



ELLENBARRIE
INDUSTRIAL GASES LTD
OCCUPATIONAL HEALTH & SAFETY MANUAL

Revision 00

Date

Page 1 of 54





PREFACE

I am extremely pleased to roll out the Occupational Health & Safety manual of Ellenbarrie Industrial Gases Limited. It covers in detail the General Safety topics only and is the first amongst the series of manuals for other pertinent topics like Cryogenic Safety, Cylinder Safety, etc. These shall be published separately for your convenience.

The manual contains a description of safety rules, regulations and methods of safe working. These directives will form the standard operating norms pertinent to OH & S and shall be effective from 1st December, 2011. No deviation from the directives would be accepted by the management. In case of any clarification please feel free to refer to the chapter on "Variance from requirements".

It is my earnest request to all of you to use this literature as a guide to ensure that our company remains at all times a safe place to work, for you and your colleagues. You are also welcome to share your valuable suggestions/ feedback with us, as there is always scope for the good to be better and the better, best.

Padam Kumar Agarwala

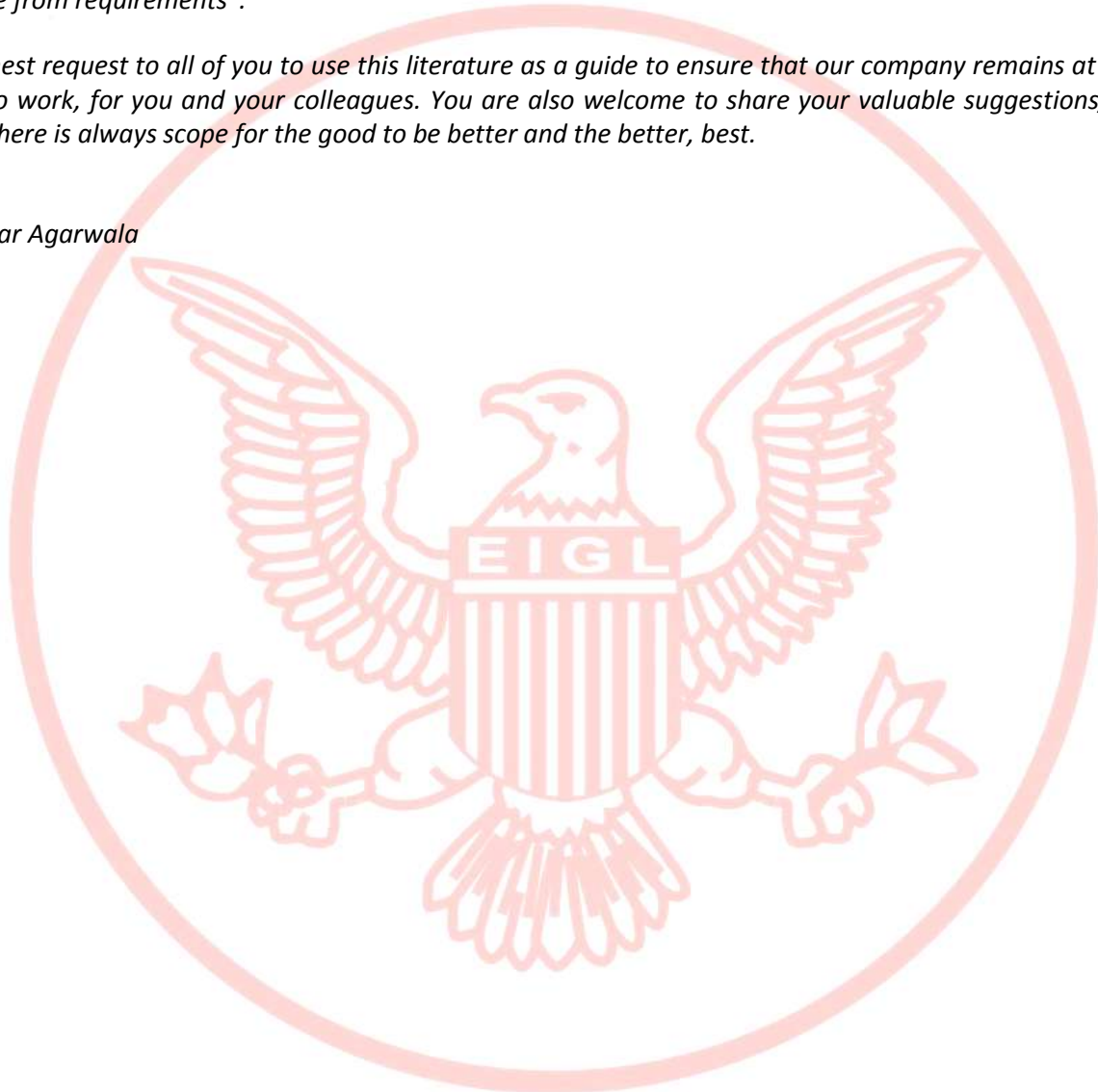




TABLE OF CONTENTS

| Sl. No. | Matter | Page |
|----------------|---|----------------|
| 1 | Purpose | 4 |
| 2 | Scope | 4 |
| 3 | Limitation | 4 |
| 4 | Disclaimer | 4 |
| 5 | Reference | 5 |
| | | Chapter |
| 6 | Definitions | 1 |
| 7 | Roles and Responsibilities | 2 |
| 8 | <i>Chief Executing Officer</i> | 2.1 |
| 9 | <i>Managing Director / Joint Managing Directors</i> | 2.2 |
| 10 | <i>Business or Departmental Heads located in the Head office (Reporting to the Directors)</i> | 2.3 |
| 11 | <i>Unit Heads located in the plants (Reporting to the Business or Departmental Heads)</i> | 2.4 |
| 12 | <i>Line Management</i> | 2.5 |
| 13 | <i>Supervisors</i> | 2.6 |
| 14 | <i>OH&S Committee</i> | 2.7 |
| 15 | <i>Vendors</i> | 2.8 |
| 16 | <i>Corporate Safety</i> | 2.9 |
| 17 | Training | 3 |
| 18 | Tool Box Talk | 4 |
| 19 | Office Safety | 5 |
| 20 | <i>Lighting</i> | 5.1 |
| 21 | <i>Work Areas</i> | 5.2 |
| 22 | <i>Signage</i> | 5.3 |
| 23 | <i>Material Storage</i> | 5.4 |
| 24 | <i>Fire Precautions</i> | 5.5 |
| 25 | Work at height | 6 |
| 26 | <i>General precautions</i> | 6.1 |
| 27 | <i>Scaffolding</i> | 6.2 |
| 28 | <i>Ladders</i> | 6.3 |
| 29 | Hot Work | 7 |
| 30 | <i>General Precautions</i> | 7.1 |
| 31 | <i>Welding</i> | 7.2 |
| 32 | <i>Gas cutting</i> | 7.3 |
| 33 | <i>Grinding</i> | 7.4 |
| 34 | <i>Drilling</i> | 7.5 |
| 35 | Confined Space Entry | 8 |
| 36 | <i>Definition</i> | 8.1 |
| 37 | <i>Procedure</i> | 8.2 |
| 38 | Manual Material handling | 9 |
| 39 | Mechanical Material handling | 10 |
| 40 | <i>General Precautions</i> | 10.1 |



**ELLENBARRIE
INDUSTRIAL GASES LTD
OCCUPATIONAL HEALTH & SAFETY MANUAL**

Revision 00
Date
Page 4 of 54

| | | |
|----|---|-------|
| 41 | <i>Cranes</i> | 10.2 |
| 42 | <i>Chains</i> | 10.3 |
| 43 | <i>Wire rope</i> | 10.4 |
| 44 | <i>Hooks and rings</i> | 10.5 |
| 45 | Personal Protective Equipments (PPE) | 11 |
| 46 | <i>General guidelines on use of PPE</i> | 11.1 |
| 47 | <i>Eye and Face Protection</i> | 11.2 |
| 48 | <i>Head Protection</i> | 11.3 |
| 49 | <i>Proper Maintenance and Care of Head Protection</i> | 11.4 |
| 50 | <i>Foot Protection</i> | 11.5 |
| 51 | <i>Hand Protection</i> | 11.6 |
| 52 | <i>Respiratory Protective Equipment</i> | 11.7 |
| 53 | <i>Electrical Protective Equipment</i> | 11.8 |
| 54 | <i>Hearing Protection</i> | 11.9 |
| 55 | <i>Protective Clothing</i> | 11.10 |
| 56 | <i>Safety Harness and Shock Absorber</i> | 11.11 |
| 57 | LOCK OUT/ TAG OUT / TRYOUT | 12 |
| 58 | <i>General guideline</i> | 12.1 |
| 59 | <i>Definitions</i> | 12.2 |
| 60 | <i>Sequence of Lockout</i> | 12.3 |
| 61 | <i>Method of Tagging out</i> | 12.4 |
| 62 | <i>Restoring Equipment to Service</i> | 12.5 |
| 63 | <i>Valve lockout procedure</i> | 12.6 |
| 64 | <i>Forgetting to remove a personal lock</i> | 12.7 |
| 65 | <i>Periodic Inspection</i> | 12.8 |
| 66 | Power Tools and Hand tools | 13 |
| 67 | <i>General Precaution</i> | 13.1 |
| 68 | <i>Electrically Powered Tool</i> | 13.2 |
| 69 | <i>Pneumatically Powered Tools</i> | 13.3 |
| 70 | <i>Hand tools</i> | 13.4 |
| 71 | <i>Tools & Tackles inspection</i> | 13.5 |
| 72 | Illumination | 14 |
| 73 | Vehicle movement inside Unit | 15 |
| 74 | <i>Driving the vehicle</i> | 15.1 |
| 75 | <i>Maintenance</i> | 15.2 |
| 76 | Working in the heat | 16 |
| 77 | <i>Prevention</i> | 16.1 |
| 78 | <i>Treatment</i> | 16.2 |
| 79 | Hazard Identification and Group Risk Assessment | 17 |
| 80 | <i>Definitions</i> | 17.1 |
| 81 | <i>Information required prior to conducting a risk assessment</i> | 17.2 |
| 82 | <i>Workplace safety and health hazards can be identified by considering</i> | 17.3 |
| 83 | <i>Possible types of accident or incident and ill health include</i> | 17.4 |
| 84 | <i>Persons-at-risk include</i> | 17.5 |
| 85 | <i>Risk evaluation consists of</i> | 17.6 |



| | | |
|-----|---|-------|
| 86 | <i>Likelihood of occurrence</i> | 17.7 |
| 87 | <i>Hierarchy of Control of Hazards</i> | 17.8 |
| 88 | <i>Implementation Procedure</i> | 17.9 |
| 89 | <i>Residual Risks</i> | 17.10 |
| 90 | Job Safety Analysis | 18 |
| 91 | <i>How to prepare Job Safety Analysis</i> | 18.1 |
| 92 | <i>Procedure for implementation</i> | 18.2 |
| 93 | Electrical Safety | 19 |
| 94 | <i>Definitions</i> | 19.1 |
| 95 | <i>Procedure for implementation</i> | 19.2 |
| 96 | <i>Personal Protective Equipments (PPE)</i> | 19.3 |
| 97 | <i>Basic PPEs to be used to avoid electrical shocks</i> | 19.4 |
| 98 | <i>General electrical safety precautions</i> | 19.5 |
| 99 | <i>Specifications for Single line diagrams of an electrical circuit</i> | 19.6 |
| 100 | <i>Electrical Pre-Work Procedure (To prepare for work on electrical systems or components)</i> | 19.7 |
| 101 | <i>Working on or Near Exposed Energized Circuits Procedure</i> | 19.8 |
| 102 | <i>Re-energizing (even temporarily) of electrical circuits or equipments after completion of work</i> | 19.9 |
| 103 | <i>Specifications for grounding / earthing</i> | 19.10 |
| 104 | Transportation of Hazardous Substances | 20 |
| 105 | <i>Truck</i> | 20.1 |
| 106 | <i>Drivers</i> | 20.2 |
| 107 | <i>Driving</i> | 20.3 |
| 107 | Business trips through road | 21 |
| 108 | <i>Vehicle</i> | 21.1 |
| 109 | <i>Driver</i> | 21.2 |
| 110 | <i>Passenger</i> | 21.3 |
| 111 | <i>Travel initiator</i> | 21.4 |
| 112 | Incident and injury Investigation | 22 |
| 113 | <i>Reporting Incidents/Injuries</i> | 22.1 |
| 114 | <i>First Aid Case</i> | 22.2 |
| 115 | <i>Reportable Lost Time Injury</i> | 22.3 |
| 116 | <i>Non-Reportable Lost Time Injury</i> | 22.4 |
| 117 | <i>Vehicular Incidents</i> | 22.5 |
| 118 | <i>Dangerous Occurrence</i> | 22.6 |
| 119 | <i>Internal Reporting</i> | 22.7 |
| 120 | <i>Statutory Reporting</i> | 22.8 |
| 121 | <i>Records</i> | 22.9 |
| 122 | <i>Accident Investigation and Corrective Action</i> | 22.10 |
| 123 | Variance from requirements | 23 |
| 124 | <i>Need for a variance</i> | 23.1 |
| 125 | <i>Parameters for a variance from mandatory standards, procedures, and requirements</i> | 23.2 |
| 126 | <i>Written variance requests will contain the following information</i> | 23.3 |
| 127 | <i>Variance Approval & Renewals</i> | 23.4 |



Purpose

All industries have some potential hazards that must be recognized and addressed. The hazards include electricity, burn, vehicle, fall, striking objects and asphyxiation. This Occupational-Health & Safety Manual is designed to provide guidance on the generic aspects of safe operation of a manufacturing unit and is intended as a harmonized standard for the use and application by all employees and contractors of Ellenbarrie Industrial Gases Limited. It shall serve to acquaint persons not versed in manufacturing technology with those factors considered important to safety.

Scope

This guide serves the interest of all who may be associated or concerned with any activity within the capacity of Ellenbarrie Industrial Gases Limited.

It applies to safety in the operation, and maintenance of manufacturing units, stressing primarily on cryogenic air separation plants. Emphasis is placed on equipment and operational and maintenance features that are peculiar to behavior of human and machineries. Safety in the design, location, construction and installation of a cryogenic air separation plant has been left beyond the scope of this manual.

Cylinder filling facilities, cryogenic separation and transportation of hazardous substances, are not covered nor are coverage extended to facilities involved in transmission piping outside the unit boundaries. Separate manuals for these activities shall be published.

Limitation

The Occupational-Health & Safety Manual is based on the experience of the persons and contributing agencies responsible for making it. Therefore, this publication has some generalized statements and recommendations on matters on which there may be diversity of opinion or practice.

Users of this guide should recognize that it is presented with the understanding that it cannot take the place of sound engineering judgment, training, competent supervision and experience. It does not constitute, and should not be construed to be, a code of federal rules or regulations.

The Occupational-Health & Safety Manual has some technical contents derived out of publications by Compressed Gas Association, European Industrial Gases Association and Asia Industrial Gases Association, however, there are editorial changes primarily in formatting, units used and spelling. Further, as this publication is not intended as universal safe practices manual for specific design and safety features, it is also important to refer to the operating manuals of the equipment suppliers.

Disclaimer

All technical guidelines under Ellenbarrie Industrial Gases Limited's name, including codes of practice, safety procedures and any other technical information contained in this manual were obtained from sources and documents believed to be reliable and are based on technical information and experience currently available at the date of their issuance.

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Reference

- i. The Indian Explosives Act and Rules.
- ii. The Motor Vehicle Act and Central Motor Vehicle Rules.
- iii. The Factories Act and concerned Factory Rules.
- iv. The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules.
- v. The Indian Electricity Act and Rules.
- vi. The Indian Boiler Act and Regulations.
- vii. The Water (Prevention & Control & Pollution) Act.
- viii. The Mines & Minerals (Regulation & Development) Act.
- ix. The Air (Prevention & Control of Pollution) Act.
- x. The Hazardous Wastes (Management & Handling) Rules.
- xi. The Manufacturing, Storage & import of Hazardous Chemicals Rules.
- xii. Indian Standard Codes of Practices.
- xiii. Compressed Gas Association standards.
- xiv. Asian Industrial Gases Association standards.
- xv. European industrial Gases Association standards.
- xvi. Occupational Safety and Health Act.

1. Definitions

1.1 General definitions

1.1.1. Shall

Verbal form to indicate a requirement strictly to be followed

1.1.2. Shall not

Verbal form to indicate a prohibition

1.1.3. Should

Verbal form to indicate a preferred course of action

1.1.4. Should not

Verbal form to indicate a deprecated course of action

1.1.5. May

Verbal form to indicate a permissible course of action

1.1.6. Need not

Verbal form to indicate that a course of action is not required

1.1.7. Can

Verbal form to indicate a possible course of action

1.1.8. Cannot

Verbal form to indicate an impossible course of action

2. Roles and Responsibilities

2.1 Chief Executing Officer

- 2.1.1 Motivates employees in implementing the safety policy.



- 2.1.1 Maintains close co ordination with the Safety Department for establishing and implementing safety regulations and also comply with applicable laws.
- 2.1.1 Makes adequate provision for the allotment of funds for safety at all the stages including tendering, planning and execution.
- 2.1.1 Institutes proper reporting, investigation and assessment of costs due to injury, damage/ loss.
- 2.1.1 Promotes action to preclude recurrence and initiate analysis to discover accident trends.
- 2.1.1 Is responsible for approving safety policy for the division and ensures that every supervisor and employee in the division similarly understands and complies with this policy and safety procedures through the safety Department

2.2. Managing Director / Joint Managing Directors

- 2.2.1 Ensures that the broader aspects of the loss prevention programme are in place.
- 2.2.2 They shall provide strong demonstrable leadership and commitment towards OH&S by personal example and action.
- 2.2.3 Ensure adequate professional support is available for effectively implementing the OH&S Policy, fulfilling OH&S targets and attaining the company's OH&S objectives.

2.3 Business or Departmental Heads located in the Head office (Reporting to the Directors)

- 2.3.1. Shall provide demonstrable management leadership and commitment through active participation in OH&S activities.
- 2.3.2. Hold responsibility for the total compliance and implementation of this OH&S manual and be accountable for the Department's OH&S performance.
- 2.3.3. Provide inputs for updating the OH&S Manual as per company specific requirements.
- 2.3.4. Coordinate with OH&S Department on Department's OH&S requirements.
- 2.3.5. Keep abreast of changes in local legal requirements and best practices.
- 2.3.6. Exhibit commitment towards OH&S and set a role model to all employees reporting to them.
- 2.3.7. Arrange / provide required resources for implementation of OH&S Manual.
- 2.3.8. Promote continual improvement of OH&S performance.
- 2.3.9. Analyze and thereafter approve or otherwise reject deviations from standard practice.
- 2.3.10. Review and approve job procedures and risk assessments.
- 2.3.11. Authorize disciplinary action as required.
- 2.3.12. Spearhead the reward and reprimand drives for their respective Departments or business.

2.4 Unit Heads located in the plants (Reporting to the Business or Departmental Heads)

- 2.4.1. Shall be responsible for total implementation of the company's safety manual within his unit and comply with the relevant statutory rules and regulations.
- 2.4.2. Chair the Monthly local OH&S Meetings.
- 2.4.3. Shall liaison with government authorities on safety related issues.
- 2.4.4. Shall establish effective lines of communication and seek consultation of Area / Depot In-charges on OH&S issues.
- 2.4.5. Shall establish a good housekeeping standard and good operational practice.



- 2.4.6. Shall Monitor implementation of this OH&S Manual on a day-to-day basis in close coordination with plant OH&S champion and take necessary action, if deviations noticed or notified.
- 2.4.7. Shall ensure that all the employees inside the premises attend to the observations and recommendations made by the OH&S champion on OH&S matters.
- 2.4.8. Shall apply to the Business or Departmental Heads for deviations from standard practice.
- 2.4.9. Shall ensure that all incidents are investigated and reported properly.
- 2.4.10. Shall Verify statistical data, be informed and participate in the incident analysis.

2.5 Line Management

- 2.5.1 Shall be responsible for OH&S support and implementation, and for promoting continual improvement of OH&S performance.
- 2.5.2 Shall Plan and arrange for critical activities before they are undertaken and inform the relevant department head and the OH&S champion about the task well in advance.
- 2.5.3 Shall prepare method statements for all the critical activities in prescribed formats, in liaison with the Unit Head and OH&S champion and execute the measures suggested by them.
- 2.5.4 Shall know the critical activities of his job based on the Group Risk Assessment and ensure implementation of the Risk control measures by the work force under him.
- 2.5.5 Shall ensure that the workforce under his scope does not work without PPE.
- 2.5.6 Shall ensure that the housekeeping is maintained in the work area, especially clear areas at heights from loose materials.
- 2.5.7 Shall Ensure lifting appliances used by them have valid third party test certificate.
- 2.5.8 Shall Inspect work area everyday to identify and eliminate all unsafe conditions.
- 2.5.9 Shall take suitable corrective measures to rectify the observations pointed out by the OH&S champion in his inspection reports.
- 2.5.10 Shall ensure that all the workmen engaged under him have the physical / mental fitness and OH&S induction suitable for the activity.
- 2.5.11 Shall deliver tool box talk to the workmen under him.

2.6 Supervisors

Note: Supervisors must recognize those factors in the workplace with accident potential. The supervisor shall provide frequent inspections of job sites, work methods, and materials/equipment used. Any unsafe equipment/material shall be tagged and rendered inoperative or physically removed from its place of operation. The supervisor shall permit only qualified personnel to operate equipment and machinery according to safe work practices.

- 2.6.1 Shall ensure safe working conditions.
- 2.6.2 Shall provide necessary protective equipment.
- 2.6.3 Shall ensure that required guards and protective equipment are provided, used, and properly maintained.
- 2.6.4 Shall ensure that tools and equipment are properly maintained and used.
- 2.6.5 Shall plan the workload and assign employees to jobs which they are qualified to perform. Ensure that the employees understand the work to be done, the hazards that may be encountered, and the proper procedure for doing the work safely.



- 2.6.6 Shall take immediate action to correct any violation of safety rules observed or reported to them.
- 2.6.7 Shall ensure workers exposed or potentially exposed to hazardous chemicals/materials have access to appropriate Material Safety Data Sheets (MSDS) and that appropriate precautions have been taken as per the recommendation.

2.7 OH&S Committee.

- 2.7.1 Shall develop the OH&S Manual.
- 2.7.2 Shall define OH&S Policy and Requirements.
- 2.7.3 Shall establish design criteria of a plant or its components.
- 2.7.4 Shall establish the requirements and scope of training of employees and provide for training in specific tasks as needed.
- 2.7.5 Shall review and approve requests for variance from the rules, regulations and procedures set forth in the Ellenbarrie OH&S Manual.
- 2.7.6 Shall review the design and operation of existing and proposed systems in the company for adherence to regulatory requirements.
- 2.7.7 Shall identify unsafe conditions and/or practices and assist in the development of corrective action plans.
- 2.7.8 Shall review incident investigation reports and recommend preventive measures.
- 2.7.9 Shall document meetings, inspections, and other OH&S activities undertaken by the Committee.

2.8 Vendors

- 2.8.1 Shall demonstrate compliance with the OH&S criteria.
- 2.8.2 Shall provide information required to complete an OH&S analysis of the system or component in final, installed configuration, and to estimate interaction with any connected systems.

2.9 Corporate Safety

- 2.9.1 Shall advise all concerned departments in planning and organizing measures necessary for effective control of loss pertaining to injury and product damage.
- 2.9.2 Shall carry out safety inspections through concerned departments and suggest remedial measures to prevent recurrence.
- 2.9.3 Shall design and conduct training and educational programs through concerned department for all levels in the organization.
- 2.9.4 Shall check the efficacy of the action taken to prevent loss.
- 2.9.5 Shall advise the purchase and store department on procurement of safety items on their quality and efficacy in preventing loss.
- 2.9.6 Shall advise all departments on matters related to reporting and filling up of formats and procedures framed to prevent loss.
- 2.9.7 Shall catalyze investigation into causes and circumstances of every incident either independently or through concerned department or unit.
- 2.9.8 Shall promote formation of safety committee and act as catalyst or adviser to such committee.
- 2.9.9 Shall organize safety awareness campaign either independently or through concerned department to promote education on safety.



2.9.10 Shall monitor and maintain such records that are deemed to be necessary for smooth discharge of his duty.

3. Training

- 3.1 The training needs of the employee shall be identified and the same shall be included in the training road map of the organization as well as that of the individual.
- 3.2 HR shall obtain nominations for the forth coming training programs from the Plant Manager, Business Unit Head, Departmental Heads and the Head Safety.
- 3.3 The HR shall notify the participants, monitors their participation and take a feedback.
- 3.4 HR shall maintain the training records.
- 3.5 The Plant Manager, Business Unit Head, Departmental Heads and the Head Safety shall monitor the efficacy of the trainings imparted to their respective personnel and provide a feedback.

4. Tool Box Talk

- 4.1 Supervisors shall normally conduct weekly tool box talks with their team or conduct them before start of any job.
- 4.2 Dates of meetings, venue, time and the Health and Safety topics discussed shall be recorded in the section's Health and Safety Log.
- 4.3 The HSE Department shall provide the supervisor with health and safety materials to aid them in conducting these meetings.
- 4.4 Toolbox talks shall also be conducted with the contractor staff.
- 4.5 The following points are covered in a tool box talk:
 - a) Specific hazards associated with a certain job.
 - b) Risk Control measures that need to be taken.
 - c) Any residual risks remaining.
 - d) Case studies of any previous incident.
 - e) Proper use of the appropriate PPE.
 - f) Motivation towards a safer attitude.

5. Office safety

5.1 Lighting

- 5.1.1 Lighting and light levels shall be checked periodically to ensure that satisfactory standards are maintained.
- 5.1.2 Light fittings shall be regularly cleaned to maintain optimum light output.
- 5.1.3 Light fittings shall be protected from contact and the height of the ceiling shall be not less than 10 ft.
- 5.1.4 The office upholstery and walls shall be so designed and coloured that maximum utility of the illumination sources are obtained but the glare effect is prevented.
- 5.1.5 All the passages, isles and corners shall be well illuminated so that the slip, trip and fall hazards are effectively controlled.



5.2 Work Areas

- 5.2.1 All floors shall be kept in good condition and free from obstruction. They shall be regularly cleaned and any liquid spillage shall be immediately removed.
- 5.2.2 All exit routes shall be earmarked conspicuously and must be kept clear at all times.
- 5.2.3 The office management shall suitably carry out a safety inspection in their area.
- 5.2.4 All waste bins shall have a closed cover.
- 5.2.5 All stairways, passageways, gangways, and access ways shall be kept free of materials, supplies, and obstructions at all times.
- 5.2.6 After any office maintenance job protruding nails in scrap boards, planks, and timbers shall be removed, hammered in, or bent over flush with the wood. After removing, protruding nails shall be collected and properly disposed in designated area. Other work related wastes like cut pieces, scrap, etc also shall be collected and moved to scrap yard for appropriate disposal.

5.3 Signage

- 5.3.1 Adequate safety signs shall be available to indicate (even during dark hours) the permanent (e.g. Fragile Roof, No Smoking) and temporary hazards (e.g. Slippery Floor), fire extinguishers, fire hoses, glass partitions and emergency exit route.
- 5.3.2 The location of facilities like First Aid Box, emergency shower, electrical switch boards, bathrooms, pantry etc. shall be conspicuously marked such that these are visible even during dark hours.

5.4 Material Storage

- 5.4.1 No cabinet drawer shall be left opened.
- 5.4.2 All the drawers of the cabinets shall not be opened at the same time.
- 5.4.3 Objects shall be stored neatly inside cabinets, not on top.
- 5.4.4 Pointed and sharp objects such as drawing instruments and scissors shall be stored in a proper case or cover when not in use.
- 5.4.5 Pointed edge scissors shall not be used inside a First Aid Box.
- 5.4.6 The use of razor blades is prohibited.
- 5.4.7 Stationery shall be stored in such a position as to provide easy access for staff to avoid the possibility of injury due to awkward lifting and carrying.
- 5.4.8 The stationery store shall strictly be a NO SMOKING zone.
- 5.4.9 Loose or light material shall not be stored or left on roofs or floors that are not having toe guards or parapet wall.
- 5.4.10 Tools, materials, extension cords, hoses, or debris shall not cause tripping or other hazards.
- 5.4.11 Tools, materials, and equipment subject to displacement or falling shall be adequately secured.

5.5 Fire Precautions

- 5.5.1 A clean desk policy shall be brought in place to slow the rate of fire spread.
- 5.5.2 Electrical apparatus not required to operate overnight shall be switched off before the occupant leaves for the day.
- 5.5.3 All employees shall be trained in the action required in case of fire.
- 5.5.4 Drills shall be carried out regularly to test employee's knowledge of the emergency procedures.



- 5.5.5 There shall always be a supply of ashtrays where smoking is allowed.
- 5.5.6 Hose reels, fire alarms, fire extinguishers and other emergency equipment must be checked once a month for readiness and operability.
- 5.5.7 Electrical appliances, wiring and other fittings and fixtures shall be inspected once in a month by a competent electrician and suitably attended to.

6. Work at height

6.1 General precautions

- 6.1.1 A Job Safety Analysis shall be prepared for all height activities on or more than 1.8 meters from existing floor level. The recommendations in the JSA shall be discussed in the tool box meeting.
- 6.1.2 The persons deployed for height work shall be physically and mentally fit.
- 6.1.3 Appropriate signage and barriers shall be placed below the works to warn of overhead operations.
- 6.1.4 Where edge protection is removed for access, or is not practicable, drivers working at or near the edge shall wear safety harnesses properly anchored to a secured lifeline.
- 6.1.5 Where fall of materials is expected, full enclosure around the work platform shall be provided to protect third parties.
- 6.1.6 Training and instructions shall be provided to all workmen and supervisory staff involved on the inspection and use of lifeline and harness before use.
- 6.1.7 For working at height more than 1.8 meters and within 1.5 meters from the edge of a structure, a full body harness with a lanyard of 2 meters shall be used.
- 6.1.8 Only double lanyard full body harnesses conforming to EN 361 and having authorized CE marking shall be used by all workmen at height. The lanyards and lifeline shall have enough tensile strength to take the load of the worker in case of a fall. One end of the lanyard shall be firmly tied with the harnesses and the other end with lifeline. The harness shall be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself. The life line shall be strong enough to withstand a load of 5000 pounds.
- 6.1.9 Roof Top Walk Ladders shall be provided for carrying out activities on sloping roofs or top of pressure vessels, in order to reduce the chances of slippages and falls.
- 6.1.10 A proper Safety Net System shall be used wherever the hazard of fall from height or of fall of objects is present. The Nets shall be of knotted type and shall conform to IS 5175/ ISO 1140. It shall have a border rope and tie cord of minimum 12mm dia. The Safety Net shall be located not more than 6.0 meters below the working surface extending on either side up to sufficient margin to arrest fall of persons working at different heights.

6.2 Scaffolding

- 6.2.1 An authorized person shall erect all scaffolds. As a minimum, the scaffolding shall have a suitable information tag completed and attached to the point of entry, and the scaffolding shall be maintained and shall be inspected once every shift.
- 6.2.2 Scaffolding shall:
- Have ladder access.
 - Have handrail at 42 inches from the deck, a mid-rail at 19 inches from the deck and toe guard (4 inches deep) starting from the from the deck.



- a) Handrails and top rails of the stair rail systems must be able to withstand, without failure, at least 200 pounds of weight applied within 2 inches (5 cm) of the top edge in any downward or outward direction, at any point along the top edge.
- b) Have tied or locked decking.
- c) Have timber sole plates (not concrete).
- d) Be tied in at every 6 meters or outriggers fitted when height is twice the base or more.
- e) Be professionally designed and approved.
- f) Not have any modification or damage to any component.
- g) Not have any component that is substandard.
- h) Not be constructed out of any material other than MS tubes and MS clamps.
- i) Mobile scaffolds shall not have a minimum-base-dimension to height ratio of more than 1: 4.
- j) The maximum height of a mobile scaffold shall not be more than 9.6 meters extendable up to 12 meters if the same is anchored to a rigid structure.
- k) The castor wheel shall have a locking device to paralyze movement of the scaffold while in use.
- l) Horizontal bracings shall be provided to prevent disfigurement of the mobile scaffold due to torsion forces while movement.

6.3 Ladders

6.3.1 All ladders shall be inspected prior to every use.

6.3.2 Requirements for ladder use are listed below.

- a) The ladder shall be tied-off and secured. The slip resistant shoe shall be available with all ladders.
- b) Ladders shall never be placed against unlocked doors. Appropriate barricade and signage shall be provided at the base of a ladder that is in use.
- c) The ladder inclination ratio of base to height will be 1:4.
- d) If used on a platform (landing), the ladder shall extend at least one meter / three feet past the platform.
- e) Personnel shall not stand on the top 3 rungs.
- f) Personnel shall maintain a grip on the styles, not the rungs.
- g) The shoe soles of the climber and the rungs of a ladder shall be free from slippery substances e.g. grease, slush, etc.
- h) Conductive (e.g., aluminum) ladders for electrical work or near electrical installations shall not be used. For all electrical work, only non metallic electrical work ladders are to be used. Use of wooden ladders is however prohibited.
- i) The maximum height for a ladder is six meters / 18 feet after which there shall be a landing.
- j) When using extension ladders, the overlap shall be a minimum of $\frac{1}{4}$ of the height. Fastening, joining, overlapping of ladders not designed for the purpose is not allowed.
- k) Ladder shall not be overloaded beyond the manufacturers' recommended limit.
- l) Step-across distance between the center of the steps or rungs of fixed ladders and the nearest edge of a landing area must be no less than 7 inches (18 cm) and no more than 12 inches (30 cm).



- m) For caged ladders bottoms of cages must be between 7 feet (2.1 m) and 8 feet (2.4 m) above the point of access to the bottom of the ladder. The bottom of the cage must be flared not less than 4 inches (10 cm) between the bottom horizontal band and the next higher band. Tops of cages must be a minimum of 42 inches (1.1 m) above the top of the platform or the point of access at the top of the ladder. There must be a way to access the platform or other point of access.
- n) Tag defective ladders as "DO NOT USE" and store them separately or dispose if irreparable.

7. Hot Work

7.1 General Precautions

- 7.1.1 All welding, cutting and other hot jobs shall be carried out under Permit to Work (PTW).
- 7.1.2 In areas where flammable chemicals are present, work shall be commenced only after all necessary decontaminations and protective measures to isolate and cordon off the area are taken.
- 7.1.3 Remove all inflammable materials from the proximity of the hot work.
- 7.1.4 A fire watcher shall be present throughout the tenure of the job and leave the spot after ensuring that there is no trace of any incipient fire.
- 7.1.5 Hot work shall be carried out only under effective supervision.
- 7.1.6 Fire extinguisher of the suitable type shall be ready for instant use in any location where hot work is being performed.
- 7.1.7 Screens, shields, fire blanket or other safeguards shall be provided for the protection of personnel, equipment and materials exposed to sparks, slag, falling objects, or the direct rays of the arc, and molten slag or sparks.
- 7.1.8 Take special and extreme care in areas using any flammable gas, flammable mixture or vapour.
- 7.1.9 Hot works involving electricity shall not be carried out without adequate rain protection to the machines.
- 7.1.10 Before carrying out any hot work inside a confined space, a gas tester shall be used to detect the presence of any inflammable mixture or potential oxygen enrichment.

7.2 Welding

- 7.2.1 Visible earthing of the welding machine and the job on the spot shall be done using a 3.15 mm GI wire and an earth spike (16 mm diameter GI spike, 2 meters long).
- 7.2.2 Proper welding cable and return cable shall be used for the job. These shall be connected to the job using C clamps. The use of weld-jointed tor steel rods as return cables shall be prohibited.
- 7.2.3 Welding cables shall be fitted as well as joined (lengthened) with properly sized welding lugs. Lugs shall be fixed using a crimping machine. Hammering of lugs shall not be allowed.
- 7.2.4 Welding machines shall not be placed within the hazardous plant area.
- 7.2.5 Welding shield and welding goggles with filters (Shade 11 - 14) certified for welding work shall be used. As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum.
- 7.2.6 Welding helmet with attached face shield, leather hand gloves, leather apron, thick and dry cotton attire without pockets, an inorganic nose mask and a pair of safety shoes are the required PPEs for the job.
- 7.2.7 Sweat soaked and rain soaked PPEs and apparels shall be avoided.
- 7.2.8 The location where welding is in progress, shall be dry.
- 7.2.9 The electrode holder shall be ISI marked and adequately insulated.



7.3 Gas cutting

- 7.2.1 In case of gas cutting a cylinder trolley shall be used and the cylinders shall be secured with a chain arrangement.
- 7.2.2 The cylinders shall be stored in upright position.
- 7.2.3 Use only hoses in perfect condition and visually examine for cracks and kinks and replace with new hoses if needed. Ensure that the connections are properly made and clamped.
- 7.2.4 Only Dual gauge regulators shall be used for both the cylinders in the cutting set.
- 7.2.5 Check for leakages immediately on open first oxygen gas control valve on the oxygen cylinder and check for leaks. Maintain a soap solution spray bottle to check for leakages.
- 7.2.6 Keep gas cylinders away from direct sunlight. Wrap using wet hessian cloth during summer season.
- 7.2.7 Oxygen cylinder fittings shall be free of oil and grease.
- 7.2.8 Open the oxygen valve first while starting the torch and close acetylene first while closing the torch.
- 7.2.9 Safety helmet, gas cutting goggles, flexible chrome leather hand gloves, leather apron, thick and dry cotton attire without pockets, an inorganic nose mask and a pair of safety shoes are the required PPEs for the job.
- 7.2.10 Others not performing cutting work and not wearing the cutting goggles or mask shall not watch the job.
- 7.2.11 The use of appropriate Flash Back Arrestors on both ends of the hose is a must.
- 7.2.12 The pin holes of the torch shall be cleaned as and when required to avoid chances of a back fire.

7.4 Grinding

- 7.4.1 Grinding machine and wheels shall be inspected prior to each use for defects such as signs of fracture, cracked handles, damaged cutting edges, splitting or cracked parts, and broken adjusting components. The electrical components like power cord, plug and socket for correct fitting shall also be checked.
- 7.4.2 The r.p.m mentioned on the wheel shall always be more than or equal to the machine r.p.m. both these information are visible on the machine as well as the wheel.
- 7.4.3 Grinders deployed on the job shall be physically fit.
- 7.4.4 Safety helmet, transparent face shield, flexible chrome leather hand gloves, leather apron, thick and dry cotton attire without pockets, a pair of ear plug, shin (leg) guard, and a pair of safety shoes are the required PPEs for the job.
- 7.4.5 Grinders shall not wear loose clothing.
- 7.4.6 Grinders shall not apply undue pressure on the equipment.
- 7.4.7 The sides of the cutting discs shall not be used for de-burring, chamfering or polishing.
- 7.4.8 Grinding machines shall have guards in place during their operation. Portable grinders shall be provided with hood type guards with side enclosures that cover the spindle and at least 50% of the wheel.
- 7.4.9 Bench grinders shall be equipped with deflector shields and side-cover guards.
- 7.4.10 An abrasive wheel shall not be abruptly applied to a job immediately after starting; neither shall it be suddenly brought to a standstill. A minimum rotation time of 30 seconds shall be allowed.
- 7.4.11 Any job shall be firmly clamped before applying an abrasive wheel to it.
- 7.4.12 The locking device of the grinding machine push button shall either be paralyzed or never used.

7.5 Drilling



- 7.5.1 The drilling machine shall be duly earthed before starting.
- 7.5.2 The drilling machine shall be placed on a firm base, Preferably a PCC.
- 7.5.3 Portable drilling machines shall be placed on a wide base and not engaged to the job unless the magnetic base has gripped the surface firmly.
- 7.5.4 The job shall be clamped firmly to a bench before being drilled.
- 7.5.5 Blunt drill bits and misfit drill bits shall not be used.
- 7.5.6 The driller shall never wear loose sleeved shirt or attire.
- 7.5.7 The driller shall either wear tightly fitting hand gloves. Loose gloves are strictly prohibited.
- 7.5.8 The driller shall wear a pair of safety goggles apart from the other PPEs.
- 7.5.9 The machine guards and the junction box guards shall be in place.
- 7.5.10 The steel scraps are sharp in nature and shall be removed using a brush.
- 7.5.11 The coolant pipe shall not be replaced by a water bottle.

8. Confined Space Entry

8.1 Definition

A Confined Space is defined as an enclosure which (a) is not designed for normal human occupancy, (b) has enough space to contain a person performing his job and (c) has limited and constricted means of entry and exit.

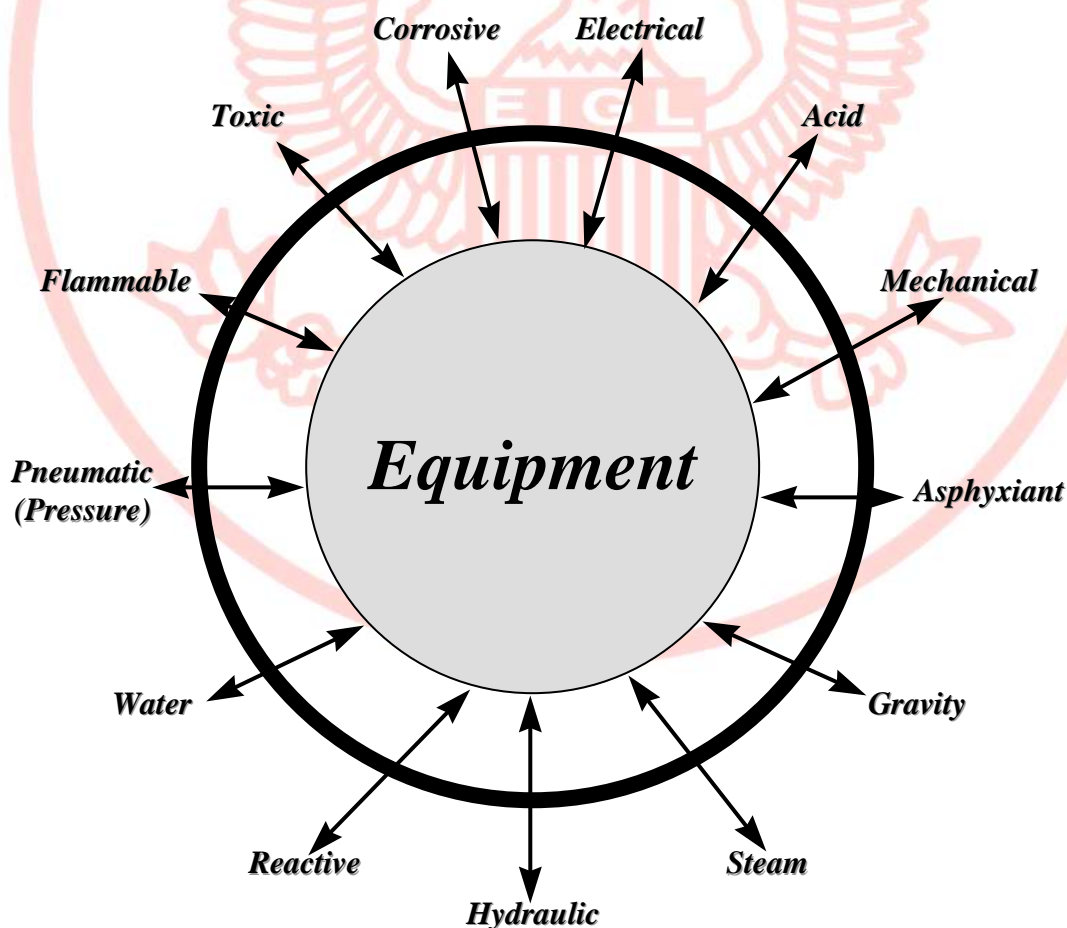
All Cooling Towers, Cold Box (ASU), Cold Box (Turbine Duct), Cold Box (Argon Pump Duct, PPU Vessels, Dust Filters, Liquid Storage Tanks, Compressor Oil Coolers, Water Softener, Water Filter, Air Suction Filter House, Gas holders, Septic Tanks, over head water tanks, underground septic tanks, drain water catch pits, and any other chambers, vats, pipes, tanks and flu where there is a possibility of a bodily entry and also a possibility of removing the covers.

8.2 Procedure

- 8.2.1 Work Permit shall be obtained before entering a confined space. All precautions mentioned therein shall be adhered to.
- 8.2.2 A job safety analysis shall be done and documented before attempting a confined space entry.
- 8.2.3 All the persons involved in the Confine space activity shall be adequately trained and checked for physical and mental fitness.
- 8.2.4 Toolbox Talks shall be given to those drivers who have to perform work inside a confined space.
- 8.2.5 The Permit Issuer shall be present during the operation.
- 8.2.6 A trained attendant shall be positioned outside a confined space throughout the tenure of the activities for extending help during an emergency.
- 8.2.7 A register shall be maintained to log each entry and exit.
- 8.2.8 It shall be ensured that the piping of the equipment which has to be opened is pressure-free by checking that blinds are in place, vents are open and volume is drained. Flood potential and isolation shall be checked.
- 8.2.9 A thorough and fool proof LOCK OUT/ TAGOUT/ TRYOUT system shall cover the entire confined space activity.
- 8.2.10 Before entry and while work is in progress inside the confined space, the area shall be tested continuously for any gases/hazardous emissions using a suspended gas detector.



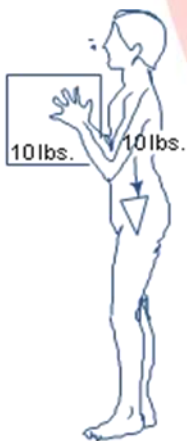
- 8.2.11 Emergency Breathing Apparatus, rescue harness, lifting equipment, resuscitation facilities, 24 volt lamp, safety line, etc., shall be provided where necessary along with other mandatory PPEs.
- 8.2.12 Emergency vehicle shall be made available during confined space activities.
- 8.2.13 A communication system with those in the confined space shall be established.
- 8.2.14 Surrounding areas has to be barricaded. Proper signage/warning lights shall be placed to give warning.
- 8.2.15 If required a guard shall be placed with flag to warn vehicles.
- 8.2.16 Work notification shall be provided to all those departments and agencies that are affected by the job and those who would be handy during an emergency.
- 8.2.17 Internal combustion engines shall not run for long periods in confined spaces unless adequate exhaust ventilation is provided.
- 8.2.18 Compressor shall be equipped with suitable arrangements for preventing contamination where persons are working in confined spaces.
- 8.2.19 In confined spaces where the use of toxic solvents, certain thinners, certain paints or volatile chemical substances cannot be avoided, special precautions shall be taken such as providing general and local exhaust ventilation, and, if this is not practicable or is inadequate, respiratory protective equipment shall be used.
- 8.2.20 Prior to the start of any work on or in equipment all potential sources of energy or other hazards must be identified and isolated. The "Circle of Safety" is intended to be the reminder/memory jogger that assists personnel in identifying all sources of energy going in or coming out of a piece of equipment.



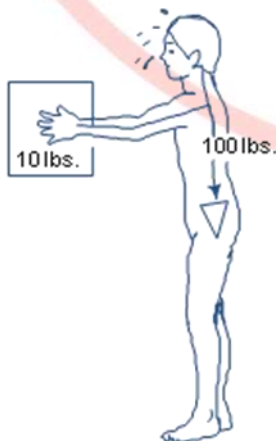


9. Manual Material Handling

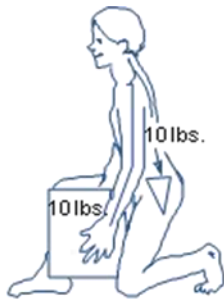
- 9.1 For very heavy loads avoid lifting alone and get help of others or use tools for lifting.
- 9.2 Use a wheel barrow more often for transporting a load along a small distance.
- 9.3 For manageable loads, get down close to the load, before lifting it.
- 9.4 Checkup whether the person engaged is physically fit for the lift or not.
- 9.5 Get a good grip and ensure that hands are not slippery.
- 9.6 Keep a straight back (a bent back can cause back sprain).
- 9.7 Lift gradually raising your legs.
- 9.8 Do not jerk or twist your waist while the load is lifted.
- 9.9 Materials shall be properly stacked and secured to prevent sliding, falling or collapsing.
- 9.10 Keep hands clear of traps between materials while using mechanical appliances to handle materials.
- 9.11 Use trolleys for shifting cylinders and chemical drums.
- 9.12 Safety helmet, safety shoe and a pair of appropriate hand gloves are mandatory PPE for manual material handling.
- 9.13 Keep the path clean, along which you intend to travel with the load.
- 9.14 Do not carry anything that may obstruct your vision.
- 9.15 Do not climb a staircase with both hands engaged to carry load.
- 9.16 Maximum load to be lifted or carried or moved without mechanical aid by a physically fit, adult male is 55 Kg; an adult female is 30 Kg; an adolescent male is 30 Kg; and adolescent female is 20 Kg; a male child is 16 kg and a female child is 14 Kg.
- 9.17 Pregnant women shall not be engaged for lifting, carrying, moving any material, article, tool or appliance.



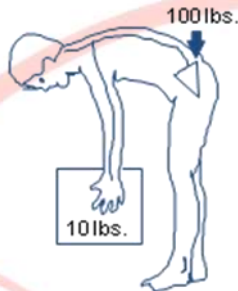
YES
10 POUND BOX
10 POUNDS PRESSURE ON THE SPINE



NO
10 POUND BOX
100 POUNDS PRESSURE ON THE SPINE



YES
10 POUND BOX
10 POUNDS PRESSURE ON THE SPINE



NO
10 POUND BOX
100 POUNDS PRESSURE ON THE SPINE

10. Mechanical Material Handling

10.1 General Precautions

- 10.1.1 Lifting of any load more than 5 Tons, loading a lifting appliance to more than 85 % of its safe working load, multi-crane lifting , any lift where the load passes over process lines or equipments and any lift where the driver faces obstructed vision shall be carried out only after obtaining a Permit To Work.
- 10.1.2 All other works shall be preceded by a Job Safety Analysis.
- 10.1.3 Lifting tools, tackles and appliances shall be subjected to test and certification by third party local government authorized (TPLGA) competent person once in every 12 months. For manual hoist the interval is once in every 6 months.
- 10.1.4 All hoisting tackles shall conform to the standard specifications.
- 10.1.5 Chains, rings, hooks, shackles, swivel and end links for hoisting and sling chains shall be made of forged steel and of the relevant standard specification and make. These are crucial parts of any hoisting system and no compromise shall be made regarding their quality. Mild steel and wrought iron parts shall be avoided.
- 10.1.6 The safety factor for all hoisting tackles shall be not less than six. This means the yield load shall be six times the maximum permissible load.
- 10.1.7 Use of polyester web sling and wire rope sling shall always be preferred ahead of chains.
- 10.1.8 The Safe working load in Kilogram/Tons, the date of inspection and the test certificate number shall be conspicuously marked on all hoisting equipments.
- 10.1.9 Hoisting equipments and other lifting tackle shall NEVER be loaded beyond the certified safe working load limit of each hoist or any other lifting tackle.
- 10.1.10 If the lifting tackles have been exposed to extremely low temperature for several hours, the same shall be allowed to warm up before being used. Cold steel is brittle and hence liable to fail.



10.1.11 Lifting tools and tackles shall not be exposed to corrosive and moist atmosphere.

10.2 Cranes

- 10.2.1 The surface on which a crane has been placed shall be a hard one.
- 10.2.2 No person shall stand in a position of danger in the course of the lifting operation. All persons shall be clearly beyond the swing area of the lifting appliance.
- 10.2.3 In case of unmanned cranes, it is the duty of the lift supervisor to take the responsibility of cranes being operated within the permissible loads and sling strengths.
- 10.2.4 Loads shall always be raised and lowered smoothly and no jerky operations shall be made.
- 10.2.5 In case of mobile cranes, the safe working load at various angles of the boom shall be clearly indicated on such cranes, and suitable indicators shall be affixed showing the angles of the boom in the various positions.
- 10.2.6 Before leaving an unloaded EOT crane, the hooks and slings shall be raised to a height which will clear all instruments, pipelines, equipments, fixed and moving object below such as pedestrians or vehicles etc.
- 10.2.7 The cabin doors of a vacant crane shall always remain in locked condition.
- 10.2.8 The lift supervisor shall get the crane driver to thoroughly check that the controls of the crane/hoist, load indicators, limit switches and other electrical/mechanical devices are in proper working conditions.
- 10.2.9 While lowering the hook block, care shall be taken to ensure that at least two wraps of cable are left on the drum after the tip of the hook is 12 inches above the existing floor level. The same parameter shall be taken care even when the hook is lowered into a pit.
- 10.2.10 When two EOT cranes are operating on the same rails, they shall maintain safe distance of 10 meters in between.
- 10.2.11 The hoisting cable shall not be slung around a load and used as a sling.
- 10.2.12 When a mobile crane is being moved, the route of movement shall be first surveyed to look out for obstructions.
- 10.2.13 Man baskets shall be lifted only after a thorough load calculation has been done and taking a factor of safety as 10. Articulated cranes (Hydra) shall not be used for lifting persons.
- 10.2.14 Any lifting appliance shall be checked on arrival in terms of lifting abilities, safety and legal requirements.
- 10.2.15 It shall be ensured that the lifting appliance is not overloaded and the loads are properly slung, both as regards to strength of the slings and the position. The driver's decision in this regard shall be treated as final and never over ruled by any authority.
- 10.2.16 A properly trained person having a sound knowledge of standard signal communication system for crane /hoist operation shall be specifically earmarked and no other person other than the authorized one shall undertake the job.
- 10.2.17 If it is inevitable to pass under any overhead electric or any other structure, then the permission of the concerned electric or other authority has to be taken and the following shall be ensured:
- a) The power supply in the overhead lines along the route shall be disconnected.
 - b) There shall be at least six feet clear space between the overhead cable or structure and the crane head. If not the crane arm shall be fully lowered and the condition of clearance ensured.
- 10.2.18 Under no circumstances, any attempt shall be made to raise the overhead cables to allow free passage of the crane.



10.3 Chains

- 10.3.1 Chains shall be examined for wear and tear and elongation and if the elongation of the chain is more than 5% of the original length (which shall be recorded in the test register) or the link wear exceeds one fourth the original thickness, then in either case, the chain shall be rejected.
- 10.3.2 Chains are susceptible to breakage without warning as any fine hair cracks may not be noticeable.
- 10.3.3 Repairs to damaged chains and other hoisting tackle shall be avoided.
- 10.3.4 No hot work what so ever shall be performed on a chain. Chains subjected to any form of heat shall be rejected.
- 10.3.5 Chains shall not be wrapped around a load or made to form a knot.
- 10.3.6 Dead ends of a chain shall never be locked using lock and keys, nuts and bolt, D shackles or any other device.
- 10.3.7 When not in use chains shall be properly placed in a non-rusting area by avoiding moisture and corrosive atmosphere. Unused chains and other tackle shall never be left in the open.

10.4 Wire rope

- 10.4.1 Eye splices and hooks for the attachments of hooks, rings and other parts to wire rope shall be provided with suitable thimbles.
- 10.4.2 Wire ropes shall be inspected visually before each use and any defects like kinks, snapped wires, rusting etc. shall be reported and such wires taken off duty and replaced.
- 10.4.3 Fastening of the wire rope shall be examined regularly by the driver of the hoist and all the loose clips and clamps tightened properly before use.
- 10.4.4 In order to prevent rusting of the wire ropes and ensure their pliability, all wire ropes shall be lubricated by the recommended fresh lubricant. Used oils and greases shall not be used as these may contain acids and alkalis that corrode the wire ropes.
- 10.4.5 Wire ropes not in use shall be stored in a safe place free of corrosive atmosphere and moisture.
- 10.4.6 Rejection criteria for a wire rope is as follows: (a) Ten randomly distributed broken wires in one rope lay or (b) five broken wires in one strand in one rope lay.
- 10.4.7 Where double or multiple slings are used for hoisting purposes, the upper end of the slings shall be connected by means of a suitable shackle or a ring and shall not be placed separately on the lifting hook.
- 10.4.8 When placing hoist slings around sharp edges or with projections etc., that might damage the sling, cloth or corrugated paper or other soft pads shall be inserted between such sharp edges and projections etc., of the load and the sling.

10.5 Hooks and rings

- 10.5.1 Specifications shall be suitably tagged on to the hooks and rings along with the date of last inspection and the maximum safe load allowed.
- 10.5.2 The safe working load of a hook and a ring shall be at least equal to the sum total of all the maximum safe loads of each chain that is attached to the ring and the hook.
- 10.5.3 When a hook has been bent by over loading or any other cause, the same shall be rejected and no attempt to be made to rectify and reuse.
- 10.5.4 Hooks with eroded shank and spread out throat shall not be used.

11. Personal Protective Equipments (PPE)



Note: Several types of controls for hazards exist at your location. These include the following:

1. *Engineering controls— Eliminate hazards through design or process changes.*
2. *Administrative controls— Reduce hazards through company policies.*
3. *Work practices—Specific methods used to reduce the potential hazards of a task.*

Unfortunately, these controls do not always provide adequate protection. Therefore, another type of control method shall be used—personal protective equipment (PPE).

11.1 General guidelines on use of PPE

- 11.1.1 PPE provides protection when other controls do not meet the full protection required.
- 11.1.2 All those PPEs that are likely to be in prolonged contact with the epidermis of the user (likely to cause dermatological or other infections due to using of the same PPE by multiple users) and also likely to be in demand for each individual during an emergency situation, shall be issued to each employee based on his job nature, on a personal-use returnable basis.
- 11.1.3 The employee shall be responsible for maintaining his PPEs in good repairs till the next date of issue, as decided by the management. Some of the PPEs that fall under this category are safety helmet, safety shoes, safety goggles, ear plug, nose mask, consumable hand gloves, etc. the mandatory ones being safety helmet, safety shoes and safety goggles for all the unit based employees.
- 11.1.4 The above concept shall not be applicable for extremely expensive PPEs like Self contained breathing apparatus, flash proof clothing, etc.

11.2 Eye and Face Protection

- a) Eye and fact protection shall be used when there is a possibility of exposure Flying particles (perlite, veralite, dust, etc.), Chemicals (liquid, gaseous, dry), Acids or other chemicals that can burn, corrode, or dissolve, Hazardous light radiation or welding and Cryogenic liquids
- b) In situations involving multiple hazards, more than one type of eye and face protection shall be used.

The most common types of eye and face protection are:

11.2.1 Face shields

- a) Face shields shall be at least 8 in (20.3 cm) long to protect your face from chemical splashes.
- b) Face shields provide some protection from flying objects, but not complete protection. Therefore, it may be necessary to wear safety goggles with the face shield.
- c) Welders shall use the appropriate welding shield to protect their eyes. The type of shield and protective shade depend on the level of light produced from the welding operation.

11.2.2 Safety Goggles

It is important to select a goggle that is appropriate for the work and the associated potential hazards. When equipped with impact resistant lenses, goggles provide protection against vaporized chemicals, splashes, large particles, and flying objects.

- a) All eye and face equipment shall meet ANSI Z87.1 standards. Eye and face protection shall be stamped with the standard on the temple, bridge, and on the lens of the safety goggles or face shield.
- b) If you are required to wear eye and or face protection, and you wear corrective lenses, you may opt for one of the following:
 - i. Eye protection that has corrective lenses built in.



- ii. Eye protection that can be worn over corrective lenses without interfering with the position, function, or protection of the lenses.
- c) Ensure that all eye and face protection is properly fitted and worn. (A proper fit will prevent hazardous materials from entering your eyes). Be sure to visually inspect all eyes and face protection for damage prior to use.
- d) Ensure that all eye and face protection is kept clean and in good condition. Do not use scratched, cracked, or otherwise damaged lenses.

11.3 Head Protection

Note: *Employees must wear head protection if a potential for injury from head impact and/or falling or flying objects such as falling cylinder caps or work beneath cylinder pallets, hose or pigtail whipping, overhead work, a process task that requires maneuvering in, around, or beneath equipment at head height or lower, warehouse locations where storage of materials is above the head level and not secured and work performed near exposed electrical conductors that could contact the head.*

- 11.3.1 Helmet shall be worn at all times during duty hours.
- 11.3.2 All safety helmets shall meet the ANSI Z89.1 standards.
- 11.3.3 Hard hat shall be so worn that the shell sits squarely on the wearer's head, not tipped to the back or side.
- 11.3.4 Hard hat shall not be modified in any way. (Name or company's logo stickers do not compromise the integrity of the helmet). However, metallic stickers or lager stickers that cover a large portion of the helmet shall not be used. No one shall drill holes in the hard hat. No one shall paint or mark the hard hat.
- 11.3.5 Suspension system shall not be removed.
- 11.3.6 Hard hats shall not be used for restoring and carrying items.
- 11.3.7 Hard hat shall not be worn with the chinstrap on or the suspension ratchet so tightened that unintended removal is prevented.

11.4 Proper Maintenance and Care of Head Protection

- 11.4.1 Hard hat shall be protected from direct sunlight, extreme heat, or extreme cold.
- 11.4.2 Hard hat shall be inspected for damage, dents or cracks, cracks or broken cradle straps and loose headbands before and after each use.
- 11.4.3 Broken or defective hard hat shall be disposed off.
- 11.4.4 The manufacturer's guidelines shall be followed for maintenance and replacement.

11.5 Foot Protection

Note: *All employees working in areas where there is a potential for foot injury shall wear steel-toed footwear. All personnel that routinely handle cylinders as part of their job shall wear metatarsal protection. Safety footwear shall protect against Oil, Chemicals, Water, Heat, Metal chips, Slip and Abrasions*

- 11.5.1 Safety foot wear shall be worn at all times during duty hours.
- 11.5.2 Ensure that the footwear complies with ANSI standard Z41-1991. This certification indicates the footwear will provide you with proper protection against impact and compression hazards.
- 11.5.3 The footwear sole shall be slip-resistant.
- 11.5.4 All employees shall to wear appropriate protective footwear while at work.



- 11.5.5 Protective footwear shall be maintained in good working condition.
- 11.5.6 Protective footwear shall be free from oil and other chemicals.
- 11.5.7 Replace your protective footwear when any of the following such as signs of wear, steel plates showing, Tears or rips in the material, Worn soles, Improper fit, occur.

11.6 Hand Protection

11.6.1 Guideline for hand protection

Employees shall wear hand protection to obtain protection from severe abrasions, punctures, chemical burns, thermal burns, harmful temperature extremes, and from absorbing harmful substances.

Note: Choose the correct hand protection after carefully evaluating the hazards. Some of the hazards are, Abrasions, Pinch points, Cuts, Cold/heat, Chemicals, Oils, Water (moisture). Once all the hazards have been identified the glove material shall be matched to the hazard. (MSDS provides information on recommended glove material for the chemical or product being used.). While selecting gloves for protection, consider Resistance to hazards, Flexibility, Strength, and Expense. The materials must be able to resist degradation from, penetration of, and permeation of contaminants.

11.6.2 Types of Glove Materials

- a) **Cotton:** A good material for a general work glove. It provides protection against abrasions. Cotton gloves come with plastic dotted palms to provide a better grip in wet or dry conditions.
- b) **Leather:** A good material for a general work glove that provides protection against cuts, scrapes, and abrasions.
- c) **Chrome Leather:** A good material used for welders gloves. This material provides protection against cuts, scrapes, abrasions, heat, and flame. These gloves are designed to allow for dexterity.
- d) **Butyl Rubber:** Provides the best protection against most gases and water vapor. It does not provide protection against halogenated hydrocarbons or petroleum products.
- e) **Natural Rubber:** Provides excellent resistance to a variety of acids, solvents and alcohols. It also provides good protection against cuts.
- f) **Neoprene:** Provides resistance to a wide variety of chemicals. It provides good resistance to most caustics, acids, alcohols, oils, and grease.
- g) **Nitrile:** Provides excellent protection against solvents, harsh chemicals, and petroleum. It also provides good protection against cuts, snags, punctures, and abrasions.
- h) **Polyvinyl Chloride (PVC):** Provides excellent abrasion resistance and protection from oils, acids, and caustics.
- i) **Viton:** Provides excellent protection against chlorinated and aromatic solvents and protection from many vapors. This is an extremely expensive material.

Note: There is no one glove that provides protection for all hazards.

- j) If you are using disposable gloves, do not reuse them; they are designed to be discarded. You may also expose yourself to chemical contaminants by using contaminated gloves.

11.7 Respiratory Protective Equipment

- 11.7.1 Respiratory protection is required when the air concentration of a contaminant is higher than the Permissible Exposure Limit (PEL). Respirators may also be used at other times, such as in an emergency situation.



- 11.7.2 Respiratory protection may be necessary while working in containers, restricted areas and gas-fired industrial furnaces where there may be gas or insufficient oxygen, Work in the vicinity of gas pipes, Work in the vicinity of heavy metal fumes, Work on the lining of furnaces and ladles where there may be dust, Spray painting where dedusting is inadequate, Work in shafts, sewers and other underground areas connected with sewage, Work in refrigeration plants where there is a danger that the refrigerant may escape.
- 11.7.3 Respirators shall be properly stored. Damage may occur if they are not protected from physical and chemical agents such as vibration, sunlight, heat, extreme cold, excessive moisture or damaging chemicals.
- 11.7.4 Suitability of Respiratory protective equipments is as shown in Table No 01.

Table No.01

| Parts of body | Hazard / Application for | Name of Safety Appliance | Picture |
|----------------------------|---|---|---|
| Respiratory System & Lungs | Dust | Dust Respirators |  |
| | Dust & Mist | Dust & Mist | |
| | Dust, Mist & Nuisance odor | Respirator for Dust, Mist & Nuisance odor | |
| | Metallic Fume | Fume respirator | |
| | Chlorine, Ammonia, Acid & Organic Vapour up to 20 ppm | Full visor gas mask with canister |  |
| Organic Vapour | Chemical respirator | Cartridge |  |
| Respiratory System & Lungs | Toxic Gases where O2 % is less than 20% | Self contained Breathing Apparatus |  |
| | Toxic Gases where O2 % is more than 20% | Blower type Fresh Air Apparatus | |



| | | |
|--|--|--|
| | For Semi unconscious / Resuscitator / Pneupack / breathing trouble Oxy-pack / Life pack | |
|--|--|--|

11.8 Electrical Protective Equipment

a) Employees who work with or around electrical equipment must use the appropriate PPE. PPE used for electrical protection includes Tested and certified Rubber gloves and sleeves, Rubber covers and mats, Rubber insulating blankets and Flash protective clothing

Note: A flash is a momentary fire or emergency release (0-4 seconds' duration) within a small area; such a fire can generate temperatures high enough to burn exposed skin and/or ignite or melt clothing. Examples are an electrical short circuit powerful enough to create an open air arc or violent ignition of leaking flammable gas.

Note: The sole function of flame-resistant clothing is to minimize body burns if someone is caught within the envelope of a flash.

b) Electrical PPE shall have Markings that indicate the manufacturer, class rating, and size

c) Electrical PPE shall not have seams, Irregularities in shape or durability, cracking, pitting, or breaking.

11.8.1 Proper Use of Electrical Protective Equipment

Electrical protective equipment must be used carefully to provide adequate protection.

Note: ASTM classifies electrical protective equipment from 0 to 4, which indicates the degree of voltage protection the equipment provides. (A higher class number indicates a higher voltage protection). For example, class 2 equipment has a higher voltage protection than class 0 equipment. Ensure the equipment class is appropriate for the electrical hazards you will encounter.

11.8.2 Proper Maintenance and Care of Electrical Protective Equipment

a) Electrical protective equipment shall be maintained in a safe and reliable condition and inspect it before and after each use. During the inspection, check rubber equipment for Holes and punctures, Tears and cuts, Swelling, Softening or hardening and Stickiness or inelasticity.

Note: Do not use any damaged equipment at your facility. Dispose all damaged equipment, or identify it as damaged.

b) Electrical protective equipment shall be stored so that it is protected from Extreme temperatures, direct light, Humidity, Chemicals or substances that may cause damage.

11.8.3 Equipment Testing

All electrical protective equipment must be periodically tested according to Table No.02.

Table No. 02

| Type of Equipment | When to Test |
|------------------------------|--|
| Rubber insulating line hose. | Upon indication that insulating value is suspect. |
| Rubber insulating covers. | Upon indication that insulating value is suspect. |
| Rubber insulating blankets. | Before first issue and every 12 months thereafter. |
| Rubber insulating gloves. | Before first issue and every 6 months thereafter. |
| Rubber insulating sleeves. | Before first issue and every 12 months thereafter. |

11.9 Hearing Protection

Employees who are exposed to noise levels at or above the action level—an 8-hour time-weighted average (TWA8) of 90 decibels (dBA)—shall be required to wear hearing protection PPEs.



The permissible exposure limits in case noise is provided in Table No. 03

Table No.03

| Permissible Exposure in cases of continuous noise. No exposure in excess of 115 dBA is permitted | |
|---|---|
| Total time of exposure(continuous or number of short term exposures) per day, in hours | Sound pressure level in dBA |
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1½ | 102 |
| 1 | 105 |
| ¾ | 107 |
| ½ | 110 |
| ¼ | 115 |
| Permissible Exposure levels in cases of impact or impulsive noise. No exposure in excess of 140 dBA peak sound pressure level is permitted | |
| Peak sound pressure level in dB | Permitted number of impulses of impact per day |
| 140 | 100 |
| 135 | 315 |
| 130 | 1000 |
| 125 | 3160 |
| 120 | 10000 |

11.10 Protective Clothing

- a) Protective clothing covers the skin and body and acts as a barrier. Employees at all Ellenbarrie and customer facilities who may potentially be exposed to oxidizers, flammable gas or liquids, or pyrophoric gases shall wear 100 percent cotton uniforms or uniforms that have been chemically treated so as to be fire resistant. Long sleeves and trousers are recommended because they protect your skin from hazards such as cuts, abrasions, and fire.
- b) Task like Welding, Working with caustics, working with acids, Handling and using solvents, handling various chemicals, packing switchgear shall require additional types of protective clothing. The protective clothing needed for each of these tasks must be made of materials resistant to the chemicals or hazard encountered.

11.10.1 Chemical Protective Clothing

- a) Chemical protective clothing consists of garments that are manufactured to resist the physical and chemical hazards that are inherent in various hazardous materials and substances.

Note: No material has total resistance to all chemical exposure. Check the manufacturer's recommendations for use and the MSDS for the chemical you will be handling.

- b) Inspect clothing after each use. Look for cracks, brittleness, and pin holes. Pay particular attention to seams, zippers, and other wear-points (e.g., elbows, knees, and seat).



- c) Remove and dispose defective garment, clean with water and mild soap.

11.10.2 Gas Welding and Brazing Protective Clothing

- a) Wear a long-sleeved shirt (with the collar buttoned) and cuff less trousers of a non-synthetic material. Cotton is highly recommended; do NOT wear synthetic material unless it is treated with a chemical fire retardant. This clothing shall be dark colored. A welder's apron or Nomex coveralls are also recommended.
- b) Wear high-topped shoes to protect the ankles area against burns from sparks, slag, or splatter.

11.10.3 Gas Torch Cutting Protective Clothing

Follow the above requirements for gas welding, as well as a long-sleeved leather welder's apron and a leather gauntlet and welder's hand gloves.

11.10.4 Arc Welding (Stick) Protective Clothing

- a) Wear dark-colored clothing to reduce reflections and prevent ultraviolet burns to unprotected/uncovered skin areas.
- b) Wear non-conductive dry gloves to minimize the possibility of electrical shock.
- c) Use curtains, or partitions to protect other personnel.
- d) Wear a long-sleeved leather welder's apron.
- e) Wear leather gauntlet and welder's hand gloves to protect your hands from exposure to radiation, sparks, hot or molten metal, and slag particles.

11.11 Safety Harness and Shock Absorber

- a) Full body or chest harnesses are required for confined space entry.
- b) Use chest harnesses for retrieval purposes from difficult locations such as tanks or bins, or as a restraining device. Do not use a chest harness where the possibility of a free fall exists.
- c) Use full body harnesses to arrest the most severe falls.
NOTE: *Whenever there is the potential for a fall, a shock absorber must be used with the body harness. Ensure that the shock absorber has sufficient room to work. In some cases, a rope grab must be used because there isn't sufficient height to allow a shock absorber to function.*
- d) Shock absorbers are for one time use only. Do not reuse them.
- e) When tying-off, ensure that the rope and shock absorber will stop the fall before a person hits the surface. Allow 3½ ft (1.06 m) for elongation of the shock-absorber.
- f) The hook of the full body harness shall be a scaffolding type snap hook.
- g) If there is insufficient room for a shock absorber to work (3½ ft [1.06 m] + the height of the worker + the original length of the shock absorber), use a different method of fall arrest.
- h) Do not punch or cut extra holes in a belt or harness or make any other modifications.
- i) If a belt does not fit properly, replace it with one of the correct size.
- j) Always snap lanyards into the D-ring of the belt or harness; do not snap them into the webbing or leather.
- k) Only use belts, harnesses, and lanyards as PPE.
- l) If belts, harnesses, or lanyards are subject to impact loading as developed in arresting a fall, or damaged or altered in any way, they must be removed from service and destroyed.

NOTE: *No fall protection system guarantees that you will not sustain injuries if a fall occurs.*



11.11.1 Inspection

Prior to each use, carefully inspect the belt, harness, or lanyard for indications of wear or deterioration. Look for webbing cuts, abrasions, burns, and chemical or physical exposure. If there is evidence of damage, remove from service and destroy.

11.11.2 Cleaning

Clean with a mild soap and water.

12. LOCK OUT/ TAG OUT / TRYOUT

12.1 General guideline

- 12.1.1 It is meant to ensure that a piece of equipment cannot be turned on, pressurized or switched on accidentally while an employee is working on it.
- 12.1.2 All Units, Head Office, Workshops, Construction area, Guest house under ELLENBARRIE INDUSTRIAL GASES LIMITED's control and also in those locations where there is a potential for unexpected energization or start-up of an electrical circuit, machine or equipment or a pipe line which has been temporarily paralyzed for employees to perform any servicing or maintenance where the release or stored energy could cause injury.
- 12.1.3 In case of any such activity arising in the customers' premises and in case the customer's LOTOTO policy is in-existent, ELLENBARRIE INDUSTRIAL GASES LIMITED's LOTOTO system shall prevail.

12.2 Definitions

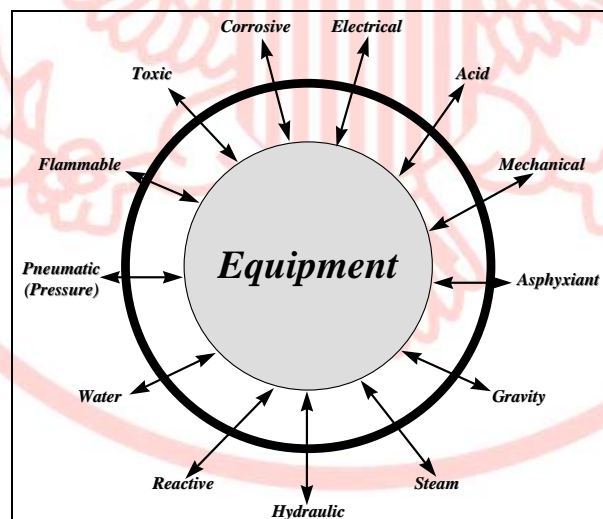
- 12.2.1 **Affected employee**--An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tag out, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.
- 12.2.2 **Authorized employee**-- A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.
- 12.2.3 **Capable of being locked out**-- An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.
- 12.2.4 **Energized**--Connected to an energy source or containing residual or stored energy.
- 12.2.5 **Energy isolating device**-- A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently; a line valve; a block; and any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.
- 12.2.6 **Energy source**--Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
- 12.2.7 **Lockout**-- The placement of a lockout device on an energy isolating device, in accordance with an established procedure, which ensures that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.



- 12.2.8 **Lockout device**-- A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.
- 12.2.9 **Servicing and/or maintenance**-- Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.
- 12.2.10 **Setting up**-- Any work performed to prepare a machine or equipment to perform its normal production operation.
- 12.2.11 **Tag out**-- The placement of a tag out device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tag out device is removed.
- 12.2.12 **Tag out device**-- A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tag out device is removed.

12.3 Sequence of Lockout:

- 12.3.1 Departmental Head notifies all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.
- 12.3.2 The authorized employee shall refer to the company energy control procedures to identify the type and magnitude of the energy that the machine or equipment utilizes, to understand the hazards of the energy, and to know the methods to control the energy. REFER TO THE SAFETY CIRCLE



- 12.3.3 Energy sources shall be deactivated so that the machine or equipment is isolated from the energy source(s).
- 12.3.4 The energy isolating device(s) shall be locked with assigned, standardized individual lock(s).
- 12.3.5 Stored or residual energy (such as capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) shall be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.



12.3.6 Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate. This is called TRYOUT

Caution: Return operating control(s) to neutral or "off" position after verifying the isolation of the equipment.

The machine or equipment is now locked out.

Note: Tag out is essentially a warning device, or tag, affixed to an energy isolating device, and does not provide the physical restraint on these devices that is provided by a lock. Tag out is to be in conjunction with lockout. If it is deemed that locking out a piece of equipment is not feasible, tag out can be used alone. Tags are required to be used on every project and are to contain the (a) Employee's Name (b) Phone Number (c) Time and Date (d) Duration of lockout/tag out and (e) Supervisor name and phone number

12.4 Method of Tagging out:

- 12.4.1 A tag out system can be utilized when the energy isolating device is not capable of being locked out and are to be used for every project.
- 12.4.2 When a tag is attached as an energy isolating method, it shall not be removed without the authorization of the authorized person responsible for it, and it shall never be bypassed, ignored, or otherwise defeated.
- 12.4.3 In order to be effective, tags shall be legible and understandable by all authorized employees, all affected employees, and all other employees whose work operations are or may be in the area.
- 12.4.4 Tags and their means of attachment shall be made of materials which will withstand the environmental conditions encountered in the workplace.
- 12.4.5 Tags shall be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

12.5 Restoring Equipment to Service:

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps shall be taken:

- 12.5.1 Check the machine or equipment and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.
- 12.5.2 Check the work area to ensure that all employees have been safely positioned or removed from the area.
- 12.5.3 Verify that the controls are in neutral.
- 12.5.4 Remove the lockout device(s), by the employee who applied the device(s), and reenergize the machine or equipment. Note: The removal of some forms of blocking may require re-energization of the machine before safe removal.
- 12.5.5 Notify all affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

12.6 Valve lockout procedure:

- 12.6.1 The valve number is noted.
- 12.6.2 The driver in charge shall be approached to close the manual valve.
- 12.6.3 The valve number shall be checked, the performer shall place his or her personal lock on the valve (a chain or a valve cover is available for this purpose), and then attach a tag.
- 12.6.4 Any conduit, pipe or pipeline containing potentially hazardous products shall isolated using the following methods.

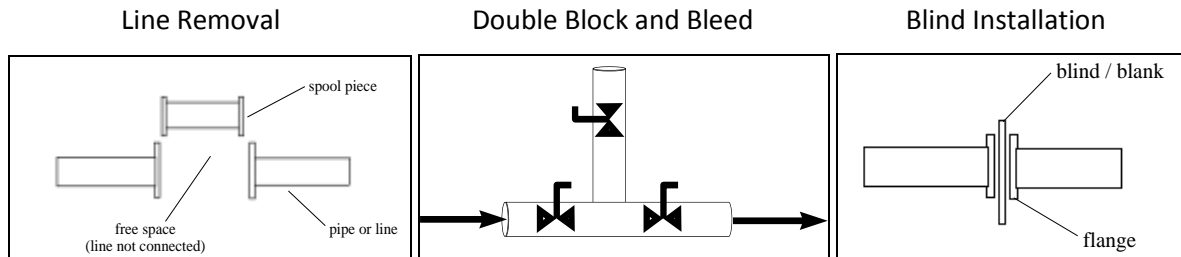


Table No 04

- 12.6.5 The automatic and/or depressurization valve, if any shall be opened, to check whether the line is depressurized. The driver in charge may be called to help.
- 12.6.6 Before carrying out the job, a check shall be made that the pipe, pipeline or the piece of equipment is empty and clean.
- 12.6.7 After completion of work, the lock from the manual valve and the piece of equipment blanking the pipeline shall be removed.
- 12.6.8 The authorized person shall take over, witness the entire unlocking process and finally remove his personal lock.

12.7 Forgetting to remove a personal lock

The performer who forgets to remove his lock is called back, without pay, to remove his lock. If the performer cannot be reached, the authorized person of the lockout may give the order to cut the lock, after checking that there is no danger to the surrounding or to the machinery. Within 24 hours, the authorized person shall submit a report, explaining the circumstances under which the lock had to be clipped off.

12.8 Periodic Inspection:

Periodic inspection of the energy control procedures shall be carried out at least annually to ensure that the procedures and the requirements of this standard are being followed.

Periodic inspection shall be conducted to correct any deviations or identify inadequacies.

13. Power Tools and Hand tools

Note: The following are the examples of power tools: Magnetic drill, grinding machine, welding machine, compressors, hand drill, buffing machine, blower, vacuum cleaner, electric chipping machine, power saw, planing machine.

The following are the examples of hand tools: saws, chisels, axes and hatches, hammers, hand planes, screw drivers, crow bars, nail pullers, knives.

13.1 General Precautions

- 13.1.1 Wear proper clothing. No loose clothing or jewelry to get caught in moving parts.
- 13.1.2 Rubber gloves and footwear are recommended when working outdoors.
- 13.1.3 Use proper personal protective equipment. Use safety glasses with most tools. If job is dusty, use the proper respiratory protection. If flying particles could be involved, use goggles and/or a face shield.
- 13.1.4 Do not abuse the cord. Never carry the tool by its cord or yank it to disconnect it from the receptacle. Keep the cord away from heat, oil and sharp edges.
- 13.1.5 Secure the work. Use clamps or a vise to hold work. It is safer than using your hand and it frees both hands to operate the tool. When moving material toward a possible cutting hazard or pinch point, do not use your hand. When feeding materials into a saw blade, use a push stick.



- 13.1.6 Do not over reach. Keep proper footing and balance at all times.
- 13.1.7 Only properly trained and authorized personnel shall be permitted to operate machinery.
- 13.1.8 Standard Operating Procedures (SOP's), Standard Practice Instructions (SPI's), Job Instructions (JI's) and/or Job Safety Analysis (JSA's) shall be understood and followed.
- 13.1.9 Use the proper protective equipment for the Job.
- 13.1.10 Safety guards used on machines known as right angle head or vertical portable grinders shall have a maximum exposure angle of 180°, and the guard shall be so located as to be between the driver and the wheel during use. Adjustment of guard shall be such that pieces of an accidentally broken wheel will be deflected away from the driver.

13.2 Electrically Powered Tools

- 13.2.1 It shall ensured that electric tools are properly grounded or / and double insulated.
- 13.2.2 All power tools / hand tools shall have guards at their nip points.
- 13.2.3 Portable electrically operated tools shall be used with a hot work permit.
- 13.2.4 Low voltage power supplies shall be preferred for portable tools. If the only suitable voltage is 240 then the tool shall be double insulated and shall be used in conjunction with an earth leakage circuit breaker (ELCB) of 30 mA sensitivity.
- 13.2.5 All electrically powered tools shall have a fail-safe device such that the machine stops automatically when the driver releases his hold.
- 13.2.6 All power tools shall be adequately guarded along those parts which are movable, containing abrasive wheels and likely to produce striking objects.

13.3 Pneumatically Powered Tools

- 13.3.1 Pneumatically powered tools shall be used under coverage of a hot work permit when used in a hazardous area.
- 13.3.2 All pneumatically powered tools shall have a fail-safe device such that the machine stops automatically when the driver releases his hold
- 13.3.3 Hoses and connectors shall be checked for tightness before use and redundant chains must connect the hose and the nipple.
- 13.3.4 Ear protectors shall be worn if the noise level exceeds 85dB (A).
- 13.3.5 J clamps or mechanical crimping only shall be preferred to connect hoses.
- 13.3.6 Hoses and hose connections used for conducting compressed air to utilized equipment, such as air driven power tools, shall be designed for the pressure and service to which subjected.

13.4 Hand tools

- 13.4.1 Mushroom-headed chisels shall not be used.
- 13.4.2 Knives having retractable blades shall be preferred.
- 13.4.3 Use of Sharp edged scissors shall be avoided.
- 13.4.4 The handles shall not be home made and shall have a flared head. Nails and metallic stubs shall not be used to fix the handles to the head. Wooden handles shall be preferred against a metallic handle. In case a metallic handle has been fixed to the head by welding, the design, workmanship and limitations of the same shall be approved by the departmental head of the team.



- 13.4.5 No homemade hand tools shall be used. In absence of any other option other than to fabricate a hand tool the departmental head of the team using the hand tool shall approve the design, workmanship and limitations of the same.
- 13.4.6 While using hand tools at height, these shall be carried using a tool bag and be operated after being attached to the user's hand by a hand strap.

13.5 Tools & Tackles inspection:

- 13.5.1 A responsible person, identified at the unit, shall inspect the lifting tools and tackles. The said materials shall be coded and colored to indicate whether they are good for use.
- 13.5.2 Inspect all tools prior to use. Check for defects, cracks in housing, electrical cord and plug, extension cord, etc. You shall make sure the tool is properly grounded (unless double insulated).
- 13.5.3 Power tools and/or accessories, which have been found to be defective, or in an unsafe condition shall be tagged with a "Do Not Operate" tag.
- 13.5.4 Disconnect power when tools are not in use, before servicing or when changing accessories such as blades, bits or cutters.

14. Illumination

Note: Conversion

1 lumen/sq.ft. = 1 foot-candle and 1 lux = 1 lumen/sq. meter; 1 square foot = 0.0929 square meter; Then, 1 lux = 0.0929 foot-candle, and 1 foot-candle = 10.76 lux.

Note: Definitions

- Candlepower: A measure of the intensity of lights that lamps project.*
- Foot-candle: A unit used to measure how much total light is reaching a surface. One foot-candle falling on one square foot of surface produces illumination of one foot-candle.*
- Glare: Brightness that causes discomfort, annoyance or eye fatigue, interfering with vision.*
- Lumen: International (SI) unit of the quantity of light or luminous flux.*
- Lux: International (SI) unit of luminance. One Lux is equal to 1 lumen per square meter.*

The illumination levels for various locations are as Table No 05 and shall be measured using a Lux-meter.

Table No 05

| SI No | Industrial Building | Illumination (Lux) |
|-------|--|--------------------|
| | Factory area | |
| 1 | Entrance, corridor, stair | 100 |
| 2 | Stock yard, main entrances, exit road, car parks, internal factory roads | 20 |
| 3 | Catwalks | 20 |
| 4 | platforms | 50 |
| 5 | Electrical and instrumentation Lab | 450 |



| | | |
|---|--|--------------------------------|
| 6 | Rubbing, ordinary painting, spraying, finishing | 300 |
| 7 | Gas and arc welding | 150 |
| | Electricity generating stations | |
| 1 | Control rooms a) Vertical control panels b) Control desk c) Rear of control panel d) Switch boxes | 200 – 300 300 150 150 |
| 2 | Transformer and outdoor switch gear | 100 |
| | Gas works | |
| | Governor, meter, compressor, booster and exhaust house | 100 |

15. Vehicle movement inside Unit

15.1 Driving the vehicle

- 15.1.1 The helper of the vehicle shall disembark no sooner the vehicle has reached the gate of any of the ELLENBARRIE INDUSTRIAL GASES LIMITED premises.
- 15.1.2 The vehicle shall only be driven by a licensed driver authorized by ELLENBARRIE INDUSTRIAL GASES LIMITED.
- 15.1.3 The vehicle shall maintain a speed of not more than 10 Km/hr.
- 15.1.4 The helper of the vehicle shall guide the driver during any movement inside the ELLENBARRIE INDUSTRIAL GASES LIMITED premises.
- 15.1.5 Reversing shall be the last option of any vehicle.
- 15.1.6 Reverse horn of each and every vehicle shall be kept operational.
- 15.1.7 All the warning devices such as indicators shall be used while moving inside the ELLENBARRIE INDUSTRIAL GASES LIMITED premises.
- 15.1.8 The edges of the loading / unloading bays along which the vehicles are parked shall have rubber fenders.
- 15.1.9 The route of the vehicles shall be conspicuously marked to ensure smooth movement during dark hours.
- 15.1.10 No one shall take rest under a stationary vehicle.
- 15.1.11 Wheels of all vehicles shall be scotched to prevent unwanted movement during decantation and loading / unloading of the cylinders.
- 15.1.12 Parking brakes shall be activated as soon as the vehicle has been stopped.
- 15.1.13 When leaving his vehicle unattended, the driver shall ensure that controls are in neutral, power shut off, brakes applied, key or connector plug removed, and the wheels scotched.
- 15.1.14 No sharp turns shall be allowed especially on a gradient.



- 15.1.15 Aisles, roadways, passageways, floors or ramps shall be maintained in good operating conditions in order to prevent damage to the vehicle or load and not to impair the stability.
- 15.1.16 The driver shall not allow any person to travel on the vehicle, its attachments or chassis unless such equipment has been specifically designed for this purpose. He shall not drive the vehicle up to a person standing in front of a bench or other fixed object.
- 15.1.17 The driver shall avoid making fast starts, sudden stops and quick turns and keep vehicle under control at all times.
- 15.1.18 Lighting of adequate intensity shall be provided in areas along which the vehicles are moving inside the unit.
- 15.1.19 Before crossing a weigh bridge plate, the driver shall make sure that it is secured and the vehicle is properly aligned with it.

15.2 Maintenance

- 15.2.1 When at any time a vehicle is found to be defective the driver shall report the matter immediately to the appropriate authority and no person shall be allowed to operate the vehicle until the fault has been rectified.
- 15.2.2 Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect industrial vehicle.
- 15.2.3 During maintenance, the operation of internal combustion engines in enclosed or semi-enclosed areas can produce noxious substances. Adequate ventilation is recommended when internal combustion engines are operated in such enclosed or semi-enclosed areas.
- 15.2.4 The fuel system shall be checked for leaks and the soundness of all fittings. In the case of leakages in the fuel system, the vehicle shall be taken out of service and shall not be returned to service until all leaks have been remedied.
- 15.2.5 During removal of wheels the vehicle shall be first secured on a jack of the appropriate capacity to avoid topple.

16. Working in the heat

Note: *The effects of heat stress are an inability to concentrate, muscle cramps, heat rash, severe thirst - a late symptom of heat stress, fainting, heat exhaustion - fatigue, giddiness, nausea, headache, moist skin, heat stroke - hot dry skin, confusion, convulsions, and eventual loss of consciousness. This is the most severe disorder and can result in death if not detected at an early stage.*

The different types of heat stress are:

1. **Heat Rash**-Heat rash occurs when the weather is hot and humid and your sweat glands become blocked. It is an annoying rash that is red and bumpy, and is also very itchy.
2. **Heat Collapse**-Heat collapse is a condition where a person actually collapses or faints because of a reduced blood flow to the head. Heat collapse is often rapid and unpredictable.
3. **Heat Cramps**-Heat cramps are spasms or pains in the muscles that occur because of an imbalance in body salts. This type of imbalance may occur because of continual perspiration or because of a low salt intake. The cramps often occur in the abdomen, arms and legs.
4. **Heat Exhaustion**-Heat exhaustion is a sign that the body's cooling system is not working properly and water and salt intakes are too low. People suffering from heat exhaustion often have symptoms such as headaches, nausea, weakness, thirst and giddiness.



5. **Heat Stroke**-The most severe form of heat stress is heat stroke. This occurs when the brain loses the ability to regulate the body's temperature and, as a result, the body temperature rises to a critical level. Those with heat stroke may suffer from, Confusion, Irrational behavior, Loss of consciousness, Convulsions, lack of sweating, abnormally high body temperature and hot, dry skin. If the body temperature is too high, it can be fatal.

16.1 Prevention

- 16.1.1 Re-scheduling of routine so that heavier and more physical tasks are carried out during the cooler times of the day.
- 16.1.2 Reduction of Heat Exposure.
- 16.1.3 Working in shaded areas can reduce outdoor sources of heat and consequently prevent heat stress.
- 16.1.4 Increasing the flow of cool air around the body helps to reduce body heat.
- 16.1.5 Drink Water Frequently
- 16.1.6 One of the best ways to avoid heat stress is to gradually adapt or acclimatize yourself to hot and humid conditions.
- 16.1.7 Having frequent breaks in a cool area is an excellent way to avoid heat stress.
- 16.1.8 Clothing which is loose fitting will help maintain a normal body temperature. Dry clothes will also help sweat to evaporate, so the skin is kept dry and the chance of heat rash is reduced.
- 16.1.9 It is essential that you take careful note of any fatigue, discomfort or other symptoms of heat stress that may occur and counteract these, if possible.

16.2 Treatment

- 16.2.1 Heat rashes disappear when the person concerned returns to a cool environment.
- 16.2.2 Heat collapse, heat cramps and heat exhaustion victims shall be treated by removing the patient from the hot environment; allowing the patient to rest in a cool place; circulating the air around the patient; spraying the patient with cool water; increasing the patient's water intake; and loosening the patient's clothing.
- 16.2.3 Heat cramps can be treated by massaging.
- 16.2.4 When treating heat exhaustion, medical or nursing assistance shall be obtained.
- 16.2.5 A person suffering from heat stroke requires medical attention urgently and emergency services and shall be contacted as soon as possible. This is a life threatening condition and the individual's body needs to be cooled as quickly as possible.
- 16.2.6 While waiting for emergency services to arrive you should:
- Move the patient to a cool environment;
 - Soak the patient's clothing with water;
 - Apply cold packs continuously;
 - Place the patient in a tub of cool water; and
 - Circulate the air around the patient.
 - Do not give the patient any stimulants.

17. Hazard Identification and Group Risk Assessment



Note: A 'risk' means the likelihood that a hazard will cause a specific harm or injury to persons or damage to property.

17.1 Definitions

- 17.1.1 Risk Management covers (a) Risk assessment of any work activity or trade; (b) Control and monitoring of such risks and (c) Communicating these risks to all persons involved.
- 17.1.2 Risk assessment is an integral part of risk management. It is the process of (a) Identifying and analyzing safety and health hazards associated with work; (b) Assessing the risks involved and (c) Prioritizing measures to control the hazards and reduce the risks.

17.2 Information required Prior to conducting a risk assessment

List of work activities, List of machinery and tools used, Records of past incidents and accidents, Relevant legislation, Relevant codes of practice or specifications, Details of existing risk controls, Feedback from staff, clients, suppliers or other stakeholders, Other information such as material safety data sheet (MSDS), manufacturer's instruction manual, copies of any relevant previous risk assessments.

17.3 Workplace safety and health hazards can be identified by considering:

Method of work e.g. repeated tasks and unsafe work practices, Electrical and mechanical hazards, Manual material handling e.g. lifting, pulling and pushing, Chemicals e.g. corrosive substances, Machinery or plant e.g. unguarded machines, Temporary structure e.g. Scaffolds, Environmental conditions, e.g. Slippery surfaces, lighting level, unstable soil conditions and Layout and location of equipment.

17.4 Possible types of accident or incident and ill health include:

Person falling from height Object falling from height, Slips or falls on the level, Electrocution, Asphyxiation, Drowning, Collapse of structure, Fire and explosion and Struck by or struck against object.

17.5 Persons-at-risk include:

Persons directly involved in the operation, Persons not directly involved in the operation, Visitors of the workplace, and Members of the public

17.6 Risk evaluation consists of:

- 17.6.1 Identifying the existing risk control measures; Assessing the potential severity of the hazards; determining the likelihood of occurrence and Assessing the risk level based on the severity and likelihood.
- 17.6.2 Risk evaluation is the process of estimating the risk levels for the hazards and their acceptability.
- 17.6.3 Risk is a function of expected SEVERITY of the hazard; LIKELIHOOD of the occurrence of the accident / incident or ill health taking into account the existing risk controls and occupancy.
- 17.6.4 Severity is the degree or extent of injury or harm caused by the hazards, or as a result of an accident. Severity of hazard is classified as per the Table No 6.

Table No 06

| | | |
|--|-------------------------------|---------------------------------------|
| Consequence Descriptions (The highest category will always be used) | | |
| VALUE | Result of Hazard to Personnel | Result of Hazard to Assets / Progress |



| | | |
|---|--|--------------------------------------|
| 5 | Single or multiple Fatality | Catastrophic Damages, Critical Delay |
| 4 | Serious Injury requiring hospitalization | Major Damages, Serious Delay |
| 3 | Lost Time Accident | Serious Damage, Moderate Delay |
| 2 | Injury requiring Medical Treatment but not Lost Time | Moderate Damage, Minor Delay |
| 1 | First Aid treatment only | Minor Damage, No Delay |

As the severity of the hazard refers to the intrinsic or inherent nature of the adverse effect (eg. amputation or fatal injury) that may result from the hazard, it does not depend on the controls in place. Therefore, in assigning the severity level, the existing controls should not be taken into account.

17.7 Likelihood of occurrence

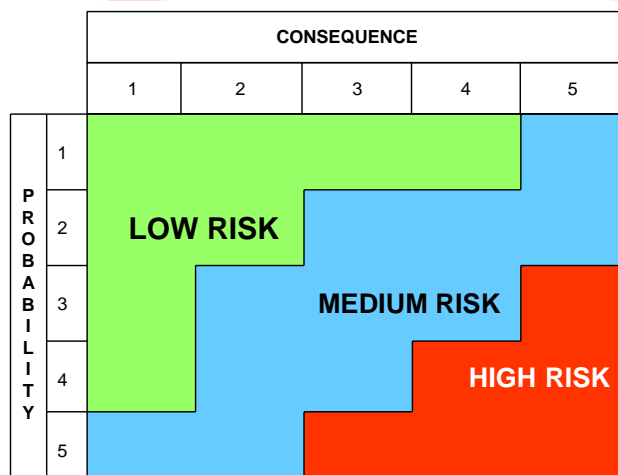
Likelihood of occurrence of an accident or incident or ill health is classified as per the table No 07

Table No 07

| Probability Descriptions (The highest category will always be used) | | |
|--|---------------|---|
| VALUE | Status | Description |
| 5 | Inevitable | Happens regularly on this site |
| 4 | Most Likely | Known to have occurred on this site in the past |
| 3 | Likely | Known to occur on other sites |
| 2 | Unlikely | Known to occur in the industry |
| 1 | Most Unlikely | Never known before |

The consequence Vs probability chart is as shown in Table No 08

Table No 08





Recommended actions based on the various levels of risk has been shown in Table No 09

Table No 09

| Risk level | Acceptability of risk | Recommended actions |
|-------------|-----------------------|---|
| Low Risk | Acceptable | No additional risk control measures may be needed. However, frequent review may be needed to ensure that the risk level assigned is accurate and does not increase over a period of time. |
| Medium Risk | Moderately acceptable | A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as is practicable within a defined time period. Interim risk control measures, such as administrative controls, may be implemented. Management attention is required. |
| High Risk | Not acceptable | High Risk level must be reduced to ALARP* level before work commences. There should not be any interim risk control measures and risk control measures should not be overly dependent on personal protective equipment or appliances. If need be, the hazard should be eliminated before work commences. Immediate management intervention is required before work commences. |

17.8 Hierarchy of Control of Hazards

The control of hazards and reduction of risks can be accomplished by following the Hierarchy of Control measures below. These control measures are not usually mutually exclusive.

- 17.8.1 Elimination of hazards refers to the total removal of the hazards and hence effectively making all the identified possible accidents and ill health impossible. This is a permanent solution and should be attempted in the first instance. Example: Using Inorganic Zinc Silicate Paint instead of Sand Blasting.
- 17.8.2 Substitution involves replacing the hazard by one that presents a lower risk. Example: Using Mono Ammonium Phosphate liquid for fire protection instead of Halon. A water-based paint can be used instead of a solvent-based paint.
- 17.8.3 Isolation involves isolating the hazard thus preventing the exposure of hazard to the workmen. Example: guarding of machinery. Fencing around a substation or live equipment.
- 17.8.4 Engineering controls are physical means that limit the hazard. Example: Providing a Residual Current Circuit Breaker (RCCB) for an electrical circuit to protect the workmen against shock.
- 17.8.5 Administrative Control involves management systems, which reduce or eliminate exposure to a hazard by adherence to procedures or instructions. Documentation should emphasize all the steps to be taken and the controls to be used in carrying out the activity safely. Example: Scaffold Tag System.
- 17.8.6 Procedural Protection is one where the hazards are controlled by inculcating an intrinsically safe method of executing the task. Example: Applying LOTO system for Maintenance works to avoid accidental starting of the plant, covering the task under an efficient Work Permit System.
- 17.8.7 Educational Protection encompasses creating awareness among workmen through training about the job specific risks involved like HSE Induction, PEP Talk, Fire Drill, Trade Specific training etc.



17.8.8 PPEs are the least effective risk control measure. Should only be considered when all other control methods are impractical, or to increase control when used with another method higher up in the Hierarchy of Control.

17.9 Residual Risks

Residual risks are the remaining risks for which the planned risk controls are not able to effectively remove or control. The risk assessment team should also highlight the residual risks of each of the controls.

17.10 Implementation Procedure

- 17.10.1 The Plant Manager, Departmental Heads, Dispatch Department, Construction Managers and Business Heads shall prepare the Group Risk Assessment (GRA) before starting the task in conjunction with Area/Section In charges & Execution Engineer. Risk assessments should be conducted by a team of persons who have a thorough knowledge of the work to be assessed. The risk assessment team should also include contractor/supplier personnel who are involved with the work, whenever necessary.
- 17.10.2 Risk involved in each activity and the existing control measure are analyzed and the impact rating and probability rating are given in the GRA sheet.
- 17.10.3 Risk level is identified from the matrix based on the ratings given.
- 17.10.4 Control Measures are evolved to bring the risk level to ALARP (As low as reasonably practicable) and residual risk is also identified. This exercise is done for activities identified as high and medium risk.
- 17.10.5 The list of control measures for the activities is handed over to the concerned execution engineer for implementation.
- 17.10.6 Risk Assessment should be reviewed when there is a significant change in work processes that could affect the safety and health of the workers, for example, the introduction of new machinery or change in work procedure, after an accident as a result of exposure to a hazard.

18. Job Safety Analysis

Note: A Job Safety Analysis (JSA) is a document which is prepared ahead of an activity or task after a thorough analysis of the Safety concerns related to the job and subsequent action plan for mitigating the shortfalls. The basic difference between a GRA and a JSA is of job volume. In GRA, a wider domain of the job is considered, Example: Hot works; while JSA is prepared for specific tasks, Example: welding, grinding, gas cutting and so on.

18.1 How to prepare Job Safety Analysis

- 18.1.1 The job shall be broken down in to basic steps by observing the job, discussing it with the operator, drawing on your knowledge of the job or combining all the three. Describe: "What" is done, not "How"?
- 18.1.2 Considering each step in the job as a separate one, the possible accidents arising out of each step shall be listed down by observing the job, discussing it with the operator, recalling past accidents or combining all the three. Special emphasis shall be given to:
- Aspects that contribute to fatalities. Example: Burns due to flammable liquids, gases, welding operations, etc; exposure to toxic and extremely hazardous atmospheres; falling object or energy release from internal sprints or pressures; asphyxiation; fire due to performing hot jobs in unusual places or handling of flammable gas or liquids; exposed electrical conductors where the work is not related to electricity.
 - The condition of the work area shall be considered. Examples: uneven, obstructed, slipper openings on floor or walkway; inadequate room; insecure piles and overhead materials; dust and fume exposure; hazards from adjacent operations.



- c) Materials from the nearby shall be considered. Example: heavy, unwieldy, rough, sharp, hot corrosive, toxic, explosive or radioactive materials; unsafe trucks, conveyors, hoists, containers.
- d) Machines or equipments shall be considered. Example: pinch points from cutting, shearing, punching or flying materials or from shafts, belts, gears or pulleys; other moving parts; electrical hazards.
- e) The tools required for the job shall be considered. Example: wrong tool for the job; tools placed in unsafe position; improper use of tools.
- f) In addition some more physical hazards may also be considered. Example: reaching over to remove object or equipments; motion too rapid for conditions; off balance position; hazardous position of man and machinery in relation to each other; incorrect posture of handling a machinery or tool or an awkwardly shaped object; hazardous position of workers in relation to each other.

18.1.3 The preventive measures and safe procedures to guide a person to do the job while avoiding the potential accident, shall then be drafted by observing the job, discussing it with the operator, drawing on your knowledge of the job or combining all the three. The draft of the JSA shall be as per below guidelines:

- a) The precaution to be taken by a worker must be specifically mentioned using a "Direct Speech" and "Dos and DONTs mode".
- b) No details shall be left out.
- c) The number of a particular precautionary measure shall be same as the potential accident against which it has been taken.
- d) Generic phrases like "Be careful" and "Take appropriate precaution" shall be avoided.
- e) JSA should be reviewed whenever there is a significant change in work processes that could affect the safety and health of the workers, for example, the introduction of new machinery or change in work procedure, after an accident as a result of exposure to a hazard.

18.2 Procedure for implementation:

- 18.2.1 The Execution Engineer shall prepare the JSA before starting the task in conjunction with the working hands and the same is endorsed by him on the sheet as "Prepared by". The JSA team should also include contractor/supplier personnel who are involved with the work, whenever necessary.
- 18.2.2 The potential accident involved in each activity and the existing control measure are analyzed by the team and the associated precautionary steps are listed down in the JSA sheet.
- 18.2.3 Potential incident or outcome is identified by observing the job, discussing it with the operator, and drawing on your knowledge of the job or combining all the three.
- 18.2.4 The Departmental Heads and Area/Section In charges shall review the document and endorse it as "checked by".
- 18.2.5 Precautionary measures are drafted and reviewed by the Plant Manager, Construction Managers, Business Heads and the same is endorsed on the JSA sheet as "Approved by".
- 18.2.6 The list of control measures for the activities is handed over to the concerned execution engineer for dissemination amongst the workers through a tool box talk.
- 18.2.7 The JSAs shall be reviewed and improved upon as and when required.

19. Electrical Safety

19.1 Definitions

- 19.1.1 **Qualified Worker:** An employee trained and authorized to conduct electrical work.



- 19.1.2 **Unqualified Worker:** Employees who have not been trained or authorized by management to conduct electrical work.
- 19.1.3 **Electrician:** An electrician deployed for additions, alterations, repairs and adjustments to existing installations shall be a competent person holding a certificate of competency issued or recognized by the state government.
- 19.1.4 **Electrical power and lighting circuits** are defined as devices specifically designed to connect, disconnect or reverse circuits under a power load condition.
- 19.1.5 **Portable electrical equipment (PEE)** is defined as cord or plug-type electrical devices, which includes the use of flexible or extension cords. Examples of portable electrical equipment included powered hand tools, powered bench tools, fans, radios, etc.

19.2 Procedure for implementation

19.2.1 Electrical Safety Rules for Non-Qualified Workers

- a) Do not conduct any repairs to electrical equipment.
- b) Unqualified Employees are prohibited from working on or near exposed energized circuits.
- c) Report all electrical deficiencies to your supervisor.
- d) Do not operate equipment if you suspect any electrical problem.
- e) Water and electricity do not mix.
- f) Even low voltages can kill or injure you.
- g) Do not use cords or plugs if the ground prong is missing.
- h) Do not overload electrical receptacles.

19.3 Personal Protective Equipments (PPE)

19.3.1 Electrical Safety PPE Rules for all employees

- a) Employees working in areas where the potential contact with exposed electrical sources is present and likely, will be provided and shall use PPE.
- b) PPE shall be used where contact with exposed electrical sources is present and likely.
- c) PPE shall be visually inspected and/or tested before use. Any defects or damage shall be replaced, repaired, or discarded.
- d) In cases where the insulating capabilities of the PPE may be damaged during the work, a protective outer cover, such as leather, shall be used.

19.4 Basic PPEs to be used to avoid electrical shocks

- 19.4.1 Employees shall wear non-conductive head protection wherever there is a danger of injury from electrical burns or shock from contact with exposed energized parts.
- 19.4.2 Employee shall wear protective eye/face equipment whenever there is a danger from electrical arcs or flashes or from flying objects resulting from an electrical explosion.
- 19.4.3 Inspection of PPEs shall be as per table No 10

Table No 10

| TYPE OF EQUIPMENT | WHEN TO TEST |
|-------------------|--------------|
|-------------------|--------------|



| | |
|-----------------------------|---|
| Rubber insulating line hose | Upon indication that insulating value is suspect. |
| Rubber insulating covers | Upon indication that insulating value is suspect |
| Rubber insulating blankets | Before first issue and every 12 months |
| Rubber insulating gloves | Before first issue and every 6 months |
| Rubber insulating sleeves | Before first issue and every 12 months |

19.5 General electrical safety precautions

- 19.5.1 Any person working on electrical equipment on a crane or other elevated must take necessary precautions to prevent a fall from reaction to electrical shock or other causes. A second person, knowledgeable as a safety watch, must assume the best possible position to assist the worker in case of an accident.
- 19.5.2 Portable ladders shall be made of non-conductive material if they are used where the employee or the ladder could contact exposed energized parts.
- 19.5.3 General Protective Equipment and Tools shall be used when in the proximity of, or working on, exposed energized parts.
- 19.5.4 When working on or near exposed energized parts, Qualified Employees shall use insulated tools or handling equipment suitable for the voltage present and working environment. In cases where the insulation may be damaged, a protective outer layer should be employed.
- 19.5.5 Fuse handling equipment (fuse puller), insulated for the circuit voltage shall be used to remove or install fuses when the terminal is energized.
- 19.5.6 Fuse wires of the proper rating shall be used. Using copper wires or any other metallic wires as replacement is strictly prohibited.
- 19.5.7 Power cables shall be dressed and tied using non conducting strips. Use of metallic wires is strictly prohibited.
- 19.5.8 Power cables shall be minimum three cored and sheathed unless the equipment has a molded type plug and is double insulated.
- 19.5.9 Power cables shall be preferably of the low smoke zero halogen (LSZH) type.
- 19.5.10 Cable joints shall be staggered, adequately insulated and done by qualified and experienced electricians.
- 19.5.11 Ropes and other hand lines used near exposed energized equipment shall be non-conductive.
- 19.5.12 Warnings and barricades shall be posted to alert unqualified Employees of the present danger related to energized parts that are exposed even temporarily. Non-conductive barricades shall be used with safety signs to prevent unqualified employees access to exposed energized parts or areas. Where barricades and warning signs do not provide adequate protection from electrical hazards, an Attendant shall be stationed to warn and protect Employees.
- 19.5.13 PEE shall be handled in such a manner as to prevent damage. Power cords shall not be stapled or otherwise hung in a way that shall cause damage to the outer jacket or insulation.
- 19.5.14 PEE shall be visually inspected for damage, wear, cracked, or spilt outer jackets or insulation, etc. before use. Any defects; such as cracked or split outer jackets or insulation shall be repaired, replaced, or taken out of service.



- 19.5.15 Compatibility of cord sets and receptacles shall be checked for proper use. Cables of suitable amperage shall be used with all equipment.
- 19.5.16 Ground type cord sets shall only be used with ground type receptacles and used with equipments requiring a ground type conductor.
- 19.5.17 Attachment plugs and receptacle shall not be altered or connected in a way that would prevent the proper continuity of the equipment grounding conductor. Adapters shall not be used if they interrupt the continuity of the grounding conductor. Plugs shall never be pulled out by holding on to the cable.
- 19.5.18 Only portable electrical equipment that is double insulated or designed for use in areas that are wet or likely to contact conductive liquids shall be used.
- 19.5.19 Employees who are wet or have wet hands shall not handle PEE (plug-in, un-plug, etc.). Personal protective equipment shall be used when handling PEE that are wet or covered with a conductive liquid.
- 19.5.20 Locking-type connectors shall be properly secured after connection to a power source.
- 19.5.21 Cable connectors (not of load-break type), fuses, terminal plugs or cable splice connectors shall not be used, unless an emergency, to connect, disconnect or reverse in place of proper electrical circuits.
- 19.5.22 After a protective circuit is disconnected or opened, it shall not be connected or closed until it has been determined that the equipment and circuit can be safely energized.
- 19.5.23 Over-current protectors of circuits or connected circuits shall not be modified, even on a temporary basis, beyond the installation safety requirements.
- 19.5.24 Only Qualified Employees shall perform test on electrical circuits or equipment. All hands-on activities shall be carried out only by a licensed and experienced electrician.
- 19.5.25 Test equipment and all associated test leads, cables, power cords, probes and connectors shall be visually inspected for external damage before use.
- 19.5.26 Test equipment shall be rated to meet or exceed the voltage being tested and fit for the environment in which it is being used.
- 19.5.27 Where flammable or ignitable materials are stored, even occasionally, electrical equipment capable of igniting them shall not be used unless measures are taken to prevent hazardous conditions from developing.
- 19.5.28 All portable hand tools shall be routed through a Ground Fault Circuit Interrupter (i.e. Earth Leakage Circuit Breaker) of 30mA sensitivity and a 63A to 100A load bearing capacity.

19.6 Specifications for Single line diagrams of an electrical circuit.

- a) Specification of the cables used.
- b) Load distribution details on each tributary.
- c) Grounding specification.
- d) Status of the cables-Underground or overhead.
- e) Segregation of all the distribution boards and junctions.
- f) Direction of flow of the electricity.
- g) Specification of the Ground Fault Circuit Interrupter.
- h) Load on the user end.
- i) Voltage involved.
- j) Location of nearest earth pit.



- k) Specification of the client's power source (if any).

19.7 Electrical Pre-Work Procedure (To prepare for work on electrical systems or components)

- 19.7.1 Except in extreme cases, work on electrical equipment will be done with all electrical circuits in the work area de-energized by following the Lockout/Tagout procedure.
- 19.7.2 Energized electrical circuits with less than 30 volts to ground, the equipment need not be de-energized if there will be no increased exposure to electrical burns or to explosion from electric arcs.
- 19.7.3 All electrical circuits shall be treated as "Live" until they have been Tagged and Locked Out and tested.
- 19.7.4 Permission from supervisor to conduct work shall be obtained.
- 19.7.5 Lockout and Tagout shall be carried out for all sources of electrical power.
- 19.7.6 Verification of de-energized condition shall be carried out before any circuits or equipment are considered and worked as de-energized.
- 19.7.7 A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be restarted.
- 19.7.8 Work shall be conducted on the circuit only after determining that there is no voltage in any of the exposed circuits.
- 19.7.9 If voltage is detected in any exposed circuit, STOP. Supervisor shall be informed and he shall determine the source and procedure to eliminate voltage.
- 19.7.10 Close up all exposed circuits, boxes, controls, and equipment after work is conducted.
- 19.7.11 Lockout/Tagout shall be removed.
- 19.7.12 Supervisor's permission to energize circuits shall be obtained.

19.8 Working on or Near Exposed Energized Circuits Procedure

In the rare situation when energized equipment (or working in near proximity to energized equipment) cannot be de-energized, the following work practices shall be used to provide protection:

- 19.8.1 Obtain permission from Head Plant to work on or near energized electrical circuits.
- 19.8.2 Treat all circuits as energized.
- 19.8.3 Lockout and Tagout all circuits possible.
- 19.8.4 Remove all conductive clothing and jewelry (rings, watches, wrist/neck chains, metal buttons, metal writing instruments, etc.).
- 19.8.5 Use proper personal protective equipment, shields, and/or barriers to provide effective electrical insulation from energized circuits. This shall include electrically rated insulated gloves, aprons, rubber soled shoes, insulated shields, insulated tools, etc.
- 19.8.6 Provide adequate lighting. Do not enter areas with exposed energized parts unless illumination is provided so that Employee shall work safely. Do not reach around obstructions of view or lighting into areas where exposed energized parts are located.
- 19.8.7 Employees entering a Confined Space with exposed energized parts shall use protective barriers, shields, or equipment, or insulated materials rated at or above the present voltage to avoid contact.
- 19.8.8 Doors or other hinged panels shall be constructed and secured to prevent them from swinging into an Employee and causing contact with exposed energized parts.
- 19.8.9 Housekeeping in areas of exposed energized parts shall not be completed in areas with close contact unless adequate safeguards (insulation equipment or barriers) are present. Conductive cleaning material (Steel



Wool, Silicon Carbide, etc.) or liquids shall not be used unless procedures (Lock and Tag Out, etc.) are in place and followed.

19.8.10 A safety observer shall be stationed outside work area. The sole function of this person is to quickly de-energize all sources of power or pull worker free from electrical work area with a non-conductive safety rope if contact is made with an energized electrical circuit.

19.8.11 A person qualified in Cardiac Pulmonary Resuscitation (CPR) shall be readily available nearby.

19.9 Re-energizing (even temporarily) of electrical circuits or equipments after completion of work

19.9.1 A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.

19.9.2 Employees exposed to the hazards associated with re-energizing the circuit or equipment shall be warned to stay clear of circuits and equipment.

19.9.3 Each lock and tag shall be removed by the employee who applied it or under his or her direct supervision. However, if this employee is absent from the workplace, the lock or tag shall be removed by a qualified supervisor nominated by the employee to perform this task. The nomination procedure shall be approved and documented by the Head Plant through the supervisor.

19.9.4 The supervisor shall ensure that the employee is aware that the lock or tag has been removed before re-energization is attempted.

19.9.5 A visual determination shall be carried out that all employees are clear of the circuits and equipment.

19.10 Specifications for grounding / earthing

19.10.1 40 mm diameter, hollow and perforated, heavy duty GI pipe of 3 meter Length to be vertically inserted (by auger-boring) into ground. Hammering is not allowed.

19.10.2 For earthing upto 63 Amp., GI wire of 3.15 mm with GI nut, bolt and washer to be used.

19.10.3 For earthing upto 250 Amp. GI flat (25 X 5 mm) with GI nut, bolt and washer to be used.

19.10.4 All panel, Distribution Board, Electricity operated metal enclosure machines (except Hand Tools) double earthing (continuous and body) to be ensured.

19.10.5 In no case, shall gas, steam, sprinkler or humidifier pipes, be used for an earth connection.

19.10.6 All earthing conductors shall be run in sight as far as possible. The same care shall be exercised in the erection of earthing conductors as for those which carry current for consuming and other devices.

19.10.7 All bonding and earthing shall be of brass, copper or non-rusting material. In damp situations, the bolts shall be of non-rusting material.

19.10.8 Earthing conductors shall ordinarily be fixed to the walls and ceilings by means of wall plugs (accessories of equivalent approved type).

19.10.9 Lightning arrestor earthing medium shall not be used for earthing any electrical gears.

19.10.10 The tightness of bolting system used for earthing to be ensured once in a week basis.

19.10.11 The earth resistance value shall be tested every year using a meggar instrument. The value shall be maintained below 1 Ohm and below 10 Ohms for lightning conductors.

19.10.12 The earth pits shall remain covered using green colored lids on which the resistance value and the date of testing shall be written conspicuously.

19.10.13 The earthing probes shall be fixed using a lug fixed by a crimping tool not hammered.



20. Transportation of Hazardous Substances

20.1 Truck

- a) Vehicles shall be in road-worthy condition.
- b) Retractable type seat belt for the driver as well as the helper seats shall be available.
- c) A fully equipped first aid box and contents shall be available inside the driver's cabin.
- d) Wheel chokes available in the vehicles.
- e) A separate Head light apart from the other lights which shall be attached to front of the driver's cabin and shall be kept ON at all times so long the vehicle is moving.
- f) Parking hand brakes shall be maintained in operative conditions at all times.
- g) The vehicle shall be fitted with a reverse horn that is loud and is maintained in good repairs at all times.
- h) The vehicle shall be fitted with an ISI mark flame arrestor on the exhaust nozzle and is maintained in good repairs at all times.
- i) Fire extinguishers minimum 02 numbers and Capacity=09 Liters, ABC type, shall be available in the truck.
- j) The driver's cabin shall be maintained in a good condition at all times. It should be primarily free from inflammable and combustible materials, any unguarded moving objects, sharp objects and heavy objects stored overhead. A small sized (1 kg) and easy to use fire extinguisher shall be kept ready to overcome minor fires.
- k) The Driver's cabin should be equipped with double rear view mirrors and these shall be maintained clean along with other glasses. The wipers shall be in good working condition.
- l) The 'Height Barrier' shall be fixed in the space between cabin and the tank to safeguard it incase tank height is more than cabin height.
- m) The fuel tank shall be protected from blows by stout steel guards or by the frames of the vehicle.
- n) The fill pipe of the fuel tank of the vehicle shall be provided with a cover locking arrangement.
- o) The wiring so fixed shall be protected to minimize accidental damage due to wear and tear.
- p) The vessel shall be electrically continuous with the chassis.
- q) The tyres shall be of antistatic type.
- r) All vehicles shall have one approved driver and one helper.
- s) All legal documents pertaining to the transportation tanks and the vehicles shall be available with the drivers. A Transport Emergency Card and an MSDS shall also be available with the driver.

20.1.1 Tyres

- a) Front tyres should be fitted with original tyres and both pair should be similar with minimum thread depth of 1.6 mm for proper braking and road grip. Vehicle fitted with re-molded/re-treaded front tyres will not be allowed.
- b) For Rear tyres, fixing of remolded tyres are allowed subject to the following conditions: (1) It should be done at standard and reputed workshop (2) Threading of each pair shall be the same. For example, both the tyres fitted at the rear front right side should be similar. Similar system will apply for all other rear tyres fittings (3) Threading depth of all the tyres should be 1.6 mm (4) Remolded old tyres should be used one time only. Thereafter tyres have to be replaced.



- c) Tyres shall be of an antistatic type.
- d) No bald tyres shall be allowed.
- e) Spare Wheel shall be available and in good condition.

20.2 Drivers

- 20.2.1 The drivers shall be carefully selected and certified fit by a qualified ophthalmologist once in every 12 months below the age of 45 years and once in every 06 months beyond 45 years.
- 20.2.2 The driver shall possess valid Heavy Vehicles license (HGV) and minimum one year experience in driving Heavy Goods vehicle.
- 20.2.3 The driver should be between 22 and 55 years of age. Helper should be always available along with the driver in the vehicle. He should be between 18 and 55 years of age.
- 20.2.4 The driver should be able to speak/read/write either Hindi/English or Local language.
- 20.2.5 It is desirable that driver license is having Hazardous substance transportation endorsement as required.
- 20.2.6 After interview, if it is found satisfactory the driver will be given training on product knowledge and handling. On successful completion of the same, he will be issued 'Gate-pass' and termed as Approved driver. Normally the Gate-pass will be valid till the validity date of license.
- 20.2.7 No un-approved drivers should be allowed to drive ELLENBARRIE tankers.
- 20.2.8 No replacement of drivers is allowed in-transit (when tanker is moving on road).
- 20.2.9 Safety shoes of a good quality (resistant to cryogenic spills), safety helmet with face shield, cryogenic hand gloves and leather apron in good condition shall be available with the drivers and the helpers.
- 20.2.10 Fluorescent jackets (fluorescent green) in good condition shall be available with the drivers and the helpers.
- 20.2.11 The drivers shall have proper uniform/dress while on duty i.e. they should wear cotton full sleeves shirt/trousers. Drivers found wearing lungis/half pants/towel etc will not be allowed to enter ELLENBARRIE premises.

20.3 Driving

- 20.3.1 The driver shall not park the vehicle in a congested area unless instructed by a legal enforcement officer.
- 20.3.2 The non-stop driving hours shall not exceed 5 hours after which there shall be a rest of 45 minutes which may be broken up into intervals of 15 minutes and 30 minutes.
- 20.3.3 Traffic signals shall be religiously obeyed.
- 20.3.4 Defensive driving techniques shall always be followed.
- 20.3.5 Speed limits of 60 Kilometers per hour shall never be exceeded.
- 20.3.6 The driver shall never drive under the influence of alcohol or a drug that cause drowsiness.
- 20.3.7 The parking brake shall be applied every time the driver parks the truck.
- 20.3.8 No one other than the driver and his helper shall be allowed to commute in the truck.

21. Business trips through road

21.1 Vehicle

21.1.1 4-wheeler

- a) The vehicle shall be road worthy and maintained in good condition.



- b) The seat belts shall be available and in usable condition.
- c) The indicators, horn, lights, wipers, mirrors, brakes and reverse horn shall be available and in working condition.
- d) The tyre pressure shall be as per recommendation by the manufacturer.
- e) The vehicles shall be preferably white or brightly colored to remain visible while on the road.

21.1.2 2-wheeler

- a) The indicators, horn, lights, mirrors and brakes shall be available and in working condition.
- b) The tyre pressure shall be as per recommendation by the manufacturer.
- c) Shall be driven with a crash helmet worn by the user as well as the pillion rider.
- d) Shall not be used during inclement weather conditions.

21.2 Driver

- a) The driver shall be holding a valid LMV license and be knowledgeable about the destination and the route.
- b) The driver shall never drive under the influence of alcohol or a drug that may cause drowsiness.
- c) The driver shall not over-speed.
- d) Traffic signals shall be religiously obeyed.
- e) Defensive driving techniques shall always be followed.
- f) Shall not attend to or make calls on the cell phone while driving.

21.2 Passenger

- a) The passenger shall fasten a seat belt whenever the front seat is availed.
- b) The passenger shall not distract or allow other to distract the concentration of the vehicle driver.
- c) Shall not plan a travel during an inclement weather condition or a public unrest unless absolutely necessary.

21.4 Travel initiator

- a) Shall explain fully the purpose of travel to the traveler.
- b) Shall explain the route and the landmarks near the place of visit.
- c) Shall assess the weather condition, general road condition.
- d) Shall explain to the traveler regarding any hazard or other conditions existing in the place of visit.
- e) Shall explain to the traveler regarding boarding and lodging facilities.

22. Incident and injury Investigation

22.1 Reporting Incidents/Injuries

- 22.1.1 All unexpected occurrences and near misses, regardless of whether injury or damage resulted, must be reported and investigated.
- 22.1.2 All accidents/incidents/near misses must be reported immediately to the Top Management.
- 22.1.3 All Near Misses and Dangerous Occurrences must be investigated and a Root Cause Analysis report submitted to Ellenbarrie management within seven days of the incident.



22.2 First Aid Case

- 22.2.1 An injury involving limited/minimal medical assistance will be classified as first aid, regardless of who provides the treatment. First Aid includes the following: using nonprescription medication at non prescription strength, tetanus immunizations, cleaning/flushing or soaking surface wounds, wound coverings, butterfly bandages, steri-strips, hot or cold therapy, non-rigid means of support, temporary immobilization device used to transport accident victims, drilling of fingernail or toenail, eye patches, removing foreign bodies from eye using irrigation or cotton swab, removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs or other simple means, finger guards, massages, drinking fluids for relief of heat stress.
- 22.2.2 **Medical Treatment Case:** Any medical treatment other than first aid items listed above provided by a physician/licensed medical professional will be classified as a Medical Treatment/Recordable case. Typically, the employee is able to return to work on the same day or for his/her next regularly scheduled shift following medical treatment. Examples of Medical Treatment/Recordable cases include: Sutures, prescriptions, foreign body extrication involving surgical instruments, fractures, second or third degree burns or caused by electric shock / electrocution, loss of consciousness.

22.3 Reportable Lost Time Injury

An injury that causes an employee to be unable to report to work within 48 hours following the accident will be classified as a Reportable Lost Time Injury. The determination that the employee could not return to work must have been made by a physician/licensed medical professional.

22.4 Non-Reportable Lost Time Injury

An injury that causes an employee to be unable to report to work for his/her next regularly scheduled shift but before 48 hours of the injury will be classified as a Non-Reportable Lost Time Injury. The determination that the employee could not return to work for his/her next regularly scheduled shift must have been made by a physician/licensed medical professional.

22.5 Vehicular Incidents

An incident related to transportation of hazardous substances by the company's VITTs, on road official travel, commuting to the place of work by a vehicle provided by the company, etc. shall be classified as a vehicular incident. Vehicular incidents may or may not involve third parties.

22.6 Dangerous Occurrence

Includes any incident that exposes a person in the immediate vicinity to an immediate risk to the person's health or safety through the collapse, overturning, failure or malfunction of, or damage to, any plant that the regulations prescribe must not be used unless the plant is licensed or registered; or the collapse or failure of an excavation or of any shoring supporting an excavation; or the collapse or partial collapse of all or part of a building or structure; or an implosion, explosion or fire resulting into loss of property; or the escape, spillage or leakage of any substance including dangerous goods resulting in exposure, or potential exposure of a person to a notifiable or prohibited carcinogenic substance; or the fall or release from a height of any plant, substance or object; or the overturning or collapse of any plant; or the inrush of water, mud or gas; or the interruption of the main system of ventilation; or any other event or circumstance specifically prescribed by legislation.

22.7 Internal Reporting

- 22.8.1 The Incident Investigation Report is to be submitted within seven days of the occurrence to the Head Office Safety Department, Business Unit Head in the Head Office, the Head Office Human Resource Department, the Jt. Managing Directors and the Chairman of the Corporate Safety Committee.
- 22.8.2 When the incident or injury requires a Root Cause Analysis (RCA) and review, as determined by Top Management or Safety Department, it must be completed within 30 days.



22.8.3 Fatalities, Dangerous Occurrences, Lost Time Injuries and Near Misses with a fatality potential can be reported immediately by telephoning, dialing 033-22292441(1923), 22491922 or fax to 033-22493396.

22.8 Statutory Reporting

22.9.1 Fatalities.

22.9.2 Injuries requiring hospitalization.

22.9.3 Any person requiring immediate medical treatment as a result of exposure to chemicals.

22.9.4 Major spills, emissions or any other serious environmental impact (e.g. a site being contaminated by a hazardous contaminant).

22.9.5 In India, reportable incidents shall include the death of a person; or a person requiring medical treatment within 48 hours of exposure to a substance; or a person requiring immediate treatment as an in-patient in a hospital; or a person requiring immediate medical treatment for the amputation of any part of his or her body; or a serious head injury; or a serious eye injury; or the separation of his or her skin from an underlying tissue (such as de-gloving or scalping); or electric shock; or a spinal injury; or the loss of a bodily function; or serious lacerations; or any other injury to a person or other consequence as specifically prescribed by legislation.

22.9.6 In addition to the normal statutory reporting, any electric related accident that involves a risk of serious injury to a person (to the occupational health and safety authority) in jurisdictions where this is required, accidents which relate to specific work areas (e.g. accidents related to electricity) shall be reported to the particular authority dealing with this area (e.g. the accident shall be reported to the state's Chief Electrical Inspector, etc).

22.9.7 All statutory reporting and liaison with the legal enforcement cell shall be done in cognizance with the members of the Corporate Safety Committee located in the Head office. The principle approval shall be from the office of the Managing Director.

Note: *The above incidents shall be reported to the legal authorities depending on the specific requirements in each jurisdiction*

22.9 Records

Each month, all units are required to submit a report to Head Office showing the number of work hours accrued, fatalities, lost work day cases, non-lost work day cases, total number of first aid cases, key incidents/near misses, and incidence rate.

22.10 Accident Investigation and Corrective Action

22.11.1 All incidents shall be investigated in accordance with the laid down guideline in the approved format.

22.11.2 This would involve an examination of the incident via the following questions:

- a) Is there a procedure which covers this area of activity?
- b) Is the procedure adequate? (i.e. effective, workable, comprehensive, simple, easy to use, etc)
- c) Was the procedure properly implemented?
- d) Was the procedure followed?
- e) Was the person adequately trained, competent and conversant with knowledge and skill for carrying out the work in safe manner?

22.11.3 The objective of the investigation shall be to establish the real cause(s) of the incident, so that corrective action is aimed at preventing recurrence of the event.

22.11.4 A Corrective Action Note shall be raised and implemented.



22.11.5 The scope and impact of the corrective action taken shall be appropriate to the magnitude and potential for harm of the incident.

23. Variance from requirements

23.1 Need for a variance

23.1.1 Establishing a procedure for obtaining a deviation from standard requirements. Standards, procedures, and requirements relating or critical to safety, health, or environmental performance are mandatory unless they conflict with existing government requirements or a written variance is obtained from authorized persons prior to implementation.

23.1.2 The procedure applies to all Ellenbarrie business and operational units.

23.1.3 Business and line management are responsible for implementing this standard.

23.2 Parameters for a variance from mandatory standards, procedures, and requirements

23.2.1 The variance results in an equally effective measure of protection for health, safety, or the environment.

23.2.2 An acceptable action plan is in place, and continued operation under the action plan will not adversely affect the safety or health of employees, the public, or the environment.

23.2.3 Regulatory requirements will not allow compliance with Ellenbarrie policies, standards, or procedures.

23.2.4 Variance approval must be obtained from the business unit head of the department that issued the requirement.

23.3 Written variance requests will contain the following information

23.3.1 A reference to the internal requirements to which the variance applies.

23.3.2 A description of the nature of the variance and a justification of why one is required.

23.3.3 A description of the alternate procedures/requirements that will be used to provide equivalent protection.

23.3.4 Justification for the requested time period for the variance (not to exceed five years).

23.4 Variance Approval & Renewals

23.4.1 The variance shall be sought by the Plant Manager/ Branch Manager and approved by Business Unit Head located at Head Office in consultation with other related departments.

23.4.2 Variance renewals are subject to the same requirements and restrictions as the original variance request.

23.4.3 A copy of each approved variance and supporting documentation is kept on file for the term of the variance. It is held by the department granting the variance and the organization or department originating the variance request.

23.4.4 Variance approvals are reviewed during Safety Committee Meetings.

Note: NO VARIANCES FROM APPLICABLE GOVERNMENT REQUIREMENTS ARE AUTHORIZED.