Explosion Hazard Controls:

(i) In case of fire, keep cylinder cool by spraying with water.

(ii) Prevent direct contact with water.

(iii)Prevent contact of Phosgene with moisture, as it shall cause slow decomposition to form hydrogen chloride with carbon dioxide.

(e) Waste Handling:

Phosgene waste shall be handled and stored in a safe manner as per the Standards.

(10) ISOCYANATES

(a) Safety Precautions:

(i) Handling and processing operations such as transferring and drying shall be automated where isocyanates are used.

(ii) Enclosures such as fume cupboards, and spray and down flow booths shall have

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local exhaust or dilution ventilation systems.

(b) Personal Protective Equipment:
Workers handing isocyanates and isocyanate-containing products shall wear the following PPE:

(i) Chemical-resistant overalls, aprons, and eye protection.

(ii) Impervious gloves, such as butyl rubber, Viton, or fully coated with Poly-Vinyl Alcohol, at all times.

(c) Handling and Storage:

(i) Supplied air (positive pressure) respirator shall be used while handling isocyanates.

(ii) Levels of isocyanates stored shall be kept to a minimum.

(iii) Isocyanates shall be stored in bunded areas.

(iv) Incompatible material shall not be stored in the same bund.

(v) Storage areas shall be isolated as far as reasonably practicable from work areas where isocyanates are used, e.g. stored on the surface of an underground mine when used underground.

(vi) Regular checks shall be made to ensure containers are not leaking, are tightly sealed and their labels are clearly visible and legible.

(vii) Storage areas shall be kept moisture-free and, where reasonably practicable, covered.

(viii) Drum covers shall be used where the storage is not undercover to prevent water entry, as on contact with water, Isocyanates react slowly to produce carbon dioxide, which produces a risk of pressurisation in containers and a subsequent explosion hazard.

(ix) TDI stored in tanks shall be blanketed with an inert gas like nitrogen or argon.

(x) Transfer systems for isocyanates in bulk storage shall be fully enclosed, and contents transferred with pump or vacuum systems.

(xi) Areas where polyurethane foam products are stored shall be well ventilated, to remove residual amounts of unreacted TDI or Methylene Diphenyl Diisocyanate (MDI) shall be present in the finished foam.

(xii) Sufficient space shall be left between foam blocks to allow heat to dissipate and reduce the risk of fire.

(xiii) Where isocyanates are stored at elevated temperatures to prevent solidifying, adequate controls shall be instituted to prevent the temperature exceeding 30° C.

(xiv) In the case of TDI, precautions against fire shall be taken.

(xv) Storage areas shall be monitored for atmospheric contamination and temperature levels.

(xvi) Access to chemical storage areas shall be limited to authorised workers only.

(d) Fire, Incompatibilities and Explosion Hazard Controls:

(i) Although TDI and MDI do not catch fire or burn easily, they shall be stored separately from combustible materials or other fire hazards, so that they will be protected in case of a fire.

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(ii) Water-based protein or other fire-fighting foams shall be used if feasible, as more effective in extinguishing large fires and also to suppress any release of diisocyanate vapour.

(iii) Stored drums shall be cooled with water, to prevent metal drums rupturing violently and combustible plastic containers degrading or melting during a fire.

(iv) Isocyanates shall be kept out of contact with incompatibles such as alcohols, amines, strong oxidising agents and water.

(e) Waste Handling:

Isocyanates waste shall be handled and stored in a safe manner as per the National Standard.

129. **Process safety management** - under serial no. 73 in the second schedule under clause (f) of sub-section (2) of section 18

(1) This shall apply to factories involving hazardous processes.

(2) Process Safety Management Elements

The following elements shall constitute Process Safety Management. These elements can be designed and implemented at varying levels of rigor to optimize process safety management performance, efficiency, and effectiveness

(a) PSM organization
(b) Workforce Involvement
(c) Process Safety Information
(d) Process Hazard Analysis
(e) Management of Change
(f) Pre-Start-up Safety Review
(g) Operating Procedures
(h) Safe Work Practices
(i) Mechanical Integrity and Quality Assurance
(j) Contractor Safety Management
(k) Process Safety Competency, Training and Performance Assurance
(l) Incident Investigation
(m) Emergency Management
(n) Compliance Audit

(3) PSM Organization

(a) Every factory shall define a PSM organization headed by a PSM representative or chairman. The duties of the PSM representative or chairman are to oversee all the requirements of this Code.

(b) The occupier shall nominate cross functional teams for each of their processes to monitor process safety activities. As deemed by the facility, the teams shall meet to discuss the progress (at least once in three months) and resolution. PSM Chairman shall monitor the implementation of PSM elements through defined key

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performance indicators

(4) Workforce Involvement

(a) Worker representatives' involvement shall be ensured, in the development, planning, implementation, performance evaluation and actions for improvement of the Process safety management system.

(b) Every factory shall develop a written Workforce Involvement program and demonstrate the following:

(i) Identify the roles and responsibilities of employees at all levels and in all positions in the facility for enhancing and ensuring the process safety of the facility operations.

(ii) Provide a system for enabling the active participation of facility and contract workers in the design, development, implementation, and continuous improvement of the Process Safety Management.

(iii) Work towards providing a formal mechanism for consulting with employees and their representatives to incorporate their knowledge in the facility operations and continuous improvement of the Process Safety Management.

(5) Process Safety Information

(a) Process safety information must include information on the hazards of the highly hazardous chemicals used or produced by the process, information on the technology of the process, and information on the equipment in the process Information on the hazards of the highly hazardous chemicals in the process shall consist of at least the following:

(i) Toxicity,
(ii) Permissible exposure limits,
(iii) Reactivity data,
(iv) Corrosivity data, and
(v) Thermal and chemical stability data, and hazardous effects of inadvertent mixing of different materials.

(b) Information on the technology of the process shall include at least the following:

(i) A block flow diagram or simplified process flow diagram,
(ii) Process chemistry,
(iii) Maximum intended inventory,
(iv) Safe upper and lower limits for such items as temperatures, pressures, flows or compositions, and
(v) the consequences of deviations, including those affecting the safety and health of employees

(c) Information on the equipment in the process must include the following:

(i) Materials of construction,
(ii) Piping and instrument diagrams (P & IDs),
(iii) Electrical classification,
(iv) Relief system design and design basis,

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(v) Ventilation system design,
(vi) Design codes and standards employed,
(vii) Material and energy balances for processes
(viii) Safety systems (e.g., interlocks, detection, or suppression systems).

(d) Every factory shall develop a written Process Safety Information and demonstrate the following
(i) Develop with a system to compile, catalogue, a specific set of data that is normally recorded in paper or electronic format.
(ii) Ensure that the Process Safety Information is up to date (in as built condition), available for all the Process Hazard Analysis and accessible for all employees. All the changes in Process Safety Information shall be communicated to all the employees.
(iii) Demonstrate development and documentation of process safety information for all stages of project lifecycle.

(6) Process Hazard Analysis

(a) The process hazard analysis shall be thorough, orderly, systematic approach for identifying, evaluating, and controlling the hazards of processes involving highly hazardous chemicals.

(b) Every factory shall develop a written Process Hazard Analysis program and demonstrate the following:
(i) The hazards involved in the process
(ii) The identification of any previous incident that had a potential for catastrophic consequences in the workplace
(iii) Identification and applicability of hazard identification and risk assessment tools and techniques (e.g. What-if Analysis, Checklist, What-if Analysis/Checklist Hazard and Operability Study (HAZOP), Failure Mode and Effects Analysis (FMEA), Fault Tree Analysis, Safety Integrity Level (SIL) Assessment, Quantitative Risk Assessment (QRA), LOPA, Facility Siting, Human Factors etc.) for the complete project lifecycle. The inputs from respective assessments shall be used in engineering decisions duly and documented.
(iv) Process Hazard Analysis tool or technique selection guide (based on the complexity, more than one tool or technique can be used for hazard identification and risk assessment).
(v) PHA shall be conducted by multi-disciplinary team with expertise in engineering and process operations
(vi) Establish Facility Risk tolerance criteria.
(vii) Engineering and administrative controls applicable to the hazards and their interrelationships, such as appropriate application of detection methodologies to provide early warning of releases through a separate Fire and Gas Detection mapping study. Acceptable detection methods might include

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process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors;

(viii) Consequences of failure of engineering and administrative controls.

(ix) Facility siting;

(x) Human factors; and

(xi) A qualitative evaluation of a range of the possible safety and health effects on employees in the workplace if there is a failure of controls

(xii) Mechanism established for addressing and monitoring the action items from respective assessments in timely manner. The schedule and resolution shall be documented.

(xiii) Define the competency (expertise) and train employees participating in the reviews of hazard identification and risk assessment.

Risk Evaluation Technique Selection Criteria

Stages / Technique	Check list	What If	What If/ Check List	HAZOP	FMEA	FTA	ETA
RandD		✓					
Conceptual Stage	✓	✓	✓				
Pilot Plant	✓	✓	✓	✓	✓	✓	✓
Detailed Engineering	✓	✓	✓	✓	✓	✓	✓
Construction/Start Up	✓	✓	✓				
Routine Operation	✓	✓	✓				
Expansion / Modification	✓	✓	✓	✓	✓	✓	✓
Incident Investigation		✓			✓	✓	✓
Decommissioning	✓	✓	✓				

(c) The occupier of the factory shall demonstrate that all the highly hazardous processes in facility undergo a formal revalidation of Process Hazard Analysis periodically (as deemed by the facility, not exceeding five (5) years.

(7) Management of Change

Every factory shall develop a written Management of Change program and demonstrate the following:

(i) Develop the Management of Change methodology and approval process. It shall include a review and authorization process for evaluating proposed changes to facility design, operations, organization, or activities prior to implementation to make certain that no unforeseen new hazards are introduced and that the risk of existing hazards to employees, the public, or the environment is not unknowingly increased.

(ii) Conduct technical risk assessment reviews in consultation with the employees. Also analyze the impact of change on safety and health.

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(iii) Determine the time period, and resources for the change.
(iv) Notify and train the employees about the changes.
(v) Update the pertinent Process Safety Information documents.

(8) Pre-Startup Safety Review

Every factory shall develop a written Pre-Startup Safety Review program and demonstrate the following:

(a) Include and conduct reviews for startups from all types of shutdown conditions. It shall also include startup or restart of equipment and processes that have been opened up, inspected, repaired, etc.
(b) The reviews shall be conducted prior to the introduction of highly hazardous chemicals to a process and include the following as a minimum:
    (i) Confirming that the construction and equipment of a process are in accordance with design specifications.
    (ii) Ensuring that adequate safety, operating, maintenance, and emergency procedures are in place.
    (iii) Ensuring that any safeguards that shall have been bypassed during the outage are verified shall be in service and operational.
    (iv) Confirming that all sensors, instruments, and valves are properly reset to the proper state or condition.
    (v) Ensuring that training has been completed for all employees who shall affect the process.
(c) Extensive checklists, multi-stage verification, and multiple functional sign-offs are carried out for startup authorization.

(9) Operating Procedures

(a) Operating procedures shall describe the process, hazards, tools, protective equipment, and controls in sufficient detail that operators understand the hazards, can verify that controls are in place, and can confirm that the process responds in an expected manner. They shall also include Operating limits, Consequences of deviation, Steps required to correct or avoid deviation, Properties of, and hazards presented by, the chemicals used in the process and the appropriate emergency response. Every factory develop a written Operational Procedures program and shall ensure that Procedures are available for the following:
    (i) Normal Operation procedures for safe execution and control of the process.
    (ii) Temporary Operation procedures
    (iii) Troubleshooting procedures when the process does not respond as expected.
    (iv) Emergency procedures when the shutdown shall be executed.
    (v) Startup procedures for safe startup or restart of the process.
(b) Every fcatory shall establish a development and review mechanism of Operating Procedures in consultation with the employees (particularly field level employees). It is the responsibility of Facility to ensure the Operating procedure reflect the current operating practices and certify them.

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(10) Safe Work Practices

(a) Safe work practices shall include energy isolation, hot work, line break, confined space entry, and any other non-routine activities which can result in process incidents.

(b) Every factory shall develop a written Safe Work Practices program and demonstrate the following:

(i) Establish a formalized process to help control hazards and manage risk associated with work done that is not directly involved with process operations. Facilities shall identify all the non-routine activities and ensure they are carried out in a restricted monitored way. These activities shall be controlled by permits (initiated and authorized) in a secured area. The possibility of Simultaneous Operations and Concurrent Operations shall be given special focus.

(ii) Define the competence and train employees for managing (initiating, receiving and authorizing) the permits.

(11) Mechanical Integrity and Quality Assurance

Every factory shall develop a written Mechanical Integrity and Quality Assurance program and demonstrate the following:

(a) Process Equipment (Pressure vessels and storage tanks, piping systems (including piping components such as valves), Relief and vent systems and devices, Emergency shutdown systems, Controls (including monitoring devices and sensors, alarms, and interlocks), and Pumps) is properly designed, installed and operated in accordance with specifications, and remains fit for use until it is retired.

(b) Safety Critical Equipment (SCE)shall includes any part of a facility or activity that has a significant role to / for:

(i) Prevent a Major Accident by eliminating the foreseeable causes

(ii) Control of Major Process Hazards

(iii) Limit and mitigate the consequences of a Major Accident

(iv) Limitation and recovery from loss of containment (LOC).

(v) Limitation and recovery from any hazardous scenario produced by the LOC, e.g. fire, explosion, toxic release.

(vi) Escape, evacuation, refuge and rescue.

(c) Identify the applicable maintenance, quality assurance practices and define the Inspection and Testing program for all the equipment. These shall follow recognized and generally accepted good engineering practices. Performance Standards shall be duly developed.

(d) Establish quality assurance practices for procuring and installing the equipment in line with Manufacturer recommendations and Good Engineering Practices.

(e) Establish the schedule for maintenance, and quality assurance. The frequency shall be determined in consultation with Manufacturer recommendations and good engineering practices, and more frequently if determined shall be necessary

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by prior operating experience. All the equipment handling highly hazardous chemicals shall be included.

(f) Determine the spare part requirements and maintain the same.

(g) Monitor the deviations from the established schedule, and deferrals. The same shall be documented with action plan and approval obtained.

(h) Define the competence requirements and train employees to carry out the maintenance, inspection and repair activities.

(12) Contractor Safety Management

Every factory shall develop a Contractor Safety Management program and demonstrate the following:

(a) Check contractor's safety records (performance and programs) when selecting them.

(b) Establish expectations, roles, and responsibilities for safety program implementation and performance.

(c) Ensure that contractor personnel are properly trained.

(d) Supply appropriate information like hazards, control measures and emergency response associated with the activities to the contractor to ensure that the contractor can safely provide the assigned contracted services.

(e) Assess the performance of Contractors during and post completion of activities. Maintain a contract employee injury and illness log related to the contractor's work in process areas.

(f) Managing of Safe Work Practices that involve Contractors.

(13) Emergency Planning and Management

Every factory shall develop a written Emergency Planning and Management program to ensure the Emergency management includes the following:

(a) Planning for possible emergencies.

(b) Providing resources to execute the plan.

(c) Practicing and continuously improving the plan.

(d) Training or informing employees, contractors, neighbors, and local authorities on what to do, how they will be notified, and how to report an emergency.

(e) Effectively communicating with stakeholders in the event an incident does occur.

(14) Compliance Audits

(a) An audit involves a methodical, typically team-based, assessment of the implementation status of one or more PSM elements against established requirements.

(b) Facility shall develop a Compliance Audit program and demonstrate the following:

(i) Certify that they have evaluated compliance with the provisions of this code at least every three years to verify that the procedures and practices developed under the

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code are adequate and are being followed.

(ii) Determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.

(iii) Define the competency (expertise) and train employees in Compliance Auditing.

FORM I

Form of Certificate of Stability

(See sub para (3) of Standard 6)

1. Name of the factory
   .....
2. Village, town and district in which the factory is situated
   .....
3. Full postal address of the factory .....
4. Name of the occupier of the factory .....
5. Nature of manufacturing process to be carried on in the factory
   .....
6. Number of floors on which workers will be employed
   .....

I certify that I have inspected the building/buildings, the plans of which have been approved by the Chief Inspector-cum-facilitator in his letter No.... ..... dated ..... and examined the various parts including the foundations with special reference to the machine, plant etc., that have been installed. I am of the opinion that the building/buildings which has/have been constructed/reconstructed/extended/taken into use is/are in accordance with the plans approved by the Chief Inspector--cum-facilitator in his letter mentioned above, that it is/they are structurally sound and that its/their stability will not be endangered by its/their use as factory/part of a factory for the manufacture of ..... for which the machinery, plant, etc. installed are intended.

Signature .....

Qualifications .....

Address .....

Date .....

If employed by a company or association,)

name and address of the company or)

association)

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FORM 2

REPORT OF EXAMINATION OR TEST OF PRESSURE VESSELS OR PLANT

(See sub para (12)(b) of Standard 42)

1	Name of occupier (or factory)	:	
2	Situation and address of factory	:	
3	Name, description and distinctive number of pressure vessel or plant	:	
4	Name and address of manufacturer and reference to their test certificate or certificate of competent person	:	
5	Nature of process in which pressure vessel or plant is used	:	
6	Particulars of pressure vessel or plant	:	
a	Date of construction	:	
b	Thickness of walls	:	
c	Date on which the pressure vessel or plant was first taken into use	:	
d	Maximum permissible working pressure recommended by the manufacturer	:	
e	Design pressure, if known	:	
f	Brief history of pressure vessel or plant was first taken into use	:	
7	Date of last hydrostatic test (if any) and pressure applied	:	
8	Is the pressure vessel or plant in open, or otherwise exposed to weather or to damp?	:	
9	What parts (if any) were inaccessible	:	
10	What examination and test were made? (Specify pressure if hydrostatic test carried out)	:	
11	Condition of pressure vessel or plant (State any defects materially affecting)		External:
	the maximum permissible working pressure or the safe working of the pressure vessel or plant		Internal:
12	Are the required fittings and appliances provided in accordance with the rules	:	
13	(a) Are all fittings and appliances properly maintained and in good condition?	:	
	(b) Have the pressure settings been checked and corrected?	:	

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14	(a) Repairs (if any) required	:
	(b) Period within which the repairs should be executed	:
	(c) Any other condition which the person making the examination thinks it necessary for securing safe working	:
15	Maximum permissible working pressure, calculated from dimensions and from the thickness and other data by the present examination, due allowance being made for conditions of working if unusual or exceptionally severe. (State minimum thickness of walls measured during the examination)	:
16	Where repairs affecting the maximum pressure are required, state the working pressure -	:
	(a) before the expiration of the period specified in item 14.	:
	(b) after the expiration of such period if the required repairs have not been completed	:
	(c) after the completion of the required repairs	
17	Other observations	:

I certify that on (date).....the pressure vessel or plant described above was thoroughly cleaned and (so far as its construction permits) made accessible for thorough examination and for such tests as were necessary for thorough examination and that on the said date, I thoroughly examined this pressure vessel or plant, including its fittings, and that the above is a true report of my examination.

Signature :	
Qualification :	
Address :	
Date :	
If employed by a company or association, name and address of the company or association :	

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FORM 3

CERTIFICATE OF INITIAL AND PERIODICAL TEST AND EXAMINATION OF LIFTING APPLIANCES AND THEIR ACCESSORY GEARS

(See sub para 7 of Standard 45)

Certificate No:.....

(1) **Name of occupier of factory** ----------

(2) **Address of factory** ----------

(3)

Situation and Description of lifting appliances and Gear with distinguishing number or marks (if any), which have been tested, thoroughly examined	**Angle to the horizontal of derrick boom at which test load applied/ For jib cranes radius at the test load was applied**	**Test load applied**	**Safe working load (SWL) at the angle/ for jib cranes radius shown in Col. (2)**
(1)	**(2)**	**(3)**	**(4)**
	(Degree/metres)	**(Tonnes)**	**(Tonnes)**

Name and Name and address of public service, association, address of public service, association,	**Name and position of the Competent Person of public service, association, company or firm or testing establishment**
(5)	**(6)**

I certify that on the .....day of ……., 20……. the lifting Appliance shown in Col. (1) together with its accessory gear, was tested in the manner set forth overleaf in my presence that a careful examination of the said lifting appliances after the test showed that it had withstood the test load without injury or permanent deformation and that the safe working load of the said lifting appliance and accessory gear is as shown in Column (4).

Signature of the competent person Seal Date

……

Registration/Authority number of the competent person.

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FORM 4

CERTIFICATE OF INITIAL AND PERIODICAL TEST AND EXAMINATION OF LOOSE GEARS

(See sub para 7 of Standard 45)

Certificate No:.....

(1) **Name of occupier of factory** ----------

---

(2) **Address of factory** ----------

(3)

Distinguishing Number of marks	**Description, dimension and material of gear/ device**	**Number of tested**	**Date of test**	**Test load applied (tonnes)**	**Safe working load(SWL) (tonnes)**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**

Name and address of manufacturer or suppliers	**Initial test and examination certificate No. and date (only in case of periodical test and examination)**	**Name and address of public service, association, company or firm or testing establishment making the test and examination**	**Name and position of the Competent Person of public service, association, company or firm or testing establishment**
(7)	**(8)**	**(9)**	**(10)**

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I certify that on the ..... day of ……., 20……. the above gear was tested and examined in the manner set forth overleaf that the examination showed the said gear/device withstood the test load without injury or permanent deformation and that the safe working load of the said gear/device is as shown in column (6).

Signature of the competent person Seal Date

……

Registration/Authority number of the competent person.

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FORM 5

CERTIFICATE OF TEST AND EXAMINATION OF WIRE ROPE BEFORE BEING TAKEN INTO USE

(See sub para 7 of Standard 45)

Test Certificate No:.....

1.	Name and address of maker or supplier	
2.	(a) Circumference/diameter of rope	
	(b) Number of strands	
	(c) Number of wires per strand	
	(d) Lay	
	(e) Core	
3.	Quality of wire (e.g. Best Plough steel)	
4.	(a) Date of test of sample of rope	
	(b) Load at which sample broke (tonnes)	
	(c) Safe working load of rope (tonnes)	
	(d) Intended use	
	(e) Batch No.	
	(f) Length of the wire rope in meters.	
5.	Name and address of public service, association, company or firm or testing establishment making the test and examination	
6.	Name and position of Competent Person in public service, association, company or firm or testing establishment making the test and examination	

I certify that the above particulars are correct and that the test and examination were carried out by me and no defects affecting its safe working load (SWL) were found.

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Signature of the competent person Seal

Date.....

Registration/Authority number of the Competent Person

FORM 6

REPORT OF EXAMINATION OF HOISTS AND LIFTS

(See sub para (1) Standard 44)

Occupier (or owner) of premises :

Address :

1. (a) Type of hoist or lift and
identification number or
description :

(b) Date of construction or
reconstruction
(if ascertainable) :

2. Are all parts of the hoist or lift
of good mechanical construction,
sound material and adequate strength
(so far as ascertainable) ? :

3. Are the following parts of the hoists
or lift properly maintained and in
good working order ? If not, state
what defects have been found :

(a) Enclosure of hoistway or liftway :

(b) Landing gates and cage gate (s) :

(c) Interlocks and the landing gates
and cage gate(s) :

(d) Other gate fastenings :

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(e) Cage and platform and fittings, guides, buffers, interior of the hoistway or liftway :

(f) Overrunning devices :

(g) Suspension ropes or chain and their attachments :

(h) Safety gear i.e., arrangements for preventing fall of platform or cage brakes :

(i) Brakes :

(j) Worm or spur gearing :

(k) Other electrical equipment :

(l) Other parts :

4. What parts (if any) were inaccessible ? :

5. Repairs, renewals or alterations, (if any) required and the period within which they should be executed :

6. Maximum safe working load subject to repairs, renewals or alterations (if any) specified in item 5. :

7. Other particulars :

I/We certify that on (date).....……. I/We thoroughly examined this hoist or lift and that the above is a correct report of the result.

Signature :

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Qualification :

Address :

Date :

If employed by a company association, name and address of the company or association

FORM 7

REGISTER OF WORKERS EMPLOYED FOR WORK ON OR NEAR MACHINERY IN MOTION

(See sub para (4) Standard 46)

1. Name of worker :

2. Serial number as in the register of workers :

3. Father's name :

4. Date of birth and age :

5. Nature of work :

6. Qualifications, if any, or period of service on similar work :

7. Date when tight fitting clothing was provided :

8. Remarks :

I certify that the above-mentioned worker whose signature or left-hand thumb impression is given below is a properly trained male adult worker who is competent to mount or shift belts, lubricate or do other adjusting operations on the machinery installed in my factory while they are in motion.

Signature or left-hand thumb impression of worker :

Signature of Occupier :

Date :

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Occupational Safety and Health Standards- List of References

List of Standards under Section 18 Of the Occupational Safety, Health & Working Conditions Code, 2020

Standards	Contents	National Standards
13	Welding, cutting, and brazing	• IS 818: Code of practice for safety and health requirements in electric and gas welding and cutting operations • IS 1179: 1967: equipment for eye and face protection during welding • IS 2573: 1986: Specification for Leather Gauntlets and Mittens • IS 6994: Specification for Safety Gloves – Leather and Cotton Gloves
14	Safety of buildings and machinery	• SP 7: 2016 National Building Code of India 2016
16	Warehouse	• IS 3594 (1991): Code of practice for fire safety of industrial buildings: General storage and warehousing including cold storage •
17	Hazard evaluation and risk management	• IS 15656 (2006): Hazard identification and risk analysis - Code of practice
19	Ergonomics	• IS 17031: Part 1: 2018/ISO 11228-1: 2003: Ergonomics - Manual handling Part 1 Lifting and carrying • IS 17031: Part 2: 2019/ISO 11228-2: 2007: Ergonomics - Manual handling part 2 pushing and pulling • IS 17031: Part 3: 2018/ISO 11228-3: 2003: Ergonomics - Manual handling part 3 handling of low loads at high frequency • IS 17009: 2018: Ergonomics - Evaluation of static working postures • IS 17031: Part 2: 2019/ISO 11228-2: 2007: Ergonomics -- Manual handling part 2 pushing and pulling • IS 17031: Part 3: 2018/ISO 11228-3: 2003: Ergonomics -- Manual Handling Part 3 handling of low loads at high frequency • IS 13276-1 :2000: Mechanical Vibration And Shock - Evaluation Of Human Exposure To Whole Body Vibration, Part 1: General Requirements • IS 13276-2 :2001: Evaluation of human exposure to whole body vibration - part 2: continuous and shock-induced vibration in buildings • IS 13276-3 :2002: Evaluation of human exposure to whole-body vibration part 3

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		evaluation of exposure to whole-body z-axis vertical vibration in the frequency RANGE O-1 Hzto 0’63 Hz • IS 13281 :1999: Mechanical Vibration and Shock Affecting Man - Vocabulary • IS 11717: 1999: Vocabulary On Vibration And Shock (First Revision) • IS 13281: 1999: Mechanical Vibration And Shocks - Human Exposure -Vocabulary (First Revision) • IS 5349: 1986: Mechanical vibration - guidelines for the measurement and the assessment of human exposure to hand transmitted vibration • IS 2631-2: Mechanical vibration and shock — evaluation of human exposure to whole body vibration part 2 vibration in buildings (1 Hz To 80 Hz) • IS 16561 : Part 4 : 2017/ISO 11064-4 : 2013: Ergonomic Design Of Control Centres: Part 4 Layout And Dimensions Of Workstations • IS 10224: Ergonomic principles in the design of work systems • IS 16564 : 2018/ISO 24504 : 2014: Ergonomics - Accessible Design - Sound Pressure Levels Of Spoken Announcements For Products And Public Address Systems • IS 16566: 2017/ISO 24502: Ergonomics-Accessible Design-Specification Of Age Related Luminance Contrast For Coloured Light • IS 16568: 2017/ISO 24500: 2010: Ergonomics - Accessible Design - Auditory Signals For Consumer Products • IS 16569: 2018/ISO 11429 : 1996: Ergonomics - System Of Auditory And Visual Danger And Information Signals • IS 16570: 2017/ISO 11428 : 1996: Ergonomics - Visual Danger Signals - General Requirements, Design And Testing • IS 16567: 2018/ISO 24501 : 2010: Ergonomics - Accessible Design - Sound Pressure Levels Of Auditory Signals For Consumer Products • IS 16561 : Part 1 : 2017/ISO 11064-1 : 2000: Ergonomic Design Of Control Centres: Part 1 Principles For The Design Of Control Centres • IS 16561 : Part 2 : 2017/ISO 11064-2 : 2000: Ergonomic Design Of Control Centres Part 2 Principles For The Arrangement Of Control Suites • IS 16561 : Part 4 : 2017/ISO 11064-4 : 2013: Ergonomic Design Of Control Centres: Part 4

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		Layout And Dimensions Of Workstations • IS 16561 : Part 5 : 2018/ISO 11064-5 : 2008: Ergonomic Design Of Control Centres: Part 5 Displays And Controls • IS 16561 : Part 6 : 2022/ISO 11604-6: Ergonomic design of control centres --part 6: environmental requirements for control rooms
20	Conveyor Safety	• IS 7155-1 : Code Of Recommended Practice For Conveyor Safety, Part 1: General Information • IS 7155-2 : Code Of Recommended Practice For Conveyor Safety, Part 2: General Safety Requirements • IS 7155-3 : Code Of Recommended Practice For Conveyor Safety, Part 3: Belt Conveyors And Feeders • IS 7155-4 : Code Of Recommended Practice For Conveyor Safety, Part 4: Vibrating Conveyor/Feeder • IS 7155-5 : Code Of Recommended Practice For Conveyor Safety, Part 5: Apron Conveyors/Apron Feeders • IS 7155-6 : Code Of Recommended Practice For Conveyor Safety, Part 6: Selection, Training And Supervision Of Operators • IS 7155-7 : Code Of Recommended Practice For Conveyor Safety, Part 7: Inspection And Maintenance • IS 7155-8 : Code Of Recommended Practice For Conveyor Safety, Part 8: Flight Conveyors (Scraper Conveyors)
21	Transport Safety	• IS 12222 Automotive vehicles — turning circle • IS 11877: Method of evaluation of maximum speed of automotive vehicles
23	Work at height	• IS 4912: Safety requirements floor and wall openings, and toe boards • IS 4912: Safety requirements floor and wall openings, and toe boards • IS 3512 Part 9:2021: Personal Fall Arrest Systems — Specification Part 9 Descending Devices • IS 11057: Specification for Industrial Safety Nets • IS 3521 Part3: Personal Fall Arrest Systems — Specification Part 3 Self-Retracting Lifelines • IS3521:2021 Part1: Industrial safety belts and harnesses specification • IS: 3521:2021 Part2Personal Fall Arrest Systems — Specification Part 2 Lanyards and Energy

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		Absorbers • IS3521:2021 Part3: Personal Fall Arrest Systems —Specification Part 3 Self-Retracting Lifelines • IS3521:2021 Part4: Personal Fall Arrest Systems — Specification Part 4 Vertical Rails and Vertical Lifelines Incorporating A Sliding-Type Fall Arrester • IS3521:2021 Part5: Personal Fall Arrest Systems — Specification Part 5 Connectors with Self-Closing And Self-Locking Gates • IS3521:2021 Part6: Personal Fall Arrest Systems Part 6 System Performance Tests • IS3521:2021 Part7: Personal Fall Arrest Systems — Specification Part 7 Single Point Anchor Devices • IS3521:2021 Part8: Personal Fall Arrest Systems — Specification Part 8 Flexible Horizontal Lifeline Systems • IS3521:2021 Part9: Personal Fall Arrest Systems — Specification Part 9 Descending Devices • IS3521:2021 Part4: Personal Fall Arrest Systems — Specification Part 4 Vertical Rails And Vertical Lifelines Incorporating A Sliding-Type Fall Arrester • IS3521:2021 Part7: Personal Fall Arrest Systems — Specification Part 7 Single Point Anchor Devices • IS3521:2021 Part8: Personal Fall Arrest Systems — Specification Part 8 Flexible Horizontal Lifeline Systems • IS 3696-1: Safety Code of Scaffolds And Ladders, Part 1: Scaffolds • IS 3696-2: Scaffolds And Ladders - Code Of Safety, Part 2: Ladders • IS 4912: Safety requirements floor and wall openings, and toe boards • IS8172: Specification for vertical steel ladders
24	Personal Protective Equipment and protective clothing	• IS 10245 Part-1: Breathing Apparatus-Closed Circuit • IS 10245 Part-4: Breathing Apparatus-Short Duration • IS 15323: Gas & Combined Filter • IS 15803: Self Rescuers • IS 9473: RPD-Filtering Half Mask • IS 9167: Specifications For Ear Protectors • IS 6229: Methods For Measurement Of Real-Ear Protection • ISO 4869-1: Hearing Protectors -Part 1: Subjective Method For The Measurement Of Sound Attenuation • ISO 4869-2: Hearing Protectors- Part 2: Estimation Of

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		Effective A-Weighted Sound Pressure Levels When Hearing Protectors Are Worn • ISO 4869-3: Hearing Protectors - Part 3: Measurement Of Insertion Loss Of Ear-Muff Type Protectors Using An Acoustic Test Fixture • ISO 4869-5: Hearing Protectors - Part 5: Method For Estimation Of Noise Reduction • IS 2925: Specification For Industrial Safety Helmets • IS3521:2021 Part 1:Industrial safety belts and harnesses specification • IS3521:2021 Part 2: Personal Fall Arrest Systems — Specification Part 2 Lanyards And Energy Absorbers • IS3521:2021 Part 3: Personal Fall Arrest Systems — Specification Part 3 Self-Retracting Lifelines • IS3521:2021 Part 4: Personal Fall Arrest Systems — Specification Part 4 Vertical Rails And Vertical Lifelines Incorporating A Sliding-Type Fall Arrester • IS3521:2021 Part 5: Personal Fall Arrest Systems — Specification Part 5 Connectors With Self-Closing And Self-Locking Gates • IS3521:2021 Part 6: Personal Fall Arrest Systems Part 6 System Performance Tests • IS3521:2021 Part 7: Personal Fall Arrest Systems — Specification Part 7 Single Point Anchor Devices • IS3521:2021 Part 8: Personal Fall Arrest Systems — Specification Part 8 Flexible Horizontal Lifeline Systems • IS 5983: Specifications For Eye-Protectors • IS 7524-I: Methods Of Test For Eye-Protectors Part I Non Optical Methods • IS 7524-II: Methods Of Test For Eye-Protectors Part II Optical Methods • IS 1179: 1967: Equipment For Eye And Face Protection During Welding • IS 1179: 1967: Equipment For Eye And Face Protection During Welding • IS 8520-IS 8940: Guide For Selection & Maintenance Of Industrial Equipment For Eye, Face And Ear Protection • IS 8521-1: Industrial Safety Face Shields, Part 1: With Plastic Visor • IS 8519: Guide For Selection Of Industrial Safety Equipment For Body Protection • IS 15321: Molten Metal Splash Protective Hood • IS 4501 : 1981 Specification For Aprons, Rubberized, Acid And Alkali Resistant • IS 6153 : 1971:Specification For Protective Leather Clothing • IS 7352 : 1974:Specification For X-Ray Lead Rubber Protective Aprons • IS 2573: 1986-Specification for Leather Gauntlets and

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		Mittens • IS 6994-Specification for Safety Gloves – Leather and Cotton Gloves • IS 4770-Rubber Gloves - Electrical Purposes - Specification • IS 8807-Glove Selection Guide • IS 15298: 2002 Part 2: Safety, Protective and Occupational Footwear for Professional Use – Specification for Safety Footwear • IS 1989:1986-Part 2: Specification for Leather Safety Boots and Shoes – For Heavy Metal Industries • IS 3737: 1966-Leather Safety Boots for Workers in Heavy Metal Industries • IS 3738: 1998-Rubber Boots – Specification • IS 3976: 2003-Protective Rubber Canvas Boots for Miners – Specification • IS 5557: 1999-Safety Rubber Boots – Specification • IS 5852: 1996-Protective Steel Toe Caps for Footwear – Specification • IS 6519: 1971-Code of Practice for Selection, Care and Repair of Safety Footwear • IS 7329: 1974-Metal Last for Safety Rubber Canvas Ankle Boots • IS 10348: 1982-Safety Footwear for Steel Plant • IS 10667: 1983-Guide for Selection for Industrial Safety Equipment for Protection of Foot and Leg • IS 11225: 1985-Leather Safety Shoes for Women Workers in Mines and Steel Plants • IS 11226: 1993-Leather Safety Footwear Having Direct Moulded Rubber Sole – Specification • IS 14544: 1998-Leather Safety Footwear with Direct Moulded PVC Soles – Specification
26	Incident notification, investigation, and reporting	• IS 3786 (1983): Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents
36	Guarding and fencing of machinery	• IS 16811: 2018: Safety of machinery -- guards -- general requirements for the design and construction of fixed and movable guards • IS 16815: 2019: Safety of machinery -- positioning of safeguards with respect to the approach speeds of parts of the human body • IS 16816: 2019: Safety of machinery -- minimum gaps to avoid crushing of parts of the human body • IS 16812: 2018: Safety of machinery -- interlocking devices associated with guards -- principles for design and selection • IS 16809 (Part 1): 2018: safety of machinery -- permanent means of access to machinery -- part

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		1: choice of fixed means and general requirements of access • IS 16819: 2018: safety of machinery -- general principles for design -- risk assessment and risk reduction • IS 16818: 2018: safety of machinery -- emergency stop function -- principles for design • IS 16817: 2018: safety of machinery -- two-hand control devices -- functional aspects and design principles • IS 16813: 2019: safety of machinery -- prevention of unexpected start-up • IS 16814: 2018: safety of machinery -- safety distances to prevent hazard zones being reached by upper and lower limbs • IS 15652 (2006): Insulating mats for electrical purposes
42	Pressure Plant	• IS 2825 1969: Code for unfired pressure vessels
45	Lifting machines, chains ropes and lifting tackles	• IS 13367-1 (1992): Safe use of cranes - Code of practice, Part 1: General • IS: 5532 – 1984 Glossary of terms for Cranes. • IS: 3177 – 1977 Code of practice for Electric Overhead Travelling Cranes and Gantry Cranes other than Steel Work • IS: 4137 – 1967 Code of Practice for Heavy Duty E.O.T Cranes including special Service Machines for use in Steel Works. • IS: 4573 – 1982 Power-driven Mobile Cranes • IS 807:2006 - Indian Standard design, erection, and testing (structural portion) of cranes and hoists —code of practice • IS 15785: 2007 Installation and Maintenance of Lift Without Conventional Machine Rooms — Code Of Practice • IS 14470 (1997): Cranes - Test code and procedures • IS: 3813 – 1967 C hooks for use with swivels • IS: 3815 – 1969 Point hooks with shank for general engineering purposes. • IS: 3822 – 1966 Eye hooks to use with chains • IS: 4164 – 1976 Lifting C hooks with eye capacity up to 25 tonnes • IS: 4190 – 1984 Eye bolts with collars • IS: 7847 – 1975 General characteristics of lifting hooks. • IS 6132: 2003- Forged shackles for general lifting purposes - dee shackles and bow shackles • IS 12785: 1994-Indian Standard wire rope slings - safety criteria and inspection procedures for

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		use • IS: 2760 – 1980- specification for steel chain slings • IS 8324-1988-Code of practice for safe use and maintenance on non - Calibrated round steel link lifting chains and chain slings (First Revision) • IS: 1835 – 1976 Round steel wire for ropes • IS: 2266 – 1981 Steel wire ropes for general engineering purposes • IS: 2762 – 1982 Wire rope slings and sling legs • IS: 3973 – 1967 Code of practice for the selection, installation, and maintenance of wire ropes • IS: 12735 – 1989 Guidelines for use of wire rope slings • IS: 2429 – 1970 Rounded steel short link chain (electric butt welded) grade 30 • IS: 2429 – 1970 non-calibrated load chain for lifting purposes • IS: 2760 – 1980 Steel chain slings • IS: 6511 – 1972 Range of preferred safe working loads for Cranes, Lifting Appliances and related Excavator Equipment • IS 14473-1- Cranes - Inspections • IS: 3109 – 1982 Calibrated load chain for Pulley Blocks & other Lifting Appliances. • IS: 3832 – 1986 Hand operated Chain Pulley Blocks • IS: 6498 – 1971 Glossary of terms used in connection with Pulley Blocks
49	Textile Machinery except machinery used in jute mills.	• IS 9474 (1980): Principles of Mechanical Guarding of Machinery
54	Forklift	• IS 4357: Methods for Stability Testing of Fork Lift Trucks • IS 6305.1: Safety Code For Powered Industrial Trucks, Part 1 Application, Operation And Maintenance • IS 15634: Fork-Lift Trucks - Forks-Arm Extensions And Telescopic Fork-Arm - Technical Characteristics And Strength Requirements. • IS 15488: Powered Industrial Trucks - Safety Signs And Hazard Pictorials - General Principles • IS 13971-1: Rough terrain fork lift trucks - code of practice for safety - part 1: application, operation and maintenance

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		• IS 13971.2: rough terrain fork lift trucks - code of practice for safety - part 1: application, operation and maintenance • IS 10571: Specification For Split Taper Sockets For Tools With Parallel Shank, Driving Square And Driving Tenon. • IS 7862: Glossary Of Terms Relating To Safety Aspects Concerning Operating Areas Of Industrial Trucks. • IS 7617: Code Of Practice For Maintenance Of Forks For Forklift Trucks • IS 7570: glossary of terms relating to. fork arms and 'attachments .,. of fork lift trucks • IS 7553: Control Symbols For Powered Industrial. Trucks • IS 6305.2: Safety Code For Powered Industrial Trucks, Part II: Manufacture • IS 15611-2 (2005): Single side loading fork - Lift Trucks, Part 2: Additional stability test for trucks handling freight container of 6 m length and above • IS 10517: Acceptance criteria for forklift trucks
58	Industrial Robots	• IS 14530: Part 2: 2019: Robots and robotic devices, safety requirements for industrial robots • IS 15652 (2006): Insulating mats for electrical purposes
66	Operations involving high noise and vibration levels	• IS 9167: Specifications for Ear Protectors • IS 6229: Methods for measurement of real-ear protection • IS 8520: 1977: Guide for selection of industrial safety equipment for eye, face, and ear protection • IS 13276-1 :2000: Mechanical vibration and shock - evaluation of human exposure to whole body vibration, part 1: general requirements • IS 13276-2 :2001: Evaluation of human exposure to whole body vibration - part 2: continuous and shock-induced vibration in buildings • IS 13276-3 :2002: Evaluation of human exposure to whole-body vibration part 3 evaluation of exposure to whole-body z-axis vertical vibration in the frequency range 0-1 Hz to 0-63 Hz • IS 13281 :1999: Mechanical vibration and shock affecting man - vocabulary • IS 11717: 1999: Vocabulary on vibration and shock (First revision) • IS 13281: 1999: Mechanical vibration and shock

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		affecting man - vocabulary • IS/ISO 5349: 1986: mechanical vibration - guidelines for the measurement and the assessment of human exposure to hand transmitted vibration • IS 2631-2: Mechanical vibration and shock — evaluation of human exposure to whole body vibration part 2 vibration in buildings (1 Hz to 80 Hz)
67	Laboratory Safety	• IS 2379 (1990): Colour code for identification of pipelines • IS 4209: 2013: Chemical Laboratories — Code Of Safety
74	Firework manufactories and match factories	• SP 7: 2016 National Building Code of India 2016
80	Chemical Works	• IS/IEC 60079-1 (2007): Explosive Atmospheres, Part 1: Equipment Protection by Flameproof Enclosures 'd' • IS/IEC 61241-4 (2001): Electrical Apparatus for Use in the Presence of Combustible Dust, Part 4: Type of Protection 'pD' • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • SP 30: 2011 National Electrical Code
81	Tank Farm	• IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 15394 (2003): Fire Safety in Petroleum Refineries and Fertilizer Plants - Code of Practice • IS: 3043 – 1987: Code Of Practice For Earthing • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 2379 (1990): Colour code for identification of pipelines • IS 10245 Part-1: Breathing Apparatus-Closed Circuit • IS 10245 Part-4: Breathing Apparatus-Short Duration
83	Lead Acid Battery Manufacturing	• IS 17031-Part 1: 2018/ISO 11228-1: 2003: Ergonomics - Manual Handling Part 1 Lifting and Carrying • IS 10592: Specification for Industrial Emergency Showers, Eye and Face Fountains

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		and Combination Units • IS 17031-Part 1: 2018/ISO 11228-1: 2003: Ergonomics - Manual Handling Part 1 Lifting And Carrying
84	Lead Acid Battery Charging	• IS 3103: Code of Practice for Industrial Ventilation
89	Ferrous Metallurgical Industries	• IS 2379 (1990): Colour code for identification of pipelines
90	Non-Ferrous Metallurgical Industries	• IS 10245 Part-1: Breathing Apparatus-Closed Circuit • IS 10245 Part-4: Breathing Apparatus-Short Duration • IS 10245 Part 2: Open Circuit Breathing Apparatus • IS 15803: Self Rescuers • IS 9473: RPD-Filtering Half Mask • IS 10592: Specification for Industrial Emergency Showers, Eye and Face Fountains and Combination Units • IS 10592: Specification for Industrial Emergency Showers, Eye and Face Fountains and Combination Units • IS 15323: Gas & Combined Filter
92	Coal (including coke) industries	• IS 10245 Part-1: Breathing Apparatus-Closed Circuit • IS 10245 Part-4: Breathing Apparatus-Short Duration
94	Pulp and paper (including paper products) industries	• IS 17031: Part 1: 2018/ISO 11228-1: 2003: Ergonomics - Manual handling Part 1 Lifting and carrying • IS 17031: Part 2: 2019/ISO 11228-2: 2007: Ergonomics - Manual handling part 2 pushing and pulling • IS 17031: Part 3: 2018/ISO 11228-3: 2003: Ergonomics - Manual handling part 3 handling of low loads at high frequency • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas
95	Fertiliser industries	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas
97	Petroleum industries	• IS 7689 (1989): Guide for the control of undesirable static electricity • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for

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		Hazardous Areas • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation
98	Petrochemical Industries	• IS 2309: Protection of buildings and allied structures against lightning code of practice • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 2379 (1990): Colour code for identification of pipelines • IS 15298: 2002 Part 2-Safety, Protective And Occupational Footwear For Professional Use – Specification For Safety Footwear • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation
99	Drugs and pharmaceutical industries	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation
101	Rubber (synthetic) industries	• IS 3103: Code of Practice for Industrial Ventilation • IS 9474 (1980): Principles of Mechanical Guarding of Machinery
102	Paints and pigment industries	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 9474 (1980): Principles of Mechanical Guarding of Machinery • IS 9457 (2005): Safety colours and safety signs - Code of Practice
105(a)	Coke oven by-products and coal tar distillation	• IS 2379 (1990): Colour code for identification of pipelines • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 9167: Specifications for Ear Protectors • IS 6229: Methods for measurement of real-ear protection • IS 8520: 1977: Guide for selection of industrial safety equipment for eye, face, and ear protection • IS 17031: Part 1: 2018/ISO 11228-1: 2003: Ergonomics - Manual handling Part 1 Lifting and carrying • IS 17031: Part 2: 2019/ISO 11228-2: 2007:

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		Ergonomics - Manual handling part 2 pushing and pulling • IS 17031: Part 3: 2018/ISO 11228-3: 2003: Ergonomics - Manual handling part 3 handling of low loads at high frequency • IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 818: Code of practice for safety and health requirements in electric and gas welding and cutting operations • IS 3483: Code of Practice for Noise Reduction in Industrial Buildings
105(g)	Electro-chemicals (Metallic Sodium, Potassium and Magnesium, Chlorates, Perchlorates and Peroxides	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation • IS 11592 (2000): Selection and Design of Belt Conveyors - Code of Practice • IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 15652 (2006): Insulating mats for electrical purposes
105(h)	Electro-thermal Produces (Artificial Abrasive, Calcium Carbide)	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation • IS 3483: Code of Practice for Noise Reduction in Industrial Buildings • IS 17031: Part 1: 2018/ISO 11228-1: 2003: Ergonomics - Manual handling Part 1 Lifting and carrying • IS 17031: Part 2: 2019/ISO 11228-2: 2007: Ergonomics - Manual handling part 2 pushing and pulling • IS 17031: Part 3: 2018/ISO 11228-3: 2003: Ergonomics - Manual handling part 3 handling of low loads at high frequency • IS 15652 (2006): Insulating mats for electrical purposes
105(k)	Halogens And Halogenated Compounds (Chlorine, Fluorine, Bromine, and	• IS: 4263-1967 Code of safety for chlorine • IS 6953: Code of safety for bromine

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	Iodine)	• IS 818: Code of practice for safety and health requirements in electric and gas welding and cutting operations
105(l)	Explosive (Including Industrial Explosives, Detonators and Fuses)	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation • IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 2309: Protection of buildings and allied structures against lightning code of practice • IS 7689 (1989): Guide for the control of undesirable static electricity
106	Insecticides, fungicides, herbicides, and other pesticides industries.	• IS 4015 (1998): Guide for Handling Cases of Pesticide Poisoning
108	Man-made fibre	• IS 5685 (1970): Code of Safety for Carbon Disulphide (Carbon Bisulphide) • IS 7689 (1989): Guide for the control of undesirable static electricity • IS 2379 (1990): Colour code for identification of pipelines • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 3103: Code of Practice for Industrial Ventilation • IS: 3043 – 1987: Code of Practice for Earthing
110	Glass and ceramics	• IS 2379 (1990): Colour code for identification of pipelines • IS 12288 (1987): Code of Practice for Use and Laying of Ductile Iron Pipes • IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products.
111	Grinding or glazing of metals	• IS 3103: Code of Practice for Industrial Ventilation • IS 1991-8 (1987): Safety requirements for the

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		use, care and protection of abrasive grinding wheels
112	Manufacture, handling and processing of asbestos and its products	• IS 3103: Code of Practice for Industrial Ventilation • IS 10245 Part-1: Breathing Apparatus-Closed circuit • IS 10245 Part-4: Breathing Apparatus-Short Duration • IS 11451: Recommendations for Safety and Health Requirements Relating to Occupational Exposure to Asbestos • IS 15323: Gas & Combined Filter • IS 15803: Self Rescuers
117	Highly flammable liquids and gases	• IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 7689 (1989): Guide for the control of undesirable static electricity • IS 2379 (1990): Colour code for identification of pipelines • IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS: 3043 – 1987: Code of Practice for Earthing • IS 6044-1 (2000): Code of Practice for Liquefied Petroleum Gas Storage Installations, Part 1: Commercial and Industrial Cylinder Installations • IS 5903 (1970): Recommendations for safety devices for gas cylinders
118	Printing and dyeing on fabrics in textiles and plywood and laminate manufacturing process	• IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 3103: Code of Practice for Industrial Ventilation • IS 6665 (1972): Code of practice for industrial lighting • IS 803: Code of practice for design fabrication and erection of vertical mild steel cylindrical welded oil storage tanks
121	Extraction of oil and raw material from scrap tyres	• IS 10987 (1992): Code of practice for design, fabrication, testing and installation of underground/above ground horizontal cylindrical storage tanks for petroleum products. • IS 2379 (1990): Colour code for identification of

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		pipelines
122	Cigarette manufacturing industries	• IS 5571 (2009): Guide for Selection and installation of Electrical Equipment for Hazardous Areas • IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installation • IS 6665 (1972): Code of practice for industrial lighting
124	Hazardous waste and e-waste processing plants	• Refer CPCB Guidelines • IS 3103: Code of Practice for Industrial Ventilation
126	Styrene manufacturing, handling, and processing industry	• IS: 3043 – 1987: Code of Practice for Earthing

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