LAYOUT, DESIGN CONSIDERATION, SAFETY, OPERATION AND MAINTENANCE OF LUBE/ GREASE MANUFACTURING AND FILLING PLANTS

Prepared by
FUNCTIONAL COMMITTEE

OIL INDUSTRY SAFETY DIRECTORATE
GOVERNMENT OF INDIA
MINISTRY OF PETROLEUM and NATURAL GAS
8th Floor, Tower-A, OIDB Bhawan
Plot No: 2, Sector-73, Noida - 201301

Tele: 0120-2593800, 2593801, Fax: 0120-2593802, 2593858
Website: - www.oisd.gov.in
NOTE

Oil Industry Safety Directorate (OISD) publications are prepared for use in the oil and gas industry under Ministry of Petroleum and Natural Gas. These are the property of Ministry of Petroleum and Natural Gas and shall not be reproduced or copied and loaned or exhibited to others without written consent from OISD.

Though every effort has been made to assure the accuracy and reliability of the data contained in these documents, OISD hereby disclaims any liability or responsibility for loss or damage resulting from their use.

These documents are intended to supplement rather than replace the prevailing statutory requirement.
FOREWORD

Petroleum Depots, Terminals, Pipeline Installations, Aviation service stations and Lube Oil Installations are intermediate processing, storage and transportation points and are vital components of the downstream logistic value chain of the petroleum industry. These play a pivotal role in ensuring seamless movement of product from Refineries to the points-of-sale in the consumption centers. In a vast country like India, with its widespread petroleum product distribution network, continuous safe operation of these units is a national imperative.

For the logistics management purpose, population of these units are large and all of them are located not too far off from human population or get surrounded by residential / industrial establishments over the passage of time indicating thereby the high risk perception associated with substantial bulk storage of inflammable petroleum products in such locations. The locations themselves experience heavy footfall of business associates increasing the safety system demands.

Further, a devastating fire and explosion incident which took place in recent past near Jaipur (India) caused loss of human lives and material and shaken the entire nation.

With the above in view, the Government of India directed the Oil Industry Safety Directorate to develop a comprehensive document covering all the facets of safety in Design, Operation and maintenance, firefighting and automation with an objective to strengthen the existing system and prevent recurrence of such incidents.

It is, therefore, essential to develop a comprehensive standard covering all aspects for such locations which would ensure adequacy in terms of its ability to indicate alarm, complete shutdown and contain any incident from developing into a catastrophe while achieving optimality in terms of life cycle cost of installation, operation and maintenance.

Accordingly, a comprehensive document on “Storage and handling of Petroleum Products at Depots and Terminals including standalone crude oil storage facility” has been developed.

Functional Committee while developing this standard deliberated extensively on various issues including provisions of existing standards, recommendations of M B Lal Committee, learning from past incidents / accidents, the accumulated knowledge and experience of Industry members and information from National and International codes and practices.

The final shape of the document which emphasized more on up gradation of instrumentation and technologies in the POL installations will enhance the inbuilt safety and effective control mechanism.

We, at OISD, are confident that the provisions of this standard, when implemented in totality, would go a long way in ensuring safe operation of the target group of installations.

Needless to mention, this standard, as always would be reviewed periodically based on field level experience, incident analysis and environment scanning. Suggestions from all stake holders are fervently solicited.
**FUNCTIONAL COMMITTEE MEMBERS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEADER: <strong>SH. RAKESH JAIN</strong></td>
<td><strong>INDIAN OIL CORPORATION LIMITED</strong></td>
</tr>
<tr>
<td>MEMBERS:</td>
<td></td>
</tr>
<tr>
<td><strong>SH. R.S.DAHIYA</strong></td>
<td><strong>INDIAN OIL CORPORATION LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. PRABHAT KUMAR</strong></td>
<td><strong>INDIAN OIL CORPORATION LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. OMVEER SINGH</strong></td>
<td><strong>BHARAT PETROLEUM CORPORATION LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. RAHUL NARAYAN</strong></td>
<td><strong>HINDUSTAN PETROLEUM CORPORATION LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. AMITABH KISHORE</strong></td>
<td><strong>ENGINEERS INDIA LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. SANDEEP SHARMA</strong></td>
<td><strong>ENGINEERS INDIA LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. KANNAN SRINIVASAN</strong></td>
<td><strong>RELIANCE INDUSTRIES</strong></td>
</tr>
<tr>
<td><strong>SH. KUMUD SARBHAI</strong></td>
<td><strong>ESSAR OIL LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. A. K. BHATIA</strong></td>
<td><strong>ESSAR OIL LIMITED</strong></td>
</tr>
<tr>
<td><strong>SH. K.C.NANDI, (CO-ORDINATOR)</strong></td>
<td><strong>OIL INDUSTRY SAFETY DIRECTORATE</strong></td>
</tr>
</tbody>
</table>

Committee Scope: This Committee shall have primary responsibility for documents on plant layout, design, instrumentation, standard operating practices, firefighting facilities, inspection and maintenance of equipment, training of operating personnel and auditing system for lube and grease manufacturing plants.

Nothing in this standard is intended to restrict new technologies or alternative arrangements, provided the level of safety prescribed by the standard is not lowered.
## INDEX

<table>
<thead>
<tr>
<th>#</th>
<th>Subject</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2.0</td>
<td>Scope</td>
<td>1</td>
</tr>
<tr>
<td>3.0</td>
<td>Definition</td>
<td>2-5</td>
</tr>
<tr>
<td>4.0</td>
<td>Lube plant layout Design</td>
<td>6</td>
</tr>
<tr>
<td>4.1</td>
<td>Layout Philosophy</td>
<td>6-7</td>
</tr>
<tr>
<td>4.2</td>
<td>Layout of facilities</td>
<td>7</td>
</tr>
<tr>
<td>4.3</td>
<td>General consideration for the layout of blocks / facilities.</td>
<td>7-8</td>
</tr>
<tr>
<td>4.4</td>
<td>Layout of facilities</td>
<td>8-11</td>
</tr>
<tr>
<td>4.5</td>
<td>Protection of facilities</td>
<td>12</td>
</tr>
<tr>
<td>4.6</td>
<td>Separation distance and inter distance tables</td>
<td>12-15</td>
</tr>
<tr>
<td>5.0</td>
<td>Design considerations</td>
<td>16-34</td>
</tr>
<tr>
<td>6.0</td>
<td>Safe Operating Practices in Storage, lube blending, grease manufacturing, filling and handling of bulk lubes</td>
<td>35-41</td>
</tr>
<tr>
<td>7.0</td>
<td>Fire protection facilities</td>
<td>42-59</td>
</tr>
<tr>
<td>8.0</td>
<td>Maintenance and inspection of equipment</td>
<td>60-66</td>
</tr>
<tr>
<td>9.0</td>
<td>Management of change (MOC)</td>
<td>67-69</td>
</tr>
<tr>
<td>10.0</td>
<td>Emergency preparedness plan and response</td>
<td>70</td>
</tr>
<tr>
<td>11.0</td>
<td>Training</td>
<td>71-78</td>
</tr>
<tr>
<td>12.0</td>
<td>Safety Audit</td>
<td>79-82</td>
</tr>
</tbody>
</table>
1. **INTRODUCTION**

Lube and Grease manufacturing and filling plants were inherently considered safe and non-hazardous operations, however, more recent experience and incidents have demonstrated that with the increase in complexity driven by new grades and processes, need is felt to re-assess the various layout and safety parameters.

At present the standard followed by the operating locations are not available in any consolidated form but are derived from various reference appearing in various OISD STDs. This leads to lack of proper understanding and application on a uniform basis across various plants.

Over the years, in India there have been one major incident where the complete plant / unit was damaged, cases of small incidents and near misses have also been reported making it all the more necessary to have a focused look at the entire range of activities in the subject facilities.

The products handled during the process of manufacturing of lubes and greases fall under the category of excluded petroleum which will not require PESO license for storage, however, small quantities of petroleum class –B andC in the form of fuels for running utilities and for additives / dyes will require storage license as applicable.

2. **SCOPE**

2.1. This standard lays down minimum safety requirements in design, layout, automation, storage, loading / unloading, packaging, inspection and maintenance, fire protection, training, emergency planning and response and safety audit systems of lube and grease manufacturing plants including standalone packing and fillings units with / without blending facilities.

2.2. The above standard will apply for facilities owned and operated by the OMC or owned by OMC but operated contractually by other operator. The same will not be applicable for activities out sourced by the companies from the private operators. For such operators the companies may issue separate guide lines to be followed on individual assessment of risk / benefit analysis, company manual / standard, company experience and philosophy.

2.3. This standard is not applicable for lube and/or grease manufacturing plants / units, located inside the Refinery or Oil and Gas processing unit or other Oil or Gas installations under the same management, within the same boundary and having shared facilities.

2.4. The provisions of this standard shall primarily apply to facilities, equipment, structures, or plants that will be constructed or be approved for construction after the effective date of publication of this standard. For existing Plants, this standard shall also be applicable except for the inter distance between facilities as stipulated in this standard.

2.5. The provisions of this standard laid down on a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued / published.

2.6. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed in this standard.
3. DEFINITIONS

Blocks
Facilities operated / used in integrated way and having all around or alternate access for approach of fire tender. For example process unit (which includes Control room, QC lab, blending / grease kettles, intermediate tank/blend finished tank/finished product tanks, filling units, drum storage, packaging material and packed container loading etc), boiler house / thermic fluid heater, group of tanks located in a dyke, bulk loading / unloading facility, utility block, fire water storage and pumps, ETP/OWS etc.

Units / sub-facilities within process area such as blending, grease manufacturing, filling operations in drums or in containers (either manual or through machine), empty / filled drum / container storage, packed loading etc can be under single block. However, suitable approach passage, between two such unit /sub- facilities, should be maintained to facilitate movement of material / equipment etc.

Boiler
Boiler means any closed vessel exceeding 22.75 liters in capacity which is used expressly for generating steam under pressure and includes any mounting or other fitting attached to such vessel, which is wholly or partly under pressure when is shut off.

Economizer
Means any part of a feed-pipe that is wholly or partially exposed to the action of flue gases for the purpose of recovery of waste heat.

Feed pipe
Means any pipe or connected fitting wholly or partly under pressure through which feed water passes directly to a boiler and which does not form an integral part thereof.

Steam Pipe
Means any pipe through which steam passes from a boiler to a prime mover or other user or both if (i) The pressure at which steam passes through such pipe exceeds 3.5 kg/cm² above atmospheric pressure or (ii) Such pipe exceeds 254 mm in internal diameter and includes, in either case any connected fitting of a steam pipe.

Effluent Treatment Plant (ETP)
ETP is a mechanism and process used to treat waters that have been contaminated due to presence of Oil / sludge / Grease / chemicals / sewage generated of different activities / operations in Petroleum Installations.

Fire Water pump house
Facility / shed housing fire engines/jockey pumps and associated control panels and communication system (fixed/portable) etc.

Fire control room
Facility / room housing Fire siren, first aid boxes, PPE, repeater panel for CCTV, repeater panel for Smoke/heat detection system, MCP panel and effective communication system (internal / external) etc. Security room or designated room in administrative building may be considered for fire control room.
**Filling shed**
Facility for filling of packed (non-bulk) lubes / grease either in drums, buckets or containers.

**Facility**
This refers to any building, structure, installation, equipment, pipeline, or other physical feature used in lube / grease processing, filling, packaging, storage, transportation and distribution.

**Flash Point**
“Flash point” of any petroleum liquid is the lowest temperature at which the liquid yields vapour in sufficient concentration to form an ignitable mixture with air and gives a momentary flash on application of a small pilot flame under specified conditions of test as per IS: 1448 (Part-I).

**Grease**
Grease is a semisolid lubricant. It generally consists of a soap emulsified with mineral or vegetable oil. The characteristic feature of greases is that they possess a high initial viscosity, which upon the application of shear, drops to give the effect of an oil-lubricated bearing of approximately the same viscosity as the base oil used in the grease.

**Lubricant**
Lubricant is a substance that reduces friction, heat and wears when introduced as a film between solid surfaces.
Or
A blend of hydrocarbon of different chemicals that can be added to allow a machine to efficiently run at extreme temperatures and protect machine surfaces under extreme pressures. In addition, it reduces; the friction, wear that occurs during operation, operating temperature, minimizes corrosion of metal surfaces and assist in keeping contaminates out of the system.

**Lube Oil Plant**
The facilities meant for receipt, storage and blending of base oils and additives into finished lube products. It includes lube blending / grease manufacturing / drums / containers filling plants.

**Oil water separator (OWS)**
Oil water separator is a system designed to separate gross amount of oil / grease and suspended solids from the oily water effluent generated due to different activities/operations in Petroleum Installations.

**Product classification**
“Excluded Petroleum” means liquids which have flash point of 93 deg C and above are known as excluded Petroleum. Normally all base oils come under “Excluded Petroleum” category.

Petroleum class B: means petroleum having flash point of twenty three degree centigrade and above but below sixty five degrees centigrade.

Petroleum class C: means petroleum having flash point of sixty five degrees centigrade and above but below ninety three degrees centigrade.

**Process**
Integrated sequence of operation, physical and chemical involving preparation, separation, purification, or change in state, energy content or composition.
**Blending / Manufacturing**
Core blending/manufacturing area having blending kettles for blending of lubes and greases manufacturing kettles and reactors/pressure reactors for cooking of grease with associated facilities. Filling and packaging area for drums and smalls packs will not be treated as process unit although they may be located under the same shade separated by a distance.

**Day Tanks:** Small volume tanks used for storage of product (HSD day tank (for DG set) and LDO/ FO (for boiler/ heater) and class C/ excluded finished product) required for day to day operations shall not be classified as bulk storage area.

**Pipeline receipt facility**
Pipeline receipt is the facilities for receipt / delivery of base oils, finished oils or additives in bulk thru’ pipelines ex. Refinery or port jetty.

**Standalone filling facility**
Receipt of finished product thru’ bulk, storage, filling, packaging and dispatch.

**Storage area**
Facility for storage of empty containers / labels, packed (non-bulk) lubricants / grease either in drums, buckets or containers in a systematic manner. Storage area also includes room / segregated place for storing / handling packed additives / dye etc.

**Scrap yard**
  i) Normal scrap yard: - Demarcated area where materials not intended for further use are temporarily stored prior to disposal.
  ii) Discarded drums yard: - Demarcated area where discarded drums not intended for further use are temporarily stored prior to disposal.

**Slop**
Off – specification products obtained during plant start up, shutdown or upset conditions and draining etc. from various equipment/tanks/pumps containing oil-water mixture from lube/grease plants are called slops. Slops containing large quantity of free water are known as wet slop. When free water content is low enough to process the slop in plant, in a controlled manner, it is known as dry slop.

**Service building / facility**
Building/s / facilities for inspection / maintenance / other supporting services which are directly required for operation of the plant such as Boiler house, air compressors, cooling tower, RO plant, ware house, work shop, garage etc.

**Tank vehicle loading / unloading**
Facility for loading unloading of base oil / finished oil / additives to / from tank wagon or road tankers in bulk.

**Utilities**
Utilities consisting of administrative building, canteen, parking shed, DG room, DP structure /substation, power distribution Centre etc shall be separated from other lube plant facilities and located at non-operating areas.
Sub-station
Sub-station means any premises or enclosures / building or part thereof, being large enough to admit the entrance of a person after the apparatus therein is in position, and housing any one or more of the following equipment:

- Apparatus for transforming or converting energy to or from a voltage.
- Apparatus for distribution.
- Any other apparatus for switching, controlling or otherwise regulating the energy.

Bonding
Bonding is the process by which two electrical conducting bodies are connected using a conductor to maintain electrical continuity to prevent sparking.

Earth Electrode
A metal plate, pipe or other conductor embedded in the soil that makes a direct contact to the general mass of the earth.

Earth Connection
A connection to the general mass of earth by means of an earth electrode. An object is said to be ‘earthed’ when it is electrically connected to an earth electrode; and a conductor is said to be earthed when it is electrically connected to earth electrode without a fuse, switch, circuit-breaker, resistance or impedance in the earth connection.

Earthing
Earthing is the provision of a safe path of electrical current to ground, in order to protect structures, plant and equipment from the effects of stray electrical current, and electrostatics discharge.

Toxic
These substances include liquids or solids which are irritating to or affect the health of humans.

MSDS
Material safety data sheet that gives complete physical and chemical properties of the substance along with the safe handling procedure for the same.

Incident
An unplanned event (occurrence, condition or action) which did or could have resulted in personal injury or damage to the plant, community or environment.

Near-miss
An incident which does not result in any injury or damage to property but has the potential to result in injury and / or property damage

Shall
Indicates provisions that are mandatory.

Should
Indicates provisions that are recommended but not mandatory.

May
Indicates provisions that are optional.
4. LUBE PLANT LAYOUT DESIGN

4.1. LAYOUT PHILOSOPHY

Following philosophy should be adopted in layout of a Lube Plant:

a) Quantitative Risk Assessment shall be carried out at the layout stage with an objective to arrive at any specific mitigation measures required for Hazards identified. Risk reduction / mitigation measures shall be given due credit.

Risk assessment shall include societal risk (if any). The outcome shall guide in preparation of onsite /off site emergency plan. Further, emergency response disaster management plan (ERDMP) should be made in line with requirement of PNGRB guide lines 2010.

Quantitative Risk Assessment (QRA) shall be done when ever major addition(s) in facilities (such as addition of class –C and above storage facility, new process unit block) or major demographic changes in the surrounding of plant areas takes place.

b) Two approaches from the highway / major road should be provided, one for normal movement and other for emergency exit. Both these approaches should be available for receipt of assistance in emergency. Minimum road width shall be 3.5 M for one way vehicular movement.

c) Alternative access shall be provided for each block so that it can be approached for fire fighting in the event of blockage on one route.

d) Road widths, gradient and turning radius at road junctions shall be designed to facilitate movement of the largest fire-fighting vehicle envisaged in the event of emergency.

e) Layout should consider the space requirements for:-

- Maintenance, operation and inspection of each equipment / facility
- Demarcated area for activities like welding, gas cutting and other hot jobs etc
- Future expansion for addition of facilities.

f) Physical segregation shall be provided between operating and non-operating area. Segregation shall be minimum 1 M height either in the form of chain link fence or brick wall or combination of both. Entry to operating area shall be through security access control only, that may be either manual or using technology.

g) Various additives shall be stored within the blocks in separate demarcated area with required fire protection as per MSDS.

4.2. LAYOUT FACILITIES

To prepare a layout, information should be collected on all applicable affecting aspects and not limiting to following:

- Storage tanks, utility requirements.
- Product receipt / dispatch and mode of transport (Rail, Road, Pipeline and Tanker / Barge).
- Warehouses, storage areas for additives, containers, packaging bitumen / asphalt etc and other open storage areas like scrap yards and dumping ground.
- Chemicals / Toxic chemicals storage, Sludge, hazardous waste storage / disposal facilities etc.
- Service buildings, fire station and allied facilities.
- Site topography including elevation, slop, and drainage.
- Meteorological data.
• Bathymetric data (high tide level, surge wave height etc.) for installations in coastal areas.
• Seismic data and probability of Tsunami in coastal areas.
• Highest flood level in the area, water table, natural streams/canals.
• Approach roads for functional areas.
• Aviation considerations to and from adjacent facilities.
• Environmental considerations.
• Statutory requirements.

4.3. GENERAL CONSIDERATION FOR THE LAYOUT OF BLOCKS / FACILITIES

While locating the various facilities the following should be considered:

a) Layout of blocks / facilities should be in sequential order of process flow.

b) The process operations like blending, Grease manufacturing and packaging operation should be carried out under the common block/shed. Separate block for boiler/heating unit shall be provided. Refer table for separation distance between blocks and between units within the block.

c) Plant elevation should be higher than the outside boundary surroundings and approach roads inside the plant area should be on higher ground to avoid flooding.

d) Process units, tank farm, bulk loading/unloading gantry/platform, filling, boiler unit/other heating unit, solid storage, additive storages, Effluent Treatment Plant (ETP) / OWS and utilities should be located on high ground to avoid flooding.

e) Fire control room should be earmarked/located in non-operating area, upwind (Majority of the year) of lube oil storage, handling, blending, grease manufacturing, filling/storage area and at a distance (refer table) from potential leak sources. It shall not be located on a lower level than surrounding plant area and tank farms. Fire control room may be in the security room/administrative building.

f) Utility facilities shall be located in separate blocks.

g) Overhead power transmission lines shall not pass over the plant processing and operating areas including the truck parking areas. Horizontal/vertical clearance shall be in line with the Central Electricity Authority.

h) High Tension (HT) line and HT sub-station(s) shall be terminated/located outside the operating area.

i) Truck (bulk and packed) movement inside the plant should be kept minimum and for this purpose the truck loading/unloading facilities should be located at a safe distance near the gate meant for its movement and should be oriented to provide one-way traffic pattern for entrance and exit. Positioning of truck at loading/unloading facilities inside the plant shall be in drive out position for easy escape in case of emergency.

j) A platform shall be provided suitably at the main entrance exit gate, inside the location, for the purpose of road taker safety fittings/documents to avoid obstruction during normal/emergency situation.

k) Surface drainage shall be provided in the plant and drainage from each operating blocks/facility shall be routed to OWS/ETP. The drains shall always be maintained operable and clean.

l) Effluent Treatment Plant should be located at a distance as per table. This should be closer to disposal point (to outside storm drain) by the side of the boundary and at lower grade to facilitate gravity flow of effluent from other operating facilities.

m) Roads should be provided in a symmetric manner to serve all areas requiring access for the operation, maintenance and fire fighting. At least two approaches should be provided for each operating area.
n) Smoking booths shall not be allowed inside the plant area.

o) Firewater storage and firewater pump house should be located upwind of lube/hydrocarbon storage and handling facilities with straight approach from non-operating area to enable easy receipt of mutual aid and make up water assistance/replenishment.

p) The provision shall be made to receive the water from other sources including mutual aid / sharing of water directly into fire water storage tanks. Provision shall also be made to receive water in an underground tank and lifting/diverting to main water storage tanks.

q) All buildings which are not related to direct plant operation should be located at upwind of lube/hydrocarbon storage and handling facilities. These shall be located outside the operating area. These areas include administrative building, canteen, security/access control gate, emergency control room etc. Location of such facilities shall be based on Risk Assessment.

r) Congestion inside the plant area because of buildings, structures, pipelines, trees etc. shall not be allowed. Such addition of facilities in existing plant shall be decided based on Quantitative Risk Assessment.

s) While selecting location of laboratory, due consideration shall be given for hazards from main plant/unit facilities assessed through Risk Assessment. Floor shall be resistant to fire and chemicals and made anti-skid. There should be no fittings on the floor that would hinder / obstruct free movement. Sinks and drains shall be made of chemically resistant material and the drains should be properly trapped and vented. Final discharge to storm water drain shall be thru’ neutralization pit.

- The laboratory shall have segregated storage of materials in various categories like inflammable hydrocarbon samples in -bulk, toxic, reactive such as chemicals and re-agents, retention samples in non-bulk etc. Compressed gas cylinders shall be chained or strapped and placed outside the laboratory in a well-ventilated shed. This area shall be readily approachable for material handling / fire fighting.

- Effective ventilation i.e forced ventilation / air turbo ventilation, single pass once – through type shall be considered with about 10-12 changes of whole air /per hr. Emergency exits should be provided at strategic locations. Each laboratory shall have two easily accessible, hindrance free exits. Doors shall open in the direction of the exit.

t) Turbo / forced ventilation shall be considered for enclosed/confined process / utility blocks.

u) Various additives (non-bulk), within blocks, shall be stored at the demarcated area based on requirement of fire protection system and application as per respective Material Safety Data Sheet. Additives falling under A/ B class shall be stored separately (duly marked) with suitable fire protection.

v) Electrical fittings and fixtures for empty package storage area (HDPE/PE/PET/PFTE) containers, cartons, labels etc shall be flame proof type. Laboratory storing inflammable materials shall have designated / demarcated.

w) All electrical cables shall be laid through conduit / cable trench. The designated cable route shall be having route markers as per applicable Rules.
4.4. LAYOUT OF FACILITIES

4.4.1. DYKE ENCLOSURE

a) Storage tanks for excluded petroleum product shall be located in dyked enclosures. Each dyke shall have roads all around for access for normal operation and maintenance as well for emergency handling.

b) For excluded product, the capacity of the dyked enclosure shall be based on spill containment and not for containment on tank rupture. The minimum height of dyke wall shall be 600 mm.

c) Where Petroleum class-C is stored in separate dyke or along with excluded product, the enclosure capacity shall be constructed for containment of the largest tank content. The height of the enclosure wall shall be not less than one metre.

d) The dyke wall made up of earth, concrete or solid masonry shall be designed to withstand the hydrostatic load.

e) The dyke enclosure wall and dyke inside area shall be constructed leak proof / impervious to prevent ground pollution.

f) Dyke enclosure (entire area of the dyke) shall have impervious layer of suitable material such as EPDM (ethylene propylene di-monomer) liner / polyethylene sheet to prevent the ground water contamination in addition to brick/stone pitching / PCC etc.

g) The dyke and the enclosures will be inspected for cracks, visible damage etc. every six months (pre and post monsoons) and after every major repair in the tanks / dykes etc. so as to keep it impervious. Following shall be done

- Piping thru’ dyke wall if any shall be properly sealed to make dyke impervious.
- The dyke area shall have proper slope outward of tank pad towards the inner periphery of the dyke enclosure to prevent reverse flow.

h) Earth-pits shall be provided outside of Dyke area and strips buried under the earth except at termination points from a shortest possible distance. The earthing lay out diagram of each facility shall be displayed near the facility for ease of understanding.

i) Pumps and pipe racks should be located outside dyke areas by the side of roads. The same shall not be applicable for excluded products.

j) Horizontal above ground tanks, irrespective of product class, mounted on pedestals shall meet followings:-

- Dyked enclosure shall contain the largest tank capacity.
- Separation distance between adjacent tanks shall be (D+d)/4 or minimum 3 m whichever is higher.
- Separation distance from adjacent facility / boundary shall be minimum 15 m.
- Minimum two manholes having minimum size of 600 mm.
- All tanks shall have either individual or common stairs with toe guards and hand railing. Emergency exit / stair should be considered.
- Drain from dyked enclosure shall be routed to ETP/OWS
- Vents shall be located / terminated at a minimum height of 4 M from the tank mountings.
• The open end of free vent pipe shall be covered with two layers of non-corrodible metal wire gauze having not less than 11 meshes per liner centimetre and shall be further protected from rain by hood or by suitably bending it downward.
• The petroleum product shall enter a tank through closed piping system / coupled electrically continuous and sound hose.

k) Under Ground Tanks, irrespective of product class, shall meet followings:-

• Inter tank distance for UG tanks shall be \((D+d)/4\) or minimum 1.5 M whichever is higher.
• A minimum of 3 M clear distance around the tank shall be maintained (from structures / boundary wall etc).
• Minimum burial depth under the earth should be 300 mm and the manholes / gauge pipe should be 300 mm above the ground level.
• Minimum two manholes having minimum size of 600 mm.
• Embankment wall of minimum 300 mm height shall be provided in the UG tank Farm Area to contain accidental overflow/spillage and area shall be paved.
• Drain from UG tank farm shall be routed to ETP/OWS
• Vents shall be located / terminated at a minimum height of 4 M from ground level.
• The open end of free vent pipe shall be covered with two layers of non-corrodible metal wire gauze having not less than 11 meshes per liner centimetre and shall be further protected from rain by hood or by suitably bending it downward.
• The petroleum product shall enter a tank through closed piping system / coupled electrically continuous and sound hose.

l) Depending upon saline /corrosive nature of water/weather, suitable corrosion protection measures shall be considered for storage tanks, pipelines and other facilities.

4.4.2. GROUPING OF STORAGE TANKS

a) Grouping of tanks in a dyke: Storage tanks should be grouped in a dedicated dyke according to their respective classification of petroleum product. For example excluded product and other than excluded products shall be stored in separate dyked enclosure.

b) In case, different class of products are stored in any combination of product classification, the following shall, be applicable:

• When excluded petroleum is stored with other class of product in same dyke, applicable fire protection shall be considered based on flash point of different class of products and fire protection for lower flash point product shall be applicable for all other tanks in that dyked enclosure.

c) Tanks should be arranged in maximum two rows so that each tank is approachable from the road around the tank farm enclosure. This stipulation is not applicable for tanks storing excluded products, however, tanks in middle rows not covered by hydrant/monitors from outside of dyke, shall be considered with elevated monitors for adequate water coverage.

d) Tertiary containment: The objective of Tertiary containment is to prevent escape of spills due to failure of secondary containment for any reasons and will not allow such spill over to outside of the boundary of the installation that may lead to any damage to outside. 
To meet the objective, the peripheral drain of the plant shall be provided with sluice gates at the exit point where from drain goes outside of boundary. Pipelines if any entering / exiting the plant boundary shall be sealed properly.
4.4.3. FIRE BREAK WALLS INSIDE DYKE ENCLOSURE

a) In a dyked enclosure where more than one tank is located, fire break walls of minimum height shall be provided to prevent spills from one tank endangering any other tank in the same enclosure as per following:-

i) For excluded petroleum product storage, for the provision of firewall, a group of small tanks with aggregate capacity not exceeding 5000 kl shall be treated as one tank for the provision of firewall. The height of fire wall shall be minimum 300 mm.

ii) For other than excluded product storage, a group of small tanks each not exceeding 9 M diameter and in all not exceeding 5000 kl in capacity shall be treated as one tank for the provision of fire wall. The height of fire wall shall be minimum 600 mm.

b) Drains inside the dyke area, if passes through fire break wall, shall be isolated suitably by providing valve.

4.4.4. LAYOUT OF SUBSTATION

a) The main substation floor shall be raised above grade level and the space below the sub-station floor (cellar) shall be utilized for installation of cable trays. The bottom of cable trench entering the cable cellar shall be kept minimum 150 mm grade level. In case the cable cellars provided from top, the cable tray entering the substation shall have provision to arrest rain water from outside.

b) Every substation shall have a min of two exits. These exits shall be located at opposite ends of the building, to prevent the possibility of operating personnel being trapped in case of fire. The doors shall open outward and be equipped with exit signs.

c) The roof shall be given adequate water proofing treatment to ensure that rain water does not seep into the substation.

4.4.5. GENERAL

a) The tank height shall not exceed one and half times the diameter of the tank or 20 m whichever is less. However, the ratio of height /dia may exceed 1.5 times subject to structural stability certification from competent / statutory authority.

b) All Piping from / to any tank including connected fixed spray riser / foam line (if applicable) shall run directly to outside of dyke to minimize piping within the enclosures.

Piping design inside tank dyke area should ensure easy accessibility for any operations in the tank farm. Elevated Catwalks above the height of the dyke wall shall be provided for safe access and exit in case of normal / emergency situations. The catwalks shall run at the same level and terminate directly outside the dyke.

c) No part of the dyked enclosure shall be below the level of surrounding ground immediately around the outside of dyke area.

d) The minimum distance between a tank shell and the inside toe of the dyke wall shall not be less than half the height of the tank.

e) Properly laid out road shall be provided for easy access on all four sides of each dyke for normal and emergency use.
4.5 PROTECTION OF FACILITIES:

a) Properly laid out roads around various facilities shall be provided within the plant for smooth access of fire tenders etc. In case of emergency.

b) The boundary wall shall be constructed as per the directives of the Ministry of Home Affairs or any other Government directive. In any case the boundary wall shall be of minimum 3m height with V/U shaped barbed wire fencing on top of the wall with 600 mm diameter concertina coil on top (in V/U shaped fencing).

c) There shall be a pedestrian patrolling track along the inside perimeter of the boundary wall for security patrolling. The pedestrian patrolling track along the boundary will be required where sufficient green belt zone is envisaged or left unutilized for future expansion and security surveillance is obstructed due to growth of tress/vegetation etc.

d) Security watchmen tower along the periphery boundary (if provided) shall have clear access from main peripheral road of plant.

e) The emergency gate shall be away from the main gate for evacuation of vehicles and personnel in emergency and shall always be kept available and free from obstruction.

f) CCTV shall be installed in plant area covering entry/exit gate, periphery of installation and all critical operating areas which shall be monitored continuously. CCTV monitoring station shall be provided in control room, Security cabin and in-charge room.

g) The storage tank bottoms may be protected against soil corrosion by providing suitable cathodic protection system based on requirement and maintained (if provided) in sound working condition.

h) Truck parking area based on fleet size shall be provided adjacent to the plant gate with following facilities:
   - Segregation of parking area thru’ chain link fence/boundary wall.
   - Separate entry and exit gate with security control.
   - Parking lane demarcation or slotting to ensure independent drive out position parking for quick evacuation in the event of emergency.
   - Suitable fire protection facility thru’ hydrant / monitors shall be considered at least from two sides of the parking lot.

4.6 SEPARATION DISTANCES BETWEEN VARIOUS FACILITIES.

4.6.1 (BETWEEN STORAGE TANKS AND OFFSITE FACILITIES)

a) For lube / grease manufacturing plant storing excluded products, minimum separation distances between various facilities shall be as per table-1. The table shall be read in conjunction with the notes specified with the table.

b) Class–C petroleum, if stored in separate dyke or along with excluded product, in lube plant, the same table–1 shall be applicable for the purpose of separation distances between various facilities.

c) Separation distances between the nearest tanks located in separate dykes shall not be less than the diameter of the larger of the two tanks or 30 meters, whichever is more. In case of space constraints, the distance can be reduced, provided hydrants are placed at a minimum distance of 20M from the respective tank shells on both sides.

d) For facilities where inter distance is not meeting in existing locations, necessary Quantitative Risk Assessment (QRA) carried out and suggested control / mitigation measures shall be implemented.
e) The layout shall also take into account findings / recommendations of Risk Analysis / Assessment study, which shall be carried out at all the stages of facility development process.

4.6.2 FOR SEPARATION DISTANCES BETWEEN OTHER BLOCKS / EQUIPMENT:-

Table -2 shall be followed for inter-distances between various facilities within the Process Block. The table shall be read in conjunction with the notes specified with the table

Table-1  Separation distances between various facilities (between storage tanks and offsite facilities):-

<table>
<thead>
<tr>
<th>#</th>
<th>From / To</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Process Block</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>15</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>15/6( Note-5)</td>
</tr>
<tr>
<td>2</td>
<td>Storage tanks in tank farm area (Excluded/Class C)</td>
<td>15</td>
<td>x</td>
<td>15</td>
<td>30</td>
<td>15/30</td>
<td>0.5D min</td>
<td>20/30</td>
<td>15</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Bulk loading/unloading gantry (road) (excluded/class C)</td>
<td>15</td>
<td>15</td>
<td>X</td>
<td>30</td>
<td>15/30</td>
<td>20</td>
<td>20/30</td>
<td>15</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Fire Engines/water tanks</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>X</td>
<td>30</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>30</td>
<td>X</td>
<td>6</td>
<td>X</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Boiler house</td>
<td>30</td>
<td>15/30</td>
<td>15</td>
<td>30</td>
<td>30</td>
<td>X</td>
<td>15</td>
<td>15</td>
<td>6</td>
<td>30</td>
<td>6</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Boundary wall</td>
<td>20</td>
<td>0.5 D min</td>
<td>20</td>
<td>6</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Admin Building/ Fire Control Room/ Canteen</td>
<td>30</td>
<td>20/30</td>
<td>20</td>
<td>30</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>15</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Cooling Tower/ DM/ RWTP</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>15</td>
<td>X</td>
<td>6</td>
<td>6</td>
<td>15</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>API separator or Sludge pit</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>6</td>
<td>X</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>Electrical sub station</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>x</td>
<td>6</td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>Workshop and</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>6</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>15</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>
Table-2
Inter-distances between various facilities within the Process Block

<table>
<thead>
<tr>
<th>Warehouse</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Fire Station (Fire tender, Ambulance etc)</td>
<td>30</td>
<td>30</td>
<td>X</td>
<td>30</td>
<td>X</td>
<td>6</td>
<td>15</td>
<td>X</td>
<td>6</td>
</tr>
<tr>
<td>13 Thermic Fluid Heater</td>
<td>15/6 (Note-5)</td>
<td>15</td>
<td>15</td>
<td>X</td>
<td>15</td>
<td>15</td>
<td>6</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

**NOTE:**

**General Note to table -1 & 2**

1. All distances are in meters. “X” indicates any suitable distance for constructional, operational and maintenance requirement as per good engineering practice.

2. All distances shall be measured between the nearest points on the perimeter of each facility except (i) in case of tank vehicle loading / unloading area where the distance shall be from the Centre of nearest bay. (ii) The distances given in case of storage tanks are from the shell of the tank.

3. The distance specified is between two sub-units/ facilities in the same Process Block.

4. Separation distances between two Process Blocks shall not be less than 30 meterse. In case of space constraints, the distance can be reduced, provided hydrants are placed at a minimum distance of 20M from the respective process Blocks on both sides.

5. Thermic fluid unit within the process block shall have clear distance of 6 mtrs from other facilities in the same process unit. Thermal fluid heater unit and Boiler unit can be in the same block.
Specific note to table-1& 2

1. For a process control room attached to single process unit like lube blending unit or grease cooking unit, the minimum separation distance shall be 6 M from the nearest vessel. Each process control room shall have separate emergency exit.

2. The distance specified in tables above is minimum.

3. Building within the blocks for operational / maintenance requirements shall not be considered as administrative building for the purpose of inter-distances.

4. Mezzanine floor for storage of input packaging material in can filling plant shall not be provided above the filling machine.
5. DESIGN CONSIDERATIONS

5.1 CONSTRUCTION OF STORAGE TANKS

Fixed Roof Tank

Fixed roof may be of cone type or dome shaped. The tank may be pressurized (to a few inches of water) type with fuel gas or inert gas blanketing to prevent oxygen/moisture ingress. For designing atmospheric / low pressure tanks, API STD 650 or API 620 or IS 803 or IS 10987 shall be followed based on the type of the tank.

5.2 Selection of type of storage tanks

Selection of type of tank generally depends on ambient conditions and the product handled. Decision lies with User Company.

5.2.1 SPECIAL CONSIDERATIONS

Tank bottoms shall be of cone up or cone down ("Apex down") based on requirement and product handled and decision lies with User Company.

5.2.2 TANK APPURTENANCES

i) Handrails
   Hand rails and toe guards shall be provided around the roof for safe movement of personnel for tank dipping, inspection, maintenance etc.

ii) Stairs
   Above ground / horizontal tanks shall have access to their roofs by means of a ladder or staircase constructed and attached to the outer tank shell. An alternate, emergency access / escape ladder or staircase may be constructed based on site specific / user requirement. Stairs shall be made of grating. All stair cases shall have resting / landing platform for every 5 M height. The landing platform as well as individual stairs / ladders shall be provided with toe guard. The stairs / ladders shall have suitable hand railings on both sides.

iii) Manholes
   Number of manholes shall depend on diameter of the tank and code followed for construction of tanks. Each manhole shall be of suitable sized and provided with hold down handle for ease of handling for maintenance etc.

   iv) Two isolation valves to be installed on each product / water draw off lines.

5.2.3 TANK FARMS / MANIFOLDS

i) Tank Farm Drains

The dyke drain shall be provided along the inside periphery of the dyke enclosure wall. In case circular drain around tank pad is provided, the same needs to be connected to the peripheral drain.

The outlet from dyke shall have the provision to either divert to the effluent Treatment plant / OWS or to main storm water drain.

Dyke drain Valves shall be provided with position indicator. Audio alarm and visual indication shall be provided in the control room to monitor open/close status of dyke valve.
5.2.4 TANK MANIFOLD

i) The number of inlet / outlet connections to the tank shell should be kept minimum. Each nozzle connected to tank shell shall have minimum two valves. 1st tank body valve on inlet / outlet / recirculation line shall be motor operated valve (MOV) / Pneumatic operated valve (POV) and 2nd valve can be hand operated valve or MOV/POV as decided by the user. This clause is applicable for above ground tanks having capacity 200 kl and above. Water/ product draw off lines terminated close to tank shall be provided with at least two manual operated isolation valves. The above stipulation is not applicable for steam lines / jet / educator mixing lines entering the tanks.

ii) The Close push buttons of MOV/POV shall be provided in field i.e. just outside the dyke. Open feature can be near the valve inside the dyke these push buttons shall have distinctive feature so that opening is different than action required for closing (e.g. pull type and push type). Motor operated valve (MOV) / Pneumatic operated valve (POV) should have provision for local manual over-ride.

iii) The push button assembly shall be mounted at a place, easy accessible to the operator and valves would be visible. MOV shall have open and close remote operation from control room also.

iv) Tank manifold(s) for excluded products, if provided, may be located inside the dyke. Manifold for class –C if considered shall be provided outside the dyke area. The floor underneath the manifold shall be paved and have embankment wall and connected to oil water drainage system leading to ETP / OWS.

v) Thermal safety valve (TSV) / Expansion line shall be provided for blocked portion of pipe line(s) to take care of the thermal expansion of product due to rise of temperature.

vi) TSV outlet line or expansion line shall be connected back to tank shell / tank inlet / outlet line suitably. TSV or expansion line shall have provision of NRV before termination to tank shell or inlet / outlet line. Isolation valves shall be installed on both sides of NRV for ease of maintenance / inspection of NRV.

5.2.5 TANK SETTLEMENT

Settlement of tanks takes place over a period of time and a depression is formed on tank pad along the circumference. The same should be effectively made up with proper slope to avoid rain water accumulation and subsequent corrosion of the bottom plate. Where large settlement is anticipated, supporting arrangement for the connected piping shall be suitably designed to take care of the settlement.

5.2.6 TANK HEATERS / MIXERS

i) Heaters

Tank heating can be accomplished either by steam heating or electric tracing or hot oil circulation. Heating flues using fired burners is not permitted.

ii) Design Criteria

Tank heaters shall be designed to hold the product at the specified storage temperature when tank is filled up to safe filling height. For design calculations, it is necessary to specify average wind velocity and minimum ambient temperature over extended period of time.

iii) Steam Heating (low pressure steam)

Man way heaters consist of a tube bundle, usually of hairpin type, fixed through a manhole of the tank. Man way heater shall be designed so that its removal can be done without the requirement of person entering in the tank.
Steam coils should have no flange connections inside the tank. Provision should exist in condensate outlet lines to check for oil leak. Gradient of the coil bundle inside the tank should be
such that condensate accumulation is avoided. Inlet and outlet nozzle height of steam coil shall be such that the same shall always be immersed in the dead level of storage tank.

iv) Hot Oil system
In case of fuel oil, LSHS etc steam leak in the tank could lead to boil over. For this reason, hot oil heating can also be considered for such cases. This would consist of fired heater located in remote area. A pump takes suction from a tank containing heating oil (e.g dowtherm) and circulates through heater to the tank. Necessary remote temperature indicators and control valves are required for the system. Isolation and sampling facilities are to be provided at each tank to check leaks. Heating oil tank level should be monitored with indicators and alarms.

v) Electric Heating
Electric heat tracing of one or more courses of shell can be provided. However, the classification and thermal rating of electric heat tracing should be verified before application. The electric conduits and cabling should conform to Classification of Areas for Electrical Installations.

vi) Tank mixtures
Mixing is required to avoid stratification of heavy oil products and also to accommodate downgraded products, seasonal quality changes as well as for pipeline inter phases during pipeline transfer.

vii) Types of mixers
- Blending may be carried out by side entry propeller mixers, jet mixers or educator mixers. In general educator mixers shall be preferred for blending. The outlet of educator shall be located away from tank shell to avoid direct impingement.
- Jet mixing shall not be considered for high viscous products and products with high water content. Selection of type of mixer should be based on safety of operation. The mixing stream in operation should never break the surface of the liquid.
- The side entry propeller mixers should be of such design as to facilitate add-packing while the tank is in operation.

5.2.7 DRAINS FROM THE TANKS

i) Bottom Drains
Drains should be provided in all tanks for draining water and also for emptying out the tank for cleaning. Besides, these are also useful for draining water after a hydro test or initial flushing during a start-up operation. Number and details of the drains shall be as per the applicable tanks design standard.

ii) Drain line
Each drain line shall have minimum two isolation valves and pipe extended beyond tank pad up-to drain point. One of these valves shall be of quick closing type. Ends of each drain point should have provision of blind flange/capping arrangement.

5.2.8 VENTS

Open Vents
Number of vents shall be provided as per applicable standard. For sizing the vents API STD 2000 is to be referred. However, following are the basic guidelines need to be considered.
- Maximum and minimum ambient temperatures
- Vapour pressure of the product at operating/design temperature
• Maximum pumping in and out rates. In the event of change in any operating parameters involving change in pumping rates complete end to end system check shall be done in line with Management of Change procedure. For details refer –MOC chapter.

• Blending components likely to be handled in the tank

5.2.9 DIP HATCH / SAMPLING

Dip hatch or gauge hatch is used for gauging the level of the liquid in a tank as well as to take out samples for testing. Gauge hatch cover shall be self-closing type. Suitable barrier shall be provided on roof around half of the neck of gauge hatches at down side to prevent any spread of spill owing to the gauging/sampling.

5.2.10 INSTRUMENTATION

i) Level controller for storage tanks: This clause is applicable for above ground tanks having capacity 50 kL and above.

Level controls on the tank shall be provided as under:
Minimum one reliable level instrument shall be provided in each above ground tank.

High Level (H) alarms: The tanks shall have provision of level instrument for sending audio visual alarms to the process control room.

Level for “H” alarm shall be decided based on site specific operating parameter i.e diameter of tank, flow rate and operators response time for corrective measures to stop product level reaching curb angel. However, this level shall be below the level corresponding to tank safe filling capacity.

ii) Additionally an independent level switch shall be provided at the “HH” level which in any case shall not be above the level corresponding to safe filling capacity of the tank. This level switch shall enable initiation of action for closure of the respective tank inlet line MOV /POVs i.e 1st tank body valve so that the entire receipt operation closes on safe mode and the product does not over flow.

Closure of pump should be based on pressure development philosophy in the outlet line in case of transfer from Refinery.

Care need to be taken for tanks receiving product from ships at high flow rates for surge pressures due to sudden closures of valves and accordingly where ever required, suitably designed surge relief system to be provided. Timely closure of transfer operations to be ensured through effective communication system.

iii) Temperature and Insulation.

When product storage temperatures are likely to be higher than 100 degree C, a remote temperature indicator with alarm should be provided in addition to local indicators. The location of the temperature indicator shall be 500 mm above the inlet/outlet nozzle so as not to sense the direct heat of the coil.

Insulation shall be provided for heat conservation. The storage tanks /process tanks having higher surface temperature shall have insulation up-to minimum 2 M high for personal protection. Also, patch insulation should be provided on the shell along with spiral stairway/ladders.

5.2.11 PIPING / VALVES / FLANGES

Piping: shall be designed for handling of Hydrocarbon liquid as per “ASME B 31.3: Process Piping” or ASME B 31.4 (for cross country pipelines only entering the terminal) or API 5L or equivalent as applicable.
Pipe joints should be welded as far as practicable with full penetration weld. Number of flanged or threaded joints should be kept to a minimum.

In case sampling point is provided on receipt line for operational requirement, the same should be provided outside of dyke in the manifold.

Sectionalizing of the pipe lines with isolation valves and arrangements for injection /draining of water shall be provided for facilitating hydro-testing of the pipe lines.

Buried piping shall be protected against physical damage and corrosion with suitable protective coating.

At road crossings, in addition to protective coating, pipes should pass through secondary encasing with properly sealed at both the ends.

The pipe lines should be provided with low point’s drains and high point vents to facilitate emptying /hydro-testing etc. Ends of each drain point shall have provision of blind flange/capping arrangement.

Valves:
Steel valves conforming to relevant API standards shall be used. Cast iron valves shall not be used.

Fittings:
Steel flanges and flanged fittings shall conform to relevant ASME / ASTM/ANSI or equivalent.
Slip on or weld neck flanges should be used.
Screwed flanges for sizes 50 mm or smaller may be used.
Steel flanges should conform to the applicable provisions of ASME B 16.5 or equivalent.
Steel screwed fittings and couplings shall conform to ASME B 16.11 or equivalent.
Steel unions shall have ground metal to metal seats. Gasket type unions shall not be used.
Plugs shall be of steel. Cast iron or brass plugs shall not be used.
All flanges shall be connected for bonding for electrical continuity.

5.3 BULK LOADING / UNLOADING FACILITY

i) Loading / unloading Pumps

- Pumps conforming to relevant API standards shall be used.
- Product pumps shall be provided with suitable sized strainers on suction and NRVs on discharge lines. All drain points of strainers shall be provided with double isolation valve and ends having provision for blind flange / screw capped
- Pumps shall be located in an exclusive paved area with drainage facilities routed to OWS / ETP.
- Pump house shall be positioned at an elevated platform and shall be well ventilated on all four sides.
- In case of sunken pump house, adequate ventilation and efficient disposal arrangements of accumulated products shall be ensured.
To avoid wide variation in pressure, leading to a ‘kick’ or ‘hammering’ in header and hoses, it is necessary to choose pumps with flat characteristic curves.

Loading pumps shall also be provided with additional remote stop switches at the strategic point close to loading area to switch off the pump in case of emergency such as over flow, fire or any other abnormal situation.

Automated plants alternately, can install ESD at strategic points for total shutdown.

Dedicated pumps for individual products shall be provided.

Suction and discharge lines shall be provided with thermal safety relief device to relieve pressure due to ambient temperature rise. Thermal Safety relief device may vent into a tank or piped to OWS located in safe area. When connected to tank, it (TSV) shall be provided with isolation valves. One isolation valve shall be installed close to the tank shell to the maximum extent possible.

Pump delivery shall have bypass to facilitate loading operations in peak and lean periods.

ii) Tank truck loading Gantry (top or bottom loading)

Loading points shall have quick shut-off valves such as Cast steel Ball Valve.

Where flow indicators / totalizers are provided for gantries, vapour eliminators shall be incorporated.

In case of loading hoses, only neoprene impregnated hoses having electrical continuity between nozzle and flange shall be used.

Proper lighting shall be provided.

Loading gantry shall be provided with at least one suitable telephone or paging device or walkie talkie for communication with pump house in normal and emergency operations.

Tank truck loading gantry shall be suitable for all weather conditions.

Tank Truck loading gantry shall be provided with safety harness to protect the operating crew against fall from height.

Swing type loading platforms with counter weight and hand railing shall be light in construction.

Proper handrail arrangement shall be provided on platforms and stairs for safe movement of personnel. Stairs and platforms shall be constructed of gratings. Minimum width of stair shall be 600 mm.

At one emergency escape ladder shall be provided at rear middle of 8 bays gantry for emergency use. Minimum width of emergency ladder stairs shall be 600 mm. Escape ladders shall be prominently identified from distant view. A safety cage shall be provided around top portion of the escape ladder.

Protection against pressure surge in the loading header due to sudden change in loading rate need to be considered. Provision of shock absorber as one of the surge protection method at suitable locations on loading header should be considered.

Provision shall be made for quick isolation of main product headers in case of emergency. For this purpose, suitable type hand operated valves or remote operated valves shall be considered as per the site conditions and overall automation system in the installation. Isolation valves shall be located at least 15 m away from the gantry and easy accessible position.
• Drain in front and rear side of the loading / unloading gantry shall be provided. Open drains along gantry shall be covered with gratings so as not to endanger movement of personnel.

• Loading gantry area shall be paved for smooth draining. Oil and water collected from loading / unloading areas shall be routed to Oil water separator system / Effluent Treatment Plant or similar facility. A slop tank should be earmarked for storing separated oil.

• The tank truck gantry shall be so designed that all the compartments of the tank truck are filled at one bay only. The layout shall ensure that all operations are planned in a manner so that no zigzag movement of the tank truck around the gantry should take place.

• All trucks entering the plant shall have safety fittings as required.

iii) Blending / Grease vessel pumps

    Installation of pumps should not be directly beneath the blending / grease vessels. Spillage from the process vessels directly on heated / overheated pumps may cause safety / fire hazard.

iv) Pipeline Pigging system and pigging Manifold.

    Interconnecting the large number of source tanks with different possible destinations (blending, filling and bulk loading etc has always been a major challenge of Lube blending plants.

    Thus wherever required, the Pipeline Pigging system can be used where a large variety of products are transferred primarily for optimization of installation cost by reducing the number of lines.

    The pigging system/ manifold must be a closed system to ensure safe interconnection without cross contamination or product loss.

5.4 HANDLING OF SICK / LEAKY TANK TRUCKS/TANK WAGON

Suitable provision shall be made for safe handling of sick / leaky tank trucks/tank wagons. These methods should include:

• Arresting of leaks using suitable method as a first aid measure till the sick / leaky tank truck /tank wagon is unloaded safely at designated place. In no case such tank truck/tank wagon to be used for transportation.

• Either permanent facility or portable pump motor arrangements with suitable fittings to be used for quick disposal. Such products to be handled further as per IQCM (Industry Quality Control Manual)

5.5 HANDLING OF SLOP

Collection and Drainage

A network of drainage system shall be provided to collect Oil drains from various equipment, storage area, filling plant, gantry areas, pump houses etc. They should also collect surface drains from places where Oil spillages are likely to occur. The drainage shall lead to OWS / ETP as the case should be.

5.6 ETP/OWS

The receiving sump of the OWS shall have suitable arrangement for skimming off upper layer of accumulated Oil. Provision shall be made for directing the collected Oil to the slop tank.

Final effluent discharge should be tested periodically to check the PPM contains in order to meet the prescribed limit by PCB.
5.7 ELECTRICAL EQUIPMENT

Electrical equipment shall be selected, sized and installed so as to ensure adequacy of performance, safety and reliability. The equipment in general shall conform to relevant Indian Standards and shall be suitable for installation and satisfactory operation in the service conditions envisaged.

Protection: The protective system shall be designed to ensure Protection of Personnel and plant equipment against damage which can occur due to internal or external short circuits, overloading, abnormal operating conditions, switching, lightning surges, etc accordingly, relays and protective devices shall be suitably selected and installed.

All enclosure for electrical equipment/ panels/ JB's/ double entry glands for cable entries in process blocks, finished product and empty storage area should have Ingress Protection (IP 54/ IP 55).

All the protective relays for the Generator, Transformer, Motors and Switchgears shall be tested at least once in a year and test records maintained.

i) Variable speed drivers, electrical system

A reduction in electricity consumption will be achieved by installing soft starters and variable speed drivers for agitators at the oil blending unit, pumps and compressors. Thus should be considered.

ii) Cables

In order to avoid spread of fire due to cables, the outer PVC sheath of all cables used inside the plant operating area shall be fire retardant type conforming to category AF as per IS: 10810. The cable shall have a low smoke property. The minimum Oxygen Index shall be 29.

All power and control cables shall have extruded inner and outer sheaths. Cables should be Aluminium /Copper Conductor PVC insulated, PVC sheathed, armoured type.

Instrument signal communication cables shall not be laid in the same trench / tray along with electrical cables. The overall cable layouts shall be designed for minimum interference between signal and power cables.

Cable route markers shall be installed at every 30 metres intervals all along the cable routes and also at cable joints and locations where the direction of cable trench changes.

ii) Measurement of earth resistance

Earth resistance can be directly read through an earth test Megger which has associated Test, auxiliary Current and Potential electrodes. This instrument which is a combination of ohmmeter and generator works on 'fall of potential' principle. Test voltage is derived from the generator of the Megger. Earth resistance also can be measured through direct earth clamp tester (DECT).

The testing of the Earth Pits shall be done half yearly basis, once in dry and once in wet weather and records maintained.

Removable link shall be provided to allow measurement of an earth electrode-resistance independently.

Allowable earth-Resistance Values
The resistance value of an earthing system to general mass of the earth should not exceed.

- 4 Ohms for electrical systems and metallic structures
- 7 Ohms for storage tanks
- 1 Ohm for main earth grid, and bonding connections between joints in pipelines and associated facilities.
- 2 Ohms for each electrode to the general mass of the earth.

5.8 PLANT EARTHING / BONDING

Installation earthing design shall be carried out in accordance with the requirements of Indian Electricity Rules and IS: 3043, OISD RP 149 or equivalent system recognized by statutory authorities under the petroleum Act / electricity Act. All earth connections (termination) should be visible for inspection to the extent possible. Termination joints inside the earth pit shall be at workable depth to facilitate testing etc. Earthing system shall be designed for the following:

- System neutral earthing.
- Protective Equipment Earthing for personnel safety.
- Protection against Static discharges.
- Lightening Protection
- Earthing for Data Processing system

The earthing system shall have an earthing network with required number of earth electrodes connected to it. The following shall be earthed:

- System neutral
- Current and potential transformer secondary neutral
- Metallic non-current carrying parts of all electrical apparatus such as transformers, switch gears, motors, lighting/power panels, terminal boxes, control stations, lighting fixtures, receptacles etc.
- Steel structures, loading platform etc
- Cable trays and racks, lighting mast and poles
- Storage tanks, vessels, columns and all other process equipment
- Electrical equipment fencing (e.g transformer, yard etc)
- Cable shields and armour
- Flexible earth provision for truck
- Pump handling hydrocarbon if its base plate is separate from motor’s base plate

a) Electrically independent earth electrodes

Earth electrodes shall be located at such a distance from each other so that the maximum current likely to flow through one of them does not significantly affect the potential of the other.

The Lightning Arrestor (LA) of the Two Pole / Four Pole structure shall be connected to two distinct earth pits. The strips shall run on insulators / isolators so as not to come in contact with the Pole structure. Connections shall be made to the pit directly and then pits will be connected to each other to form an independent earthing network. This independent lightning protection earthing network (grid) may be connected to electrical safety earthing network (grid) below ground (500 mm), minimum at two points.

The use of rod / pipe / strip electrodes is permissible. Their choice will depend upon site conditions, soil resistivity and economic considerations. The material of earth electrodes shall be galvanized iron.
The whole of lightning protective system including any earth ring shall have a combined resistance to earth not exceeding 10 ohm without taking account of any bonding.

The Two Pole / Four Pole structure shall be earthed with two distinct earth connections. The Gang Operated Switch shall also be earthed.

Fencing of two Pole / four Pole, Transformer yard shall be earthed and also electrical continuity between various structures the fencing shall be ensured.

The Neutral of the Transformer shall be earthed with two distinct earth pits separately. Connections will be made to the pit directly and then pits will be connected to each other to form a grid. This Grid may be connected to electrical earthing network preferably at two points below the ground (500 mm).

The Neutral of the Diesel Generator shall be connected to two distinct earth pits separately. Connections shall be made to the pit directly and then pits will be connected to each other to form a grid. This Grid may be connected to electrical earthing network preferably at two points below the ground (500 mm).

The transformer body shall be earthed at two points separately leading to earthing system.

All Metallic non-current carrying parts of all electrical apparatus shall be earthed to ensure that the exposed metallic parts do not become dangerous by attaining high voltages in case of faults.

All the electrical equipment operating above 250 volts shall have two separate and distinct connections to the earth grid.

All Steel structures, loading platform / gantries etc shall have two separate earthing connections. Connections shall be taken from the grid.

Each Product Storage Tank shall have minimum two separate earth connections from the grid. If tank circumference is more than 60 M, then one more additional earth connection to be made to ensure that one earth connection at every 30 M circumferential distance. Earthing grid for each tank farm shall have minimum two earth pits, however, grid resistance should be within 1 ohm. Tank farm earthing grid may be connected to other earthing grid.

No of earth connections shall be decided based on tank diameter considering that the spacing between any two earth connections shall not exceed thirty meters along the tank perimeter.

b) Bonding:

Flanges: All joints in pipelines, valves, storage tanks and associated facilities and equipment for petroleum shall be made electrically continuous by bonding. The resistance value between each joint shall not exceed 1 ohm.

Tank Truck Loading and Unloading Gantry: For the gantry 6 mm Sq. braided copper wire with one end firmly bolted to the Loading Unloading Arm / hoses and the other end provided with G.I / Copper / Non corrodible metal crocodile clips are to be used, the crocodile clips being attached to the tank-truck under loading or discharging. (For External Bonding of Loading unloading arms/hose with the Tank Truck).

c) Static earthing

Static Earthing (earthing for static charge dissipation) shall be provided at Tank Lorry filling / decantation Gantries, to prevent building up of Static Charges.
The earthing for static dissipation, electrical system and automation system shall be separate and can be taken from main grid below the ground.

d) **Lightning protective for structure and building**

Lightning protection shall be provided for the structures and buildings which are higher than 20 meters or as per the risk index analysis worked out as per IS 2309.

Self-conducting structures having metal thickness of more than 4.8 mm may not require lightning protection with aerial rod and down conductors. They shall, however, be connected to the earthing system, at least, at two points at the base.

Non-conducting chimneys or stacks whose overall width or diameter at top is up-to 1.5 M shall be provided with one aerial rod and down conductor and chimneys with overall width of diameter at top more than 1.5 M shall be provided with 2 Nos. aerial and down conductors.

In case, lightening arrester is provided for any structure or building or stack, an independent earthing network shall be provided for grounding the lighting protection system. They may be connected at main earthing grid at two places below the ground at least 500 mm.

OISD –GDN-180 may be referred for details on lighting protection.

e) **Earthing for data processing system**

Low noise Earthing are required for critical data processing equipments. These are to be independent of any other Earthing of the Building. RFI (Radio frequency interference) suppression filters fitted to the data processing equipment may produce high earth leakage current. In such cases failure of protective earth connection may lead to high touch voltages.

Where ever isolation transformers are used the output neutral of the transformer shall be independently earthed so as to ensure that the Earth-Neutral Voltage is less than 1 volt.

f) **Minimum Permissible Sizes of the Earthing Conductors:**

Size of the conductor shall be selected based the fault current that is required to be dissipated during emergencies.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Size of the conductor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Earthing Grid</td>
<td>50mm x 6 mm GI strip</td>
</tr>
<tr>
<td>Lightening Arrester of the 2/4 Pole Structure</td>
<td>50mm x 6 mm GI strip</td>
</tr>
<tr>
<td>2/4 Pole structure / Sub-Station equipments /</td>
<td>50mm x 6 mm GI strip</td>
</tr>
<tr>
<td>VCB etc</td>
<td></td>
</tr>
<tr>
<td>Fence of the 2/4 pole structure / transformer</td>
<td>25mmx3 mm GI strip</td>
</tr>
<tr>
<td>Power Transformer Neutral</td>
<td>50mmx6 mm GI strip</td>
</tr>
<tr>
<td>Power Transformer Body</td>
<td>50mmx6 mm GI strip</td>
</tr>
<tr>
<td>Equipment</td>
<td>Material and Details</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Fire Water Pump House</td>
<td>25mmx3 mm GI strip</td>
</tr>
<tr>
<td>Building / Structure Columns</td>
<td>50mm X 6mm GI Strip</td>
</tr>
<tr>
<td>Storage Tanks</td>
<td>50mm X 6mm GI Strip</td>
</tr>
<tr>
<td>Push Button Stations</td>
<td>No. 8 SWG Solid GI Wire</td>
</tr>
<tr>
<td>Street Light Poles</td>
<td>10 mm (3/8&quot;) GI Wire Rope</td>
</tr>
<tr>
<td>Small Equipment and Instruments</td>
<td>No. 8 SWG Solid GI Wire</td>
</tr>
<tr>
<td>Bonding of Pipes</td>
<td>25 mm square copper strip / braided flexible cable.</td>
</tr>
<tr>
<td>Motors up to 3.7 Kw</td>
<td>No. 8 SWG Solid GI Wire</td>
</tr>
<tr>
<td>Motors above 3.7 Kw up to 30Kw</td>
<td>10 mm (3/8&quot;) GI Wire Rope</td>
</tr>
<tr>
<td>Static Earth at Tanker / Wagon loading/ Unloading gantry</td>
<td>50mmx6 mm GI strip.</td>
</tr>
<tr>
<td>Flexible cable for Static Earth</td>
<td>10 Sq mm Copper flexible cable with lugs at one end and crocodile clip at other end.</td>
</tr>
</tbody>
</table>

**g) No of earth pits**

This is minimum requirement and additional earth pits shall be made such as to maintain Grid Values below 1 Ohm.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthing for LA</td>
<td>2 Nos independent</td>
</tr>
<tr>
<td>For Di / Four Pole Structure, GO, Fence</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Neutral of the transformer / group of transformers</td>
<td>2 Nos independent</td>
</tr>
<tr>
<td>Neutral of the D G Set / group of DG sets</td>
<td>2 Nos independent.</td>
</tr>
<tr>
<td>Body of DG Set / control panel for DG Set</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Sub-station –PMCC Room</td>
<td>2 Nos independent.</td>
</tr>
<tr>
<td>Fire Pump House</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Air Comp House</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>All structures Shed of Pump House / Fire Engine / Loading unloading Gantry / Air Compressor / Engg Store etc.</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Static Earth for Loading / unloading Gantry (Tank Truck)</td>
<td>2 Nos independent.</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>All 3 Phase Motors / FLP lights in each shed</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>High Mast Tower (HMT)</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Admin Blocks</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Data Processing</td>
<td>Independent grid of minimum 2 earth pits. One earth for Metallic body parts of equipments and two for neutral of isolation-transformer</td>
</tr>
<tr>
<td>Inspection Platform / Watch Tower / Weigh Bridge</td>
<td>One earthing connection from grid.</td>
</tr>
<tr>
<td>Water Storage Tanks (Fire Water Tank)</td>
<td>Two earthing connections from grid.</td>
</tr>
<tr>
<td>Laboratory</td>
<td>2 Nos independent</td>
</tr>
<tr>
<td>Product Storage Tank</td>
<td>Two earthing connections from grid.</td>
</tr>
</tbody>
</table>

### h) Electrical safety for laboratories

Hazardous area classification within laboratory building should be carried out in line with OISD STD-113 and IS:5572. Accordingly, the electrical equipment / fittings should be selected in line with IS:5571.

Following aspects should be considered for electrical equipment / fittings in the laboratory.

- Layout of electrical switch room have spacing as per Indian electricity rules.
- Plugs, having multiple outlets, should not be used. Industrial type closed / tight metal clad fittings for plug and socket assembly should be used.
- ELCB/ MCB shall be installed in the main power switchboard.

### i) General

- Fail safe Interlock / change over switch shall be provided between the normal supply and the DG power to ensure that the equipment get supply from one source only.
- Insulation mats shall be provided in the Sub Station, control panels etc.
- Relays / Cables insulation shall be tested once in a year and records maintained.
- Transformer oil shall be tested once in a year and record maintained. Transformer Oil filtration shall be done based on test results as and when required.
- Variable Frequency Drives (VFDs): In case VFDs are used for motors the motors should be inverter grade or equivalent as VFDs require Insulation class F motor and additional cooling of winding / bearings at lower RPM.
5.9 PLANT LIGHTING

Sufficient lighting shall be provided so as to enable Plant operators to move safely within the accessible areas of installation and to perform routine operations. In the event of normal power failure, emergency lighting shall be provided in critical areas.

Normal lighting system shall be on 415/240V AC supply, whereas critical emergency lighting will be DC based in critical areas like Sub-Station, D G Room, Control Room, Security cabin(s).

Under normal operation, both emergency and normal lighting shall be fed by normal power source. On failure of normal supply, emergency lighting shall be transferred to emergency source until the start of D.G. set within 15 seconds.

Critical Emergency lighting (D.C. supply based) shall be normally kept ‘ON’. During power failure, battery bank shall be used to provide power.

Lighting shall be provided for the various facilities in the Depot/Terminal. The illumination levels in different areas shall be as per good engineering practice.

The Illumination in the operational areas including inside the dyke and manifold shall be such that adequate visibility is there at all times for emergency and normal operations.

Lighting requirements provided during the failure of power supply is intended broadly to,

• Facilitate carrying out of specified operations, for safe shutdown of the installation.

• Gain access and permit ready identification of firefighting facilities such as fire water pumps, fire alarm stations etc.

• To gain access to escape route for safe evacuation of operating personnel.

i) Depending on the nature of job activities carried out, the minimum illumination levels for various areas shall be as follows:

<table>
<thead>
<tr>
<th>Area</th>
<th>Lux level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main roads (Gate entry /exit, roads around loading / unloading (bulk/packed) operating area)</td>
<td>20</td>
</tr>
<tr>
<td>Secondary roads (along storage tanks and Periphery etc)</td>
<td>10</td>
</tr>
<tr>
<td>Tank farm area (tank body valve approach and operating area)</td>
<td>20</td>
</tr>
<tr>
<td>Pump / Compressor / additive dosing Sheds / Fire Pump House</td>
<td>100-150</td>
</tr>
<tr>
<td>Boiler house / thermic fluid unit / Cooling tower unit.</td>
<td>100-150</td>
</tr>
<tr>
<td>Main Operation Platforms and Access Stairs (bulk and packed)</td>
<td>60</td>
</tr>
<tr>
<td>Ordinary Platforms</td>
<td>20</td>
</tr>
<tr>
<td>OWS / ETP Area</td>
<td>60</td>
</tr>
<tr>
<td>Location</td>
<td>Distance (m)</td>
</tr>
<tr>
<td>---------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Sub Station / PMCC room</td>
<td>150</td>
</tr>
<tr>
<td>Transformer yard / HT Di pole area</td>
<td>100</td>
</tr>
<tr>
<td>Battery room, Charger/UPS rooms</td>
<td>150</td>
</tr>
<tr>
<td>Inside Process block /filling units</td>
<td>100 / 150</td>
</tr>
<tr>
<td>Process control Room bldg./ laboratory</td>
<td>300</td>
</tr>
<tr>
<td>Lube Warehouse</td>
<td>100</td>
</tr>
<tr>
<td>Admin Building</td>
<td>300</td>
</tr>
<tr>
<td>Security Cabin / Watch Booth</td>
<td>100</td>
</tr>
<tr>
<td>Stairs (building)</td>
<td>50</td>
</tr>
<tr>
<td>Corridors (building)</td>
<td>70</td>
</tr>
<tr>
<td>Tank truck Parking area</td>
<td>20</td>
</tr>
</tbody>
</table>

i) Low pressure sodium vapour lamps shall not be installed in hazardous areas.

ii) The lighting fixtures on various circuits shall be suitably designed so that failures of any one circuit do not result in complete darkness.

iii) Switches controlling the lighting fixtures and exhaust fan shall be installed outside the battery room.

iv) Switches of lighting panels installed in hazardous area, shall have a pole to break the neutral, in addition to the poles for phases.

v) For details on inspection practices OISD standard 147 to be referred.

vi) Min. One number calibrated lux meter shall be kept in the location.

ii) Emergency lighting panel:

Emergency lighting panel shall have provision of power input both from normal supply and DG supply independently with a provision of failsafe interlock. In the event of failure of normal supply or emergency or maintenance, emergency panel shall be receiving alternate supply from DG set. Emergency lighting panel shall host the following equipment:

Jockey Pump, Critical lighting (one or two high mast, minimum lighting for fire pump house, security room, control room, administrative building, operating facilities etc), Fire Siren, Electrical pumps for fire water replenishment, Gate Barrier, safety instrumentation and interlocks such as CCTV, smoke/heat detectors, Dyke drain valve system, UPS of automation, supply to essential firefighting equipment.
5.10 AIR TURBO VENTILATION SYSTEM IN LUBE PLANTS

The ventilation not only provides pleasant, healthy working atmosphere in work places but also maintains hygienic condition. In emergency like fire, it also extract smokes / fumes which enables easy escape of personnel working there and fire fighters to reach the fire site. Construction material shall be weather proof.

Thus effective ventilation is desirable for 7 x 24 hrs at lube / grease blending blocks, laboratory, boiler house, workshop and other working places wherever required. Design of ventilation system shall be such that it provides single pass once –through type and considered with about 10-12 changes of whole air /per hr

Air turbo ventilation system is preferable as this ventilation works on natural wind energy without any electricity or generator. It can be installed on roof /slopes on sheds.

Salient features should be:-

- 7 x 24 hrs availability
- Noisless operation
- Cost effective
- Capable of extracting heat, humidity, smoke, fumes and dust etc.
- Maintains hygienic condition.

5.11 FLOORING

a) Flooring of blocks shall be non-skid type and having proper slope for necessary drainage.

b) Any level difference on floor in account of operational requirement / equipment layout should be clearly demarcated so as to ensure safe movement of persons.

5.12 STAIRS AND PLATFORMS

a) All platforms / stairs shall be of non-skid type surface, preferably made of gratings.

b) Toe guards and suitable railing shall be provided all around the elevated platform.

c) Alternate access / emergency escape shall be considered for each elevated platform.

5.13 LADDERS

i) General information:
Ladder is an appliance or equipment usually consisting of two side rails joined together at regular intervals with cross pieces like steps, rugs or cleats and used in ascending or descending between two points at different levels.

In Oil industry mainly two types of ladders are used; one is built up ladder and another portable ladders of rigid construction. Salient features are given below, for details refer IS 3696.

Built up ladders: These are built on the job to its particular requirements. They are fastened to the structure in a fixed position, securely held in place and not moved about as required.

Portable ladders of rigid construction: These are used as and when required to give access to scaffolds, platforms etc. in a building or other structure or to any required location for repairs or maintenance. They may be of any type viz. stock ladders, extension ladders, sectional ladders, step ladders, trestle ladders, extension trestle ladders etc.

Portable ladders may be categorized of lean to ladders or self-supporting ladders.
Lean to ladder, that is, their upper ends are supported by leaning against a wall or any other rigid support.

Self-supporting ladders hinged near the upper end with a spreader arrangement between two sections. When such a ladder is arranged for use, it is in the form of letter “A”. Wide flat steps are secured to the side rails which form one of the slopping side of “A”. The other slopping side acts as a strut to support the ladder.

ii) Material construction of ladder:

Metal ladder may be either of steel complying with IS 1977 or of Aluminium alloy complying with the suitable grade of IS 617. Wooden ladder or rope ladder should not be used in Petroleum Industry except usages around electrical equipment or circuits of any kind where there is a possibility of coming in contact with the current. Wooden ladders may be either of timber or of bamboo.

iii) General requirements:
- All ladders shall be constructed to carry their intended loads safely.
- Side rails of metal ladders shall be of sufficient cross-section to prevent excessive deflection in use.
- Ladders which are to remain as a part of the permanent structure shall conform to any local, state or municipal bye laws which may be applicable.
- Top and bottom of each built up ladder shall be securely fastened.
- All surfaces of the ladder shall be planed, free of splinters and edge of hand rails used shall be beveled.
- Rung spacing shall be uniform and not over 300 mm on centers. Rungs shall be recessed at least 12 mm into rails.
- Safety shoes, lashing or other effective means shall be used to avoid danger of slipping.

5.14 STACKING OF DRUMS / PACKED PRODUCTS

i) Stacking of drums or packed lubes / grease should be on racks/pallets/reapers and above the grade levels.

ii) Stacking should be max in 4 rows, 5 tier height and 25 M length. A minimum access path shall be provided which should be min of fork lift turning radius plus 0.5 M between two groups of stack.

iii) Light fittings on the ceiling should be fixed in between two stack lines. Suitable cage type protection shall be provided so as to avoid external damage.

iv) The drum / packed storage space shall be properly marked / painted on the flooring.

5.15 BOILER

The steam boilers intended for use in lube /grease plants shall be governed by the regulation of Indian Boilers Act, 1923 and latest amended Rule thereof applicable in the concerned state.

The design and drawings of the boiler or boiler component, as the case may be, and the materials, mountings and fittings used in the repair of such boiler or boiler component conform to the applicable regulations.

5.16 STEAM STRAP

Suitable type steam strap shall be installed at outlet of steam lines. A steam trap is a device used to discharge condensate and non-condensable gases with a negligible consumption or loss of live steam. Most steam traps are nothing more than automatic valves. They open, close or modulate automatically. Others, like venture traps, are based on turbulent 2-phase flows to obstruct the steam flow.
The three important functions of steam traps are:

- Discharge condensate as soon as it is formed.
- Have negligible steam consumption.
- Have the capability of discharging air and other non-condensable gases.

5.17 THERMAL / STEAM INSULATION

Thermal energy inputs could be reduced through the proper insulation of the blending kettles, steam lines, tanks (deemed fit), equipment etc. to prevent heat losses. Effective insulation protects the personnel from burn injury, thus insulation always to be maintained in healthy condition.

5.18 COMPRESSOR

Compressed air

The quality of instrument air shall conform to the requirements as recommended by the manufacturers of instruments/equipment:

If one compressor is envisaged to run normally, another standby compressor of 100% capacity shall be provided. When more than one compressor running is envisaged, 50% standby capacity shall be provided.

5.19 SERVICE WATER FOR PLANT OPERATIONS

Service water is required for the plant operations such as, Boiler use, cooling tower, compressor cooling and in hose stations for washing etc.

Water may be provided at a pressure of about 3 Kg/sq.cm.g. If one pump is envisaged to run normally, another pump with 100% capacity shall be provided as a standby. Where more than one pump running is envisaged, 50% capacity as standby shall be provided.

Water Quality
Water shall be of potable quality conforming to IS: 10500 - Specification for Drinking Water

5.20 COOLING TOWER

Cooling Tower should be located on the downwind side of the Plant, control room and administrative buildings. Product Pipe rack/track should be located minimum 6m from cooling tower to avoid corrosion due to drift. Suitable dosing system should be provided for corrosion, scale and micro-biological control.

5.21 GREASE PRESSURE VESSEL / REACTOR / CONTACTOR

Pressure vessels shall be suitably designed as per “Static and Mobile Pressure vessels (Unfired) Rule 1981”. It shall have two SRV’s set at 110% and 115% respectively of the maximum operating working pressure.

The Pressure relief line to be connected to a soap collection vessel, suitably isolated, of capacity 1.5 times the nominal capacity of the Grease Pressure Vessel/Reactor/Contactor. The vessel should have suitable nozzles for removal of soap.

Soap transfer lines from grease pressure vessel to open grease kettles to be electrically heat traced. The above transfer lines to have provision of compressed air/LP steam injection inside the line.
The pressure vessel shall have two (each) temperature and pressure indicators at local level and at process control room. In addition, manual temperature and pressure gauge may also be considered.

Vessel shall have a MOV/POV as the first body valve, followed by a manual valve on the soap transfer line.

5.22 INDUCTION SEALING SYSTEM

The container sealing shall have auto cut-off in case of no/slow movement of containers. It shall also enable auto cut-off in case of no containers.

5.23 STORAGE SPACE FOR EMPTY PACKAGES, PACKED ADDITIVES, AND PACKED FINISHED PRODUCT

The storage area should be designed for supporting adequate inventories for peak production capacity to ensure safe storage, handling and smooth operation.

5.24 SRV FOR VESSELS/KETTLES

Vessels / kettles with internal coils/limpet coils/jackets shall have SRV/s installed near entry and exit nozzle set at 110% of the maximum operating/working pressure.

5.25 PRESSURE REGULATION FOR LOW PRESSURE STEAM

Pressure reducing station should be provided, as applicable, for ensuring supply of low pressure (LP) steam.

5.26 TRANSFER / FILLING HOSES

Special type hoses should be used for transfer / filling operations to ensure spill free operations in lube / grease plant. Hoses intended to be used for special products /chemicals / liquids in a lube / grease plant should be selected in conformity to the type / pressure rating required to serve the intended purpose.

5.27 AUTO CUTOFF FACILITY

Lube / grease filling machines preferably should have automatic features like auto filling, auto cutoff, auto pick up etc.
6. SAFE OPERATING / HANDLING PRACTICES IN LUBE / GREASE PLANT OPERATIONS

6.1 GENERAL

This section deals with the safe operating practices and provisions applying to loading, unloading and storage of bulk Petroleum Products at installations. There should be strict compliance w.r.t selection, deployment of proper skilled manpower for effective operation and maintenance.

6.2 SAFE OPERATING PRACTICES

i) Plant process control room where ever provided shall be manned on continuous basis during operations and in emergency.

ii) Site Specific, Standard Operating Procedures (SOPs) shall be developed which not only give what the procedures are, but also why they are needed. These must be made with the involvement of users and approved by the operations and safety team. Such procedures shall be periodically reviewed, updated and records maintained especially whenever any changes / modifications to the facilities are made as per Management of Change procedure (MOC).

iii) The critical operating steps based on “SOPs” shall be displayed on the board near the location where applicable.

iv) POV shall be in fail safe mode (i.e. with loss of pressure the valve shall shut off). At the day end operations all operating valves must be in closed position.

v) VHF handsets of appropriate type shall be provided to all operating personnel working in critical areas.

vi) Check list for operators for checking safety system and equipment shall be prepared and check records kept in safe custody.

vii) All operations shall be carried out under supervision of a responsible officer. Only in serious exigencies, permission can be granted by authorized personnel subject to obtaining a reliever forthwith. The person leaving site shall only be allowed on a valid authorization issued by the immediate officer and records maintained.

viii) The pipe line transfer should preferably be commenced during day light. Due to urgency if operation requires to be carried out/extended in night time, the same to be carried out under supervision of adequate trained and experienced staff.

ix) Manning level in the shift shall be adequate to ensure coverage for normal and emergency operations.

x) Suitable interlocks shall be provided for tripping / alarm of MOV operation based on the events e.g low level, high level, high high level, high pressure, low pressure etc.

xi) The contents of the dyke drain generated from draining of tanks, any other spillage or effluent containing oil shall be diverted to Oil Water separator (OWS) / Effluent Treatment Plant for safe disposal.

xii) Personnel protective equipment (PPE):

    Equipment designed to offer protection against potential hazards, Fire, toxicity, accidental fall etc. during normal and emergency operations.

    Personnel protective equipment such as safety shoe, hand gloves, apron, safety goggles, safety belt, helmet, ear muff, dust respirator, self-contained breathing apparatus (SCBA), fire proximity suit,
resuscitator etc. as applicable shall be worn while carrying out operations in normal and emergency situations.

6.3 BULK HANDLING FOR MOVEMENT BY ROAD

i) Transportation of petroleum products by road is regulated by the Motor Vehicle Act 1988.

ii) Containers and tank trucks shall be fabricated in accordance with OISD-RP-167 POL Tank lorry design and Safety or applicable statutory requirement.

iii) All TTs to be fitted with antilock breaking system (ABS) as per RTO regulations published in 2006.

6.4 SAFETY PRECAUTIONS DURING TANK VEHICLE LOADING / UNLOADING IN BULK

Following precaution shall be taken due to associated hazards during transfer of Petroleum products to or from a tank truck.

i) Open source of ignition shall not be allowed in the area where product transfer operations are carried out.

ii) Similarly minimum 3% vapour space shall be kept in containers and 2% vapour space in tank trucks in respect of petroleum Class C / excluded product.

iii) Fire extinguishers shall be placed near the tank trucks during operations in a designated marked place.

iv) The Double pole master switch shall be put off immediately after parking the truck in position. No electrical switch on the truck shall be turned "on" or "off" during the transfer operation.

v) The first operation after positioning the truck shall be; providing wedge / stopper and earthing. They shall be removed / disconnected just before the release of the truck.

vi) Hoses shall be handled with care and inspected periodically as per OISD-STD-135.

vii) No repairs shall be made on the truck while it is in the loading / unloading area.

viii) Personnel shall wear applicable Personal Protective equipment.

ix) Filling/transfer operations should be suspended immediately in the event of –

- Uncontrolled leakage occurring
- A fire occurring in the vicinity
- Lightning and thunder storm

6.5 SAFE PROCEDURES DURING OPERATION

A. Loading operations

i) Check for following in a tank truck as per statutory regulations before accepting it for filling:

- Provision of PV vent, emergency vent, Master valve and other safety fittings.
- Fire screen between cabin and tank is provided. For this purpose, cabins with metallic back cover without any opening will be considered as fire screen.
- Provision of 2 nos. of Fire Extinguishers of ISI mark (1 no. X 9 kg DCP and 1 no. 1 kg CO2 /DCP /equivalent approved fire extinguisher).
- Spark arrestors should be properly bolted / welded on the exhaust.
- No leakage in exhaust silencer pipe.
- Valid RTO certificate is available.
• Availability of brazed copper strip for Earthing / bonding connection.

ii) Drive the truck at stipulated speed to the loading bay.

iii) Place the truck on loading bay and place wheel wedge /stopper / chokes at front and rear wheels. Keep the truck in neutral mode with hand brakes "ON".

iv) Stop the engine and switch off all electrical equipment.

v) All persons should leave the driver's cabin.

vi) Provide earthing connections of the vehicle at specified point to the fixed grounding system.

vii) Start the loading operations.

viii) The quantity loaded into the truck can be assessed by –

   • Liquid level thru’ manual dipping
   • Filling thru’ Flow meter

B. Unloading operations

i) Operations described under clause 6.5(A) should be selectively carried out.

ii) Test the connections for leaks

iii) Start the Unloading operations

iv) Before realizing the trucks ensure that valves are closed / ends are capped.

v) An authorized person of the company shall supervise the transfer operation and respond immediately in the event of an emergency.

Checklist for bulk/packed lube / additive trucks at loading / unloading locations is given at Annexure-1

6.6 HANDLING OF SICK BULK TRUCK /TANK WAGON

When a truck/wagon is found leaking during / after loading, provision should be kept for unloading the content safely. A drain header should be provided to drain out the content to a underground tank / sump from where it can be pumped out to storage tank or to the loading header. Alternatively, in case, mobile pump is used for unloading sick truck, suitable type electrical motor and power connection should be provided.

6.7 PIPELINE TRANSFER OPERATIONS

Pipeline transfer of product is carried out for receipt / delivery of products to the plant from refinery / jetty pipeline within the same company or between the oil companies.

Where ever pipe line transfer is envisaged between various companies, a mass flow meter with integrator shall be installed on receipt line at both ends i.e despatch and receipt ends. Signal shall be provided in the control rooms of both dispatching and receiving companies / plants for monitoring delivered quantity.
The following safe practices to be followed:

i) Gauging procedure shall be completed and line shall be made through.

ii) Physical inspection shall be carried out up to the exchange manifold for any leakage / damage etc.

iii) Line up shall be started from the exchange pit end

iv) Seal the pressure relief lines of receipt nozzles of product tanks connected to the same common receipt header.

v) After ensuring that there are no leaks, pumping shall be commenced

vi) Pumping shall be commenced initially at low flow rate and only after stabilizing of flow, the flow rate may be increased.

vii) Product shall not be pumped beyond safe filling height of the tank

viii) After completion of the receipt, pumps must be stopped

ix) In case of Emergency Shutdown, care shall be taken so that back pressure is not developed in the pipelines and pump head.

x) Sampling shall be carried out as per provisions of Industry Quality Control Manual (IQCM)

xi) Pipe Line transfer (PLT) shall not be taken simultaneously in more than one tank

xii) In case product is required to be taken into more than one tank, tank should be switched over after completion of operation in first tank, close all valves to the first tank, make line through for the second tank as per procedure. For flying switch over from one tank to another, a written down procedure to be in place and followed.

6.8 SAFETY PRECAUTIONS IN TANK FARM AREA OPERATIONS

i) At the end of day operations, 100 % closure of all the operating valves must be ensured and they shall not be left in partial open condition.

ii) All electrical fittings shall be maintained to ensure its integrity and type of protection.

iii) The tank farm must be kept clean and free from vegetation

iv) Tanks and tank aprons must be periodically checked for damage, leakages, sweating and repairs in line with requirement of OISD STD 129.

v) Proper earthing and bonding shall be maintained for storage tanks and across the flange joints

vi) Dyke drain valve shall be positioned outside of dyke and kept normally in closed condition and shall be operated only under supervision of authorized person and log book maintained.

vii) Isolation Valves on expansion line(s) / TSV vent line(s) shall be always kept open except under requirement during location specific operations to take care thermal expansion.

viii) No gauging or sampling of tanks should be undertaken during thunder or hail storms.

ix) Flow velocity at tank inlet should not exceed 1 m/s until the inlet is completely submerged.

x) Safety shoe (Conductive type) shall be worn while gauging, sampling or taking temperatures.
xi) Ensure that gauge tapes with earthing provision are used for gauging.

xii) Tank dip pipes shall be extending to tank bottom. If dip pipes are not provided, give a relaxation time of 30 minutes before sampling/gauging.

xiii) Synthetic fiber cord shall not be used for sampling, dipping, gauging etc. If the sampling, gauging, dipping, etc., equipment is a conductor, the cord must be conductive, e.g. a metal wire. Metal chains should not be used instead.

xiv) Natural fibers such as sisal and manila have sufficient conductivity to prevent the operator from becoming charged by handling it, hence can also be used.

xv) In case of large tank farms effective communication is essential. Apart from VHF, Pagers with loud hooters may be provided on roadside at various locations. This can also be utilized for communication during emergency like fire.

xvi) While cleaning the tanks, care should be taken to avoid generation of static electricity. Cleaning of tanks by gas oil spray shall not be permitted. Cleaning of tanks by steaming shall be permitted for Class C/excluded products but not permitted for class-B products. Water washing is preferred.

xvii) If the tank has internal heating coils, steam to the coils should not be charged until the coils are fully submerged and condensate from these coils must be monitored for Oil content.

xviii) Side entry mixtures may be operated only when liquid level is above the blades.

6.9 SAFETY INSTRUCTION REGARDING USAGE OF PORTABLE LADDERS

i) Before use, all ladders shall be tested for load test. For load test, a test load of 1.5 times the mass of worker plus the mass of 16 bricks shall be hung from each rung. The rung and ladder shall not show any distress or noticeable bending. The lower rungs may be tested by reversing the ladder. Unless otherwise specified, the mass of worker shall be taken as 68 kgs. Load testing shall be done when ladders are brought to the construction site and when damage to ladders is anticipated or observed on visual inspection.

ii) No ladder having a missing or defective rung shall be used. Defective ladders shall be promptly and properly repaired or replaced.

iii) Ladders leading to landing shall extend at least one meter above the landing and shall be secured at the upper end.

iv) To prevent slipping, a ladder shall be secured at the bottom end, otherwise, a person shall be stationed at the base wherever it is use.

v) The pitch at which a lean to ladder is used shall be such that the horizontal distance of its foot from the vertical plane of its top shall be not more than one quarter of its length.

vi) If the surface of the floor on which the ladder rests is smooth or sloping, the ladder shall be provided with non-slip bases.

vii) If the use of ladder is essential during strong winds, it shall be securely lashed in positions

viii) No ladder shall be placed or leant against window panes, sashes or such other unsafe or yielding objects, nor placed in front of doors opening towards it. If set up in driveways, passage ways or public walkways, it shall be protected by suitable barricades.
ix) When ascending or descending, the user shall face the ladder, use both his hands and place his feet near the ends of the rungs rather than near middle.

x) It is dangerous to lean more than 300 mm to side in order to reach a larger area from a single setting of the ladder. Instead, the user shall get down and shift the ladder to the required position.

xi) Metal ladders shall not be used around the electrical equipment or circuits of any kind where there is a possibility of coming in contact with the current. Metal ladders shall be marked with signs reading “CAUTION: DO NOT USE NEAR ELECTRICAL EQUIPMENT”

6.10 PRECAUTIONS FOR BOILER OPERATIONS

These instructions should be frequently and carefully studied, with view to keeping in mind the precautions to be observed and the ordinary procedure to be followed in the Safe working of boilers.

a) Precautions before starting the Fire; Before starting the fires in a boiler, the attendant should:
   • See that there is sufficient water in the boiler, and that the gauge cocks are working freely.
   • Ease safety valves, or open cock on top of boiler to allow air to escape.
   • See that the blow-off cock is fully closed and tight.
   • See that the safety valves and feed check valve are free and workable.
   • See that water is not leaking from any part of the boiler.
   • Note if the pressure gauge pointer is at zero. See that the feed pump is in working order.

The attendant must not rely on the supposition that the water he has previously put in is still in the boiler, as it may not have run out without his knowledge through a leak or open cock, nor can be sure that the gauge glass shows the true water level until he has tested it. This is done in the following manner, shut off the lower gauge cock and empty the glass by the drain cock; then shut the drain cock and open the gauge cock; if everything is in order, the water will then rise in the glass to the same height as before.

b) Special attention for gauge glass: A large number of accidents have been due to inoperative water gauges and to negligence of the attendant in not carefully reading the water level. It does not follow that there is plenty of water in the boiler because there is plenty of water in the gauge glass. The passages may be choked, and empty gauge glasses are sometime mistaken for full ones and explosions have resulted the reform. Hence it is important to keep the gauge cocks perfectly tight and clean blowing through the test cocks frequently. Every water gauge glass to be fitted with a guard to prevent injury to the attendants. See that it is always in place, and clean when there is steam in the boiler.

c) Pressure gauge: The pressure or steam gauge should be kept in order, and be in such a position as to be easily seen by the boiler attendant. There should be a plain mark on it showing the highest pressure allowed for the boiler, and the dial should be kept clean so that the figures may easily be read.

d) Safety valve: The safety valves are provided to guard against over pressure. They should be moved by hand every day so as to prevent them from sticking. If moved only occasionally, they are liable to leak. The valve can be tested by slowly raising it a little, and when let down it should close perfectly tight. It should never be opened by a sudden knock or pull. If it does not close tight, turn it on its seat until it fits or when its construction does not permit this, raise it slowly a few times and let it down again but on no account must the valve be screwed down further or loaded more than what has been allowed by the Inspector. Safety valves must never be overloaded, and spring valves should have ferrules or other provisions against the valves being screwed down too far.
e) Steam pressure: Ordinarily the safety valve will prevent steam from raising much above the working pressure, but if the steam gauge shows so rapid an increase of pressure as to indicate danger of exceeding the highest limit, water should be immediately fed into the boiler and the dampers partially closed in order to diminish the effect of the fire. If however, the water has fallen so low that there is danger of an accident from this cause, the fires should be withdrawn before feeding in water, the safety valves eased and if the engine is at rest it should be started so as to reduce the pressure.

f) The Blow-off Cock: The blow-off should be used daily if the water is at all dirty or sedimentary, especially with Locomotive type and Vertical Boilers, as their narrow water spaces are liable to get choked with mud, which soon hardens into a solid mass. The amount of water to be blown out depends on the size of the boiler and can be determined only from experience. When blowing out, the best result is obtained if the water has been at rest for some time (say before the engine is started) thus giving the sediment time to settle. If the feed water is clean merely turn the cock round.

g) Re-ignition boiler: Before re-ignition of boiler, sufficient degassing shall be done as per SOP to ensure nil hydrocarbon vapour presence. SOP to be displayed.

6.11 FORK LIFT OPERATIONS

- Load bearing test for the forklifts shall be done at a frequency in line with requirement of concerned state Govt Inspector of Factories and record maintained.
- Vision test / eye test for the fork lift operators shall be done at a frequency in line with requirement of concerned state Govt. Inspector of Factories and record maintained.
- Neither forklift or it’s operator shall be engaged if above statutory requirements are expired.

6.12 WEIGH BRIDGE

- Calibration of weigh bridge shall be carried out as per concerned state Govt. Legal Metrology requirement.
- Required quantity of weight should be kept at site as per requirement of Legal Metrology.
7.0 FIRE PROTECTION FACILITIES

7.1 GENERAL CONSIDERATIONS
The size of product storage and handling facilities, their location and terrain determine the basic fire protection requirements.

7.2 FIRE PROTECTION PHILOSOPHY
The fire protection philosophy is based on loss prevention and control. It considers that a lube plant carries an inherent potential hazard due to flammable nature of petroleum products stored therein. A fire in one facility can endanger other facility of the plant, if not controlled / extinguished as quickly as possible to minimize the loss of life and property and prevent further spread of fire.

7.3 FIRE PROTECTION
Depending on the nature of risk, required fire protection facilities should be provided from the followings:-

- Fire Water System -(storage / pumps / distribution piping network with hydrant / monitors/elevated monitors)
- First Aid Fire Fighting Equipment.
- Trolley mounted Fire Fighting Equipment.
- Carbon Dioxide System
- Dry Chemical Extinguishing System
- Clean Agent Protection System.
- Detection and alarm systems
- Communication System

7.4 DESIGN CRITERIA FOR FIRE PROTECTION SYSTEM

a) Facilities shall be designed on the basis that city fire water supply is not available close to the installation.

b) The hydrant system shall be kept pressurized @ 7 kg/sq.cm by jockey pumps. The fire water pumps shall be provided with auto start facility with pressure drop in fire water network.

c) For lube plant storing mainly Class C / excluded products, the water requirement shall be based on 1 monitor of 144 kl/hr and 4 hose streams of 36 kl/hr i.e. a total of 288 kl per hr for four hrs.

d) If Class –A and or B products are stored in the lube plants, applicable fire protection system in line with OISD STD-117 or OISD STD 244 shall be provided. Class –A and or B storage tanks should be in separate dyke. If stored in common with class –C / excluded storage, the applicable fixed type spray system shall also be provided on all tanks as applicable in OISD STD-117/OISD STD-244.

e) The operating / hazardous areas shall be protected by a well laid combination of hydrants and monitors. The following plants are exempted from this provision:-
   i) The plants having aggregate above ground storage capacity of less than 1000 KL, irrespective of class.
   ii) Plants storing products in UG tanks, irrespective of class.
f) Installations where inter distances between tanks (class C and above) in a dyke and / or within dykes are not conforming to the extant provisions of this standard. Additional remedial measures (if any) need to be taken based on QRA report and recommendations.

g) The empty package storage area within blocks which stores flammable materials such as cans or small containers /cartons/labels/pails or buckets/HDPE barrels etc shall be covered by manually operated medium velocity fixed type spray system with application @ 10 lpm / sq.m area. Isolation valves on fixed type spray riser lines shall be provided at sufficient distance from the hazard i.e 15 M (minimum), preferably outside of shed. Alternate isolation valves should be considered from opposite side.

h) The storage area should be divided in zones with max 150 sq.m size. For the purpose of fire water calculation 3 zones shall be considered at a time, affected zone and adjacent two zones. For optimization of water consumption the area may be divided into suitable sized zones. The total area of 3 zones shall be limited to 450 sq.m. In case area exceeds the above stipulation, the same shall have separation distance of minimum 3 M between two storage areas.

i) The smoke/heat detectors shall be installed overhead near carton storage area, process control room, ware house and laboratory. These smoke/heat detectors, in the event of smoke/heat shall annunciate visual indication and audio alarm in the process control room at field and repeater panel in fire control room for action thereon.

j) Lube (bulk/packed) truck loading/unloading gantries/facilities, tank farm area (including product pump station and manifold area) shall be fully covered with alternate hydrant and water cum foam monitors having nozzle with jet, spray and fog arrangement and located at a spacing of 30 M at least at two sides of the facility.

k) Hydrant facility should not be laid inside the process blocks viz. blending/grease process blocks. However, hydrant system should be laid all around the process blocks.

l) The hydrants and monitors shall be located at a minimum distance of 15 m from the hazard to be protected.

m) Portable monitors / foam hose streams shall be provided for fighting fires in dyke area and other plant area.

n) At least two Nos. trolley mounted water cum foam monitor of capacity 2400 lpm each shall be provided at lube / grease plant.

7.5 FIRE WATER SYSTEM DESIGN

Water is used for fire extinguishments, fire control, and exposure protection of equipment, foam application and personnel from heat radiation.

Header Pressure: Fire water system shall be designed for a minimum residual pressure of 7 kg/cm2 (g) at hydraulically remotest point in the installation considering the design flow rate.

a) A fire water ring main shall be provided all around perimeter of the plant facilities with hydrants / monitors spaced at intervals not exceeding 30 M when measured aerially. Fire hydrants and monitors shall not be installed within 15 Meters from the facilities/ equipment to be protected.
b) The internal replenishment arrangement either from bore well or natural reservoir should be at least 12.5% of per hour design flow rate. Availability of fire water from internal source should be 7 x 24 Hrs.

c) In case of purchase of fire water from outside by road tankers, vendor should be selected in such a manner that he must possess sufficient fleets to arrange replenished water with short notice to meet the requirement of 7.5(b) to the maximum extent possible.

d) The installation shall have facilities for receiving fire water from external source in emergency and diverting them to the fire water storage tanks.

7.6 FIRE WATER DESIGN FLOW RATE

The design flow rate shall be any one of the maximum requirements of the following cases for four (4) hrs.

a) For lube plant storing exclusively Class C/excluded products, the water requirement shall be based on 1 monitor of 144 kl/hr and 4 hose streams of 36 kl/hr i.e. a total of 288 kl per hr.

b) For Class-A and/or B petroleum, if stored in the same plant, the water requirement shall be based on requirement as stipulated in OISD STD 117 or OISD STD -244, whether the fixed fire protection facilities are provided or not.

c) Water requirement corresponding to 2 nos. of 2400 lpm water cum foam monitor.

d) The water requirement for fixed type water spray system (affected zone and adjacent zones).

Design flow rate shall be the maximum among a, b, c and d above.

7.7 FIRE WATER STORAGE

a) Water for the firefighting shall be stored in easily accessible surface or underground or above ground tanks of steel, concrete.

b) The effective capacity of the reservoir/tank above the level of suction point shall be minimum 4 hours aggregate rated capacity of pumps.

c) Fresh water should be used for firefighting purposes. In case sea water or treated effluent water is used for firefighting purposes, the material of the pipe selected shall be suitable for the service.

d) Storage shall be in two equal interconnected compartments to facilitate cleaning and repairs. In case of steel tanks there shall be minimum two tanks and all the tanks shall be of equal height/depth to prevent any migration/overflow due to difference in height/depth. During maintenance of water tanks, availability of at least 50% of the water capacity shall be ensured.

e) Large natural reservoirs having water capacity exceeding 10 times the aggregate fire water requirement can be left unlined.

7.8 FIRE WATER PUMPS

a) Fire water pumps having flooded suction shall be installed to meet the design fire water flow rate and head. If fire water is stored in underground tanks, an overhead water tank of sufficient capacity shall be provided for flooded suction and accounting for leakages in the network, if any. Pumps shall be provided with suitable sized strainers on suction and NRVs on discharge lines. Isolation valve one each shall be installed on upstream of suction strainer and downstream of NRV on discharge line respectively.

b) The pumps shall be capable of discharging 150% of its rated discharge at a minimum of 65% of the rated head. The Shut-off head shall not exceed 120% of rated head for horizontal centrifugal pumps and 140% for vertical turbine pump.

c) At least one standby fire water pump shall be provided up to 2 nos. of main pumps. For main pumps 3 nos. and above, minimum 2 nos. standby pumps of the same type, capacity and head as the main pumps shall be provided. Fire water pumps shall be of equal capacity and head.
d) The fire water pump(s) including the standby pump(s) shall be of diesel engine driven type. Where electric supply is reliable, 50% of the pumps can be electric driven. The diesel engines shall be quick starting type with the help of push buttons located on or near the pumps or located at a remote location. Each engine shall have an independent fuel tank adequately sized for 6 hours continuous running of the pump. Fuel tank should be installed outside of fire pump house and shall have provision for venting. If tanks are installed inside the pump house, a safe distance from engine (3 m) to be maintained and the vent shall have provision for venting outside the pump house. Installation of fuel tank shall be such that tank bottom is at least 200 mm above the suction valve of the fuel injection pump / as specified by OEM.

e) Fire water pumps and storage shall be located away from the potential hazards and shall be at least 30 M (minimum) from periphery of hazards, equipment or where hydrocarbons are handled or stored.

f) Fire water pumps shall be exclusively used for firefighting purpose only.

g) Suction and discharge valves of fire water pumps shall be kept full open all the times.

h) Jockey pump shall be provided for keeping the hydrant system /line pressurized at all times. The capacity of the pump shall be sufficient to maintain system pressure in the event of leakages from valves etc. Capacity of the jockey pump shall be 3% minimum and 5 % max of the designed fire water rate. Besides the main jockey pump the stand by pump of same capacity and type shall be provided.

i) Auto cut-in / cut-off facility should be provided for jockey pumps to maintain the line pressure. The capacity of each jockey pump shall be minimum 3% of the designed flow rate.

j) The fire water pumps shall be provided with auto start facility which shall function with pressure drop in hydrant line and specified logic even if initial pump does not start or having started, fails to build up the required pressure in the fire water ring main system the next pump shall start and so on. The detail operation of fire water pumps shall be as follows:

- The main fire pump(s) shall start automatically in set sequence in response to a low pressure condition in the hydrant system.
- Stand by fire water pump(s) shall start automatically if the main pumps do not start or fail to build up the required pressure within 20 seconds.
- Provision shall be made for manual starting of each pump at the pump house and from control room also. However, manual stop of each pump unit shall be only at pump house.

7.9 FIRE HYDRANT NETWORK

a) Looping: The fire water network shall be laid in closed loops as far as possible to ensure multi-directional flow in the system. Isolation valves shall be provided in the network to enable isolation of any section of the network without affecting the flow in the rest. The isolation valves shall be located normally near the loop junctions. Additional valves shall be provided in the segments where the length of the segment exceeds 300 M.

b) Fire hydrant ring main shall be laid above ground ensuring that:

i) Pipe line shall be laid at a height of 300 mm to 400mm above finished ground level.

ii) The pipe support shall have only point contact. The mains shall be supported at regular intervals:

- For pipeline size less than 150 mm, support interval shall not exceed 3 m..
- Pipe line size 150mm and above not exceeding 6 meters or design approved.

iii) The system for above ground portion shall be analyzed for flexibility against thermal expansion and necessary expansion loops where called for shall be provided.
c) Fire hydrant ring main may be laid underground at the following places:
   i) At road crossings.
   ii) Places where above ground piping is likely to cause obstruction to operation and vehicle movement.
   iii) Places where above ground piping is likely to get damaged mechanically.
   iv) Where Frost conditions warrant and ambient temperature is likely to fall below zero deg. Centigrade, underground piping should be provided at least 1 meter below the ground level. Alternatively, in such cases water circulation to be carried out for above ground pipelines.

d) Fire water ring main laid underground shall ensure the followings:
   i) Pipes made of composite material shall be laid underground.
   ii) The Ring main shall have at least one meter earth cushion in open ground, 1.5 m cushion under the road crossings and in case of crane movement area pipeline shall be protected with concrete/steel encasement as per design requirement and in case of rail crossing, provisions stipulated by Indian Railways shall be complied.
   iii) The Ring main shall be suitably protected against soil corrosion by suitable coating / wrapping with or without cathodic protection.
   iv) In case of poor soil conditions it may be necessary to provide concrete / masonry supports under the pipe line.

e) Size of hydrant pipeline:
   i) The hydraulic analysis of network shall be done at the design time. Also whenever fire water demand increases due to addition of facilities or extensive extension of network, fresh hydraulic analysis shall be carried out.
   ii) The velocity of water shall not exceed 5 meter per second in fire water ring main.
   iii) Fire water ring main shall be sized for 120% of the design water flow rate. Design flow rates shall be distributed at nodal points to give the most realistic way of water requirements in an emergency. It may be necessary to assume several combinations of flow requirement for design of network.
   iv) The stand post for hydrants and monitors shall be sized to meet the respective design water flow rates.

f) General:
   i) Fire water mains shall not pass through buildings or dyke areas. In case of underground mains the isolation valves shall be located in RCC/brick masonry chamber of suitable size to facilitate operation during emergency and maintenance.
   ii) Associated fixed spray /foam riser/branch connections meant for storage tanks if applicable shall be taken directly to the outside of tank dyke and shall not pass through fire wall of any adjacent tanks.
   iii) The riser connections shall be taken directly from the mains and provided with separate isolation valve outside of dyke. Suitable strainer shall be provided on fixed spray riser connection and shall be located outside of dyke.

7.10 HYDRANT / MONITORS

a) Hydrants/ monitors shall be located considering various fire scenario at different sections of the premises to be protected and to give most effective service.

b) At least one hydrant post shall be provided at every 30 M of external wall measurement or perimeter of battery limit in case of high hazard areas. For non-hazardous area, they shall be
spaced at 45 M intervals. The horizontal range and coverage of hydrants with hose connections shall not be considered beyond 45 M.

c) Hydrants shall be located at a minimum distance of 15 M. From the periphery of storage tank or equipment under protection. In case of buildings this distance shall not be less than 2 M and not more than 15 M from the face of building.

d) Provision of hydrants within the building shall be provided in accordance with IS: 3844.

e) Hydrant/Monitors shall be located along road side berms for easy accessibility.

f) Fixed water/water cum foam monitors (if applicable) on the network shall be provided with independent isolation valves and Double headed hydrants with two separate landing valves. Hydrants/Monitors shall be located with branch connection.

g) Double headed hydrants and monitors on suitably sized stand post shall be used. All hydrant outlets/monitor isolation valves shall be situated at workable height of 1.2 meter above ground or hydrant/monitor operating platform level.

h) Monitors shall be located to direct water on the object as well as to provide water shield to firemen approaching a fire. The requirement of monitors shall be established based on hazards involved and layout considerations.

i) Hydrants and monitors shall not be installed inside the dyked areas. However, as an additional requirement, oscillating monitors shall be provided in inaccessible area within the dyke with isolation valve or ROV outside the tank farm.(In cases inter distances between tanks in a dyke and/or within dykes are not meeting the requirements).

j) Bulk and packed truck loading and unloading facilities shall be provided with alternate hydrant / water monitors to ensure adequate coverage and located at a spacing of 30 M at least at two sides of the facility.

The hydrants and monitors shall be located at a minimum distance of 15 M from the hazard to be protected.

### 7.11 MATERIAL SPECIFICATIONS

The materials used in fire water system shall be of approved type as indicated below:-

a) Pipes: Carbon Steel as per IS: 3589/IS: 1239/IS: 1978 or Composite Material or its equivalent for fresh water service. In case saline, brackish or treated effluent water is used, the fire water ring main of steel pipes, internally cement mortar lines or glass reinforced epoxy coated or pipes made of material suitable for the quality of water able to withstand the temperature and pressure shall be used. Alternately, pipes made of composite materials shall be used. The composite material to be used may be as per API 15LR/API 15HR / IS12709. In case composite pipes are used they shall be used underground.

b) Isolation Valves: Gate valve or quick shut off type isolation valves made of Cast Steel having open/close indication shall be used. Other materials such as cupro-nickel for saline/brackish water can be used. The material of the valve shall be suitable for the service.

c) Hydrants post:

   Stand post - Carbon Steel

   Outlet valves – Gunmetal/ Aluminium/ Stainless/ Steel/Al-Zn Alloy

d) Monitors / Water cum foam monitors.

   Approved / listed by any of the international certifying agencies like UL, FM, VdS or LPC.
The electrical or hydraulic remote control mechanism shall be in line with Hazardous Area Classification.

e) Fire Hoses:
Reinforced Rubber Lined Hose as per IS 636 (Type A) /Non-percolating Synthetic Hose (Type B)/UL or Equivalent Standard.

f) Painting:
- Fire water mains, hydrant and monitor stand posts, risers of water spray system shall be painted with “Fire Red” paint as per of IS: 5.
- Hose boxes, water monitors and hydrant outlets shall be painted with “Luminous Yellow” paint as per IS: 5.
- Corrosion resistant paint shall be used in corrosion prone areas.

7.12 PROCESS CONTROL ROOM (HAVING CONSOLE/MONITOR, RACK, UPS, BATTERY AND COMPUTERS) PROTECTION
- Smoke /heat detectors shall be installed in the process control room with alarm facility in control room and repeater panel in fire control room.
- Control room should be protected by portable type Clean Agent Fire Extinguishers in addition to portable Co2 fire extinguishers.
- Clean agent shall conform to the NFPA-2001 (Latest edition).

7.13 FIRST AID FIREFIGHTING EQUIPMENT

Portable Fire Extinguishers

i) All fire extinguishers shall conform to respective IS/UL or Equivalent codes, viz. 1, 2, 3, 4, 6 and 9 Kg DCP portable type (IS: 15683 /UL 299) and 2, 3, 4.5 and 6 Kg CO2 portable type (IS:15683/UL 154) and 25/50/75 Kg DCP trolley mounted type (IS: 10658/UL 299) and bear ISI/UL mark. BIS/UL or Equivalent certificates of all extinguishers shall be maintained at the location.

ii) While selecting the Extinguisher, due consideration should be given to the factors like flow rate, discharge time and throw in line with IS: 2190 / UL 711.

iii) The Dry Chemical Powder used in extinguisher and carbon dioxide gas used as expelling agent shall be as per relevant IS/UL or Equivalent code.

iv) While selecting the dry chemical powder, due consideration should be given to the typical properties viz. Apparent Density (0.65 +/-0.05), Fire Rating (144B), Thermal Gravimetric Analysis (with decomposition at around 250°C) and foam compatibility.

v) Siliconised Potassium bicarbonate DCP powder (IS 4308:2003) / Mono-ammonium phosphate based DCP powder (IS: 14609) can also be used for recharging DCP fire extinguishers.

vi) Spare CO2 cartridges and DCP refills as required based on their shelf life should be maintained. However, minimum 10% of the total charge in the extinguishers should be maintained at the location.

vii) Portable fire extinguishers shall be located at convenient locations and are readily accessible and clearly visible at all times. The no. of extinguishers at various locations shall be provided as per following table.
viii) The sand buckets shall have round bottom with bottom handle having 9 liter water capacity conforming to IS: 2546. The sand stored in bucket shall be fine and free from oil, water or rubbish.

ix) Suitable weather protection shall be provided wherever the fire extinguishers or sand buckets are positioned outdoor.

x) The maximum running distance to locate an extinguisher shall not exceed 15 m.

xi) The extinguisher shall be installed in such a way that its top surface is not more than 1.5m above the floor/ground level.

---

### Lube /Grease manufacturing plants

<table>
<thead>
<tr>
<th>Type of Area</th>
<th>Scale of Portable Fire Extinguishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) A/G Tank Farm</td>
<td>2 Nos. 09 Kg DCP extinguishers for each tank plus 4 Nos. 25 Kg DCP extinguishers for each Tank Farm positioned at four corners. In case of adjoining tank farms, the no. of 25 Kg extinguishers can be reduced by 2 nos. per tank farm.</td>
</tr>
<tr>
<td>(ii) U/G Tank Farm</td>
<td>2 Nos. 09 Kg DCP extinguisher for each Tank Farm</td>
</tr>
<tr>
<td>Bulky loading/unloading gantry</td>
<td>1 x 10 kgs DCP for every two bays plus 1 x 75 kgs or the gantry.</td>
</tr>
<tr>
<td>(iii) Pump House (Class C and excluded)</td>
<td>1 no. 09 Kg DCP for every 4 pumps up to 50 HP. 2 nos. 09 Kg DCP or 1x25 kg DCP for 4 pumps.</td>
</tr>
<tr>
<td>(iv) Other Pump Houses</td>
<td>1 No.09 Kg DCP extinguisher for every two pumps or min 2 Nos.09 Kg DCP extinguisher for each Pump House whichever is higher.</td>
</tr>
<tr>
<td>(v) Lube Go-down</td>
<td>1 No. 09 Kg DCP extinguisher for every 200 m² or min. 2 Nos. in each Go-down whichever is higher. In addition minimum 1 no. 75 kg wheeled type DCP extinguishers shall be provided.</td>
</tr>
<tr>
<td>(vi) Lube Filling Shed</td>
<td>1 No. 09 Kg DCP extinguisher for 200 m² or min. 2 Nos. in each Shed whichever is higher plus 1 x 75 kgs DCP for each lube block.</td>
</tr>
<tr>
<td>(vii) Administrative Building and Store House</td>
<td>1 No.09 Kg DCP extinguisher for every 200 m² or min. 2 Nos. 09 Kg DCP extinguishers for each floor of Building/Store whichever is higher.</td>
</tr>
<tr>
<td>(viii) DG Room</td>
<td>2 Nos. each 09 Kg DCP and 4.5 Kg CO2 extinguishers for each DG room.</td>
</tr>
<tr>
<td>(ix) Main switch Room/Sub-Station</td>
<td>1 No. 4.5 Kg CO2 extinguisher for every 25 m² plus 1 No. 9 Liter sand bucket.</td>
</tr>
<tr>
<td>(x) Computer Room/ Cabin</td>
<td>2 Nos. of 2 Kg CO2 or 2 Nos. of 2.5 Kg Clean Agent extinguisher per Computer Room and 1 No. 2 Kg CO2 or 1 No. 1.0 Kg Clean Agent extinguisher per cabin.</td>
</tr>
</tbody>
</table>
(xi) Security Cabin 1 No. 09 Kg DCP extinguisher per cabin.

(xii) Canteen 1 No. 09 Kg DCP extinguisher for 100 m².

(xiii) Workshop 1 No. 09 Kg DCP extinguisher and 1 No. 2 Kg CO2 extinguisher.

(xiv) Laboratory 1 No. 09 Kg DCP extinguisher and 1 No. 4.5 Kg CO2 extinguisher.

(xv) Oil Sample Storage Room 1 No. 09 Kg DCP extinguisher per 100 m² or min. 1 no. 10 Kg extinguisher per room whichever is higher.

(xvi) Effluent Treatment Plant 1 No. 75 Kg. and 2 nos. 09 Kg. DCP Extinguisher

(xvii) Transformer 1 No. 09 Kg. DCP extinguisher per transformer.

(xviii) UPS / Charger Room 1 No. 2 Kg. CO2 extinguisher.

NOTE: - ALL FIRE EXTINGUISHERS SHALL BEAR ISI OR EQUIVALENT MARK

Wheeled Fire Fighting Equipment inclusive of quantity specified elsewhere in the standard.

<table>
<thead>
<tr>
<th>Sl n</th>
<th>Type of equipment</th>
<th>Minimum Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2400 lpm water cum foam monitor</td>
<td>two</td>
</tr>
<tr>
<td>2</td>
<td>250 lits foam compound trolley</td>
<td>Two</td>
</tr>
<tr>
<td>3</td>
<td>75 kgs DCP</td>
<td>Three</td>
</tr>
<tr>
<td>4</td>
<td>25 Kgs DCP</td>
<td>As per requirement of this STD.</td>
</tr>
</tbody>
</table>

7.14 HOSES, NOZZLES and ACCESSORIES

(i) Hoses

i) Reinforced rubber lined canvas or Non-percolating synthetic fire hoses conforming to IS- 636/ UL 19 (Type A or B) shall be provided.

ii) The length and diameter of the hoses should be 15 m and 63 mm respectively fitted with instantaneous type male and female couplings of material as specified in IS 636/UL 19. All fire hoses shall be tested @ 10 kgs/sq.cm once in every six months and record maintained.

iii) The number of hoses (in addition to hose box hose) stored in a lube /grease plant shall be 30% of the number of hydrant outlets. The minimum No. of hoses stored, however, shall not be less than 10 numbers.

iv) The hoses shall be stored at convenient and easily accessible location in the lube / grease plant.

(ii) Nozzles: In addition to one jet nozzle provided in each hose box, there shall be at least two nozzles in each category as per relevant IS/UL Codes and maintained in the plant as per following table

<table>
<thead>
<tr>
<th>Sl n</th>
<th>Item Description</th>
<th>Minimum requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jet Nozzle</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>2</td>
<td>Fog Nozzle</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>3</td>
<td>Universal branch pipe with nozzle</td>
<td>2 Nos.</td>
</tr>
</tbody>
</table>
(iii) Accessories

The following minimum no. of Personal Protective Equipment, First Aid Equipment and Safety Instrument shall be provided as indicated against each item.

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item Description</th>
<th>Minimum requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sand drum with scoop</td>
<td>4 Nos.</td>
</tr>
<tr>
<td>2</td>
<td>Electrical Siren (3 km range)</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Hand operated siren one each at operating area</td>
<td>1 No. at each operating area</td>
</tr>
<tr>
<td>4</td>
<td>Red and Green flag for fire drill</td>
<td>2 Nos. in each color.</td>
</tr>
<tr>
<td>5</td>
<td>PA system</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Wind socks</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

(iv) Hose box and accessories:

One hose box to be provided between two hydrant points. Each hose box shall contain 2 numbers of fire hoses and one No. Jet nozzle.

(v) Personnel protective equipment

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item description</th>
<th>Minimum requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety helmet</td>
<td>1 No. per person</td>
</tr>
<tr>
<td>2</td>
<td>Safety shoe</td>
<td>As per plant requirement</td>
</tr>
<tr>
<td>3</td>
<td>Flash goggles</td>
<td>As per plant requirement</td>
</tr>
<tr>
<td>4</td>
<td>Rubber hand glove</td>
<td>2 Pairs</td>
</tr>
<tr>
<td>5</td>
<td>Fire proximity suit</td>
<td>1 Suit</td>
</tr>
<tr>
<td>6</td>
<td>SCBA Set (30 minute capacity) with spare cylinder</td>
<td>1 set</td>
</tr>
<tr>
<td>7</td>
<td>Ear muff</td>
<td>As per plant requirement</td>
</tr>
<tr>
<td>8</td>
<td>Suitable electrical hand gloves</td>
<td>As per plant requirement</td>
</tr>
<tr>
<td>9</td>
<td>Resuscitator</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Safety shower and eye wash facility</td>
<td>1 set each</td>
</tr>
<tr>
<td>11</td>
<td>Water jelly blanket</td>
<td>1 No.</td>
</tr>
<tr>
<td>12</td>
<td>Stretcher with blanket</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>13</td>
<td>Multipurpose detector (HC and Oxygen)</td>
<td>1 No.</td>
</tr>
<tr>
<td>14</td>
<td>Boiler suit</td>
<td>As per plant requirement</td>
</tr>
<tr>
<td>15</td>
<td>Apron at lab</td>
<td>As per lab requirement.</td>
</tr>
<tr>
<td>16</td>
<td>First Aid box</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

Note:

The above guidelines are minimum requirement of each item and can be increased depending on the scale of operations/size of plant or as per requirement of statutory authorities.

A fire trolley containing Fire Proximity Suit, B. A. Set, and Stretcher with water Jel Blanket, Resuscitator, First Aid Box, Spare fire hoses, Special purpose nozzles, Foam branch pipes, foam etc shall be kept in a speculated place easily access-able on demand.

Explosive meter, P. A. System shall be readily available at the plant and positioned to have easy access to it during emergency situation.
In addition, an emergency kit shall be provided consisting of safety items as per the item list given below and shall be readily available at the terminals.

EMERGENCY KIT

Emergency Kit consists of listed emergency equipment required for rescue and control/arresting leakage in case of emergency in lube / grease plant. The equipment shall be mounted on a compact light weight trolley. Emergency Kit shall be consisting of the following emergency equipment:

<table>
<thead>
<tr>
<th>#</th>
<th>Item</th>
<th>Quantity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FIRE PROXIMITY SUIT</td>
<td>1 set</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PVC SUIT</td>
<td>2 sets</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>LEAK CONTROL KIT</td>
<td>Consisting of 1 no each of leak arresting pad, leakage control of external pipes, internal pipes, large external pipes up to 8 inch, drums / containers leakages, general purpose leakages, large hole leakages in storage tanks - I set</td>
<td>As applicable.</td>
</tr>
<tr>
<td>4</td>
<td>PETROLEUM PRODUCT CLEAN UP CHEMICAL</td>
<td>1 set.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Boom (5 inch dia, 3 mtr. Long): 6 nos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Granular particles to absorb Oil : 20 Kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>OIL SPILL DISPERSANT (Water based) along with hand held spray nozzle.</td>
<td>Dispersant : 40 litre Spray Gun with back pack: I set.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NON SPARKING TOOLS</td>
<td>One Set as required</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BREATHING APPARTUS SET(40 minute duration)</td>
<td>2 sets</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>FLAME PROOF SEARCH LIGHT</td>
<td>2 nos</td>
<td>Rechargeable type suitable for Explosive Environment.</td>
</tr>
<tr>
<td>9</td>
<td>HAND SIREN WITH STAND</td>
<td>1 no</td>
<td>Approx. range of 1.6 KMS</td>
</tr>
<tr>
<td>10</td>
<td>FIREMAN AXE</td>
<td>1 no</td>
<td></td>
</tr>
</tbody>
</table>
All the items of the kit shall be kept on a trolley specifically designed for the purpose. List of PPE's as mentioned in other clauses should be merged with this list.

7.15 TROLLEY MOUNTED FIREFIGHTING EQUIPMENT

Trolley mounted firefighting equipment includes foam trolleys, water cum foam monitor, 75/25 kgs DCP fire extinguisher etc.

7.16 USE OF FOAM AND STORAGE

Foam shall be used AR-AFFF or AFFF or equivalent and minimum quantity shall be stored for application of 2 x 2400 lpm capacity water cum foam monitors for 30 minutes or actual requirement for class-B tank (if applicable) whichever is higher. Potential foam loss to be considered due to wind / wastage. At coastal plants potential foam loss should be considered minimum 25 % and that of for noncoastal plants should be 15% of design requirement.

7.17 SMOKE/HEAT DETECTION AND ANNUNCIATION, DYKE DRAIN VALVE ANNUNCIATION SYSTEM AND EMERGENCY SHUT DOWN LOGIC.

i. Combination Smoke/heat detection and annunciation system:

Combined or separate (any one) smoke and or heat detection system should be installed near carton storage area, process control room, ware house and laboratory. Smoke / heat detectors of proper type should be selected and maintained in sound working condition.
i) General

Smoke / heat detectors are recognized as the most common method of fire detection for life safety throughout the world. The best method to prevent spread of fire is to detect the smoke at initial stage itself. This would require basically a reliable and continuous smoke detection system with alarm annunciation to alert the operating personnel to take timely corrective action.

ii) Application

a. Smoke / heat detectors should be installed near carton storage area, process control room, warehouse and laboratory. These detectors should be placed in such a way that smokes are detected at the incipient stage of incident.

b. The control panel with audio alarm and visual indication should be provided in the process control room and repeater panel at the fire control room.

iii) Power Supply:

The supply to the system shall be through a reliable on line uninterrupted power supply (online UPS)

iv) Architecture Components

The main components shall be:

1. Smoke / heat detectors
2. Field Transmission units / Signal scanners.
3. Control system / PC
4. Display
5. Annunciation System etc
6. Cables, hooters, repeater, Power Supplies etc.

v) Annunciation System

Appropriate annunciation system shall be available to ensure that all the alarms generated, both, audio and visual are reported to the plant personnel at local and remote control panel. The alarms both, audio and visual can be repeated at additional location to ensure corrective action is taken.

vi) Smoke/heat Detectors:

The detectors shall be able to detect the presence of smoke /heat well below the limit.

vii) Inspection and Testing:

1. The system shall be checked by the safety officer on a daily basis.

2. The system shall be thoroughly tested every month by suitable method to ensure that the Audio Video alarms are generated at local and remote panel and records maintained.

B. Dyke Drain valve Annunciation system

All the tank dyke drain exit valves shall be fitted with a limit switch / sensor for indication of the position of the valve. The valves of the Dyke shall remain in closed position. In case any valve is open then Audio Visual alarms shall come at local and remote control panel for suitable corrective measures.
In case of automated locations existing PLC can be used. However, where the locations are not automated a standalone system shall be provided.

i) Power Supply
The supply to the system shall be through a reliable on line uninterrupted power supply. (Online UPS)

ii) Architecture Components
The main components shall be:

1. Proximity Switches / Sensors.
2. Field transmitter unit / Signal Scanners.
3. Control System / PC / TAS
4. Display
5. Annunciation System etc
6. Cables, hooters, Mimic, Power Supplies etc.

All the components installed in the hazardous area shall confirm to the Hazard Area Classification applicable and shall be certified by Central Institute of Mining and Fuel Research (CIMFR) /Petroleum and Explosive Safety Organization (PESO) / Authorized lab by the country of the origin.

iii) Annunciation System

Appropriate annunciation system shall be available to ensure that all the alarms generated, both, audio and visual are reported to the installation personnel at local and remote control panel on real time basis. The alarms both, audio and visual should be repeated at additional location to ensure corrective action is taken.

iv) Control system:

The system shall be available at all times.

The control equipment should have data logging facilities to provide print outs of the history of the events with date and time of open and close position of the valves.

v) Inspection and Testing:

1. The system shall be checked by the safety officer on a daily basis.

2. The system shall be thoroughly inspected every month by opening and closing the valves and verifying that the Audio Video alarms are generated at local and remote panel and records maintained.

C. Emergency shut Down (ESD) and Manual Call Point (MCP) logic for plant shutdown.

The ESD at automated plants and MCP at non-automated plants shall be provided in process control room, fire control room as well as at various strategic locations. ESD / MCP system shall be only through push buttons with wired connection.

i) Annunciation of ESD / MCP shall initiate following actions:

1. Process Shutdown
   ➢ To stop loading pumps
Barrier gates to open
Tank lorry filling (TLF) operations through the batch controllers to stop.
All MOVs/POVs to close.

2. Power Shutdown (except for 1. grease pressure vessels operation during soap saponification and soap transfer stage. 2.0 Grease pressure vessels heating system, for which separate panel should be considered).

Trip all the panels other than Emergency panel. The Emergency panel should host fire siren, bore wells, jockey pumps, critical High Mast tower lights, security cabin, fire control room and fire pump house, Critical lights in TLF, Admin block, MCC room and power to the control room / Automation system.

There should be interlock between ESD for Process shut down and ESD for Power shut down so that full power shut down takes after a time lag required for closing the MOVs/POVs and full closure of valves shall be ensured. The time lag shall be plant specific.

Alarm signal shall be exchanged between the all control rooms so that necessary actions are taken by the operating personnel.

ii) Inspection and Testing:
The system shall be checked during each fire drill conducted with full system shut down and records shall be maintained.

7.18 FIRE ALRM /COMMUNICATION SYSTEM

i) Hand operated sirens; alternately fire call points shall be provided at strategic locations and clearly marked in the plant. Fire call points shall have combination of audio / visual alarm.

ii) Main fire siren (3 km Range) switch shall be provided in fire control room / security room.

iii) Electrical fire siren shall have alternate supply source both from normal panel and supply and thru emergency panel and emergency supply.

iv) The tone of fire siren shall be different from shift siren

v) The following fire siren codes shall be followed for different situations:
   • Fire: For fire situation, the siren shall be wailing sound for two (2) minutes.
   • Disaster: For disaster situation, the siren shall be wailing sound for two (2) minutes, repeated thrice with a gap of 60 seconds.
   • All Clear: To indicate all clear signal, the siren shall be straight run sound for two (2) minutes.
   • Test siren: To indicate testing, the siren shall be straight run sound for two (2) minutes.

7.19 FIRE SAFETY ORGANISATION/ TRAINING

a) Organization

A well-defined comprehensive Onsite Emergency Plan as per OISDGDN- 168 shall be drawn.

b) Training

i) Training on safety, firefighting and rescue operation shall be compulsory for all officers, operators, security, T/T drivers and contract workmen, clericals who are likely to be present/working in the plant and record maintained. The above training shall be imparted before induction.
Each employee shall undergo a refresher course once in every three years after initial training.

ii) The training shall be conducted through an expert agency such as Fire Brigade/recognized training institute/Oil industry approved reputed agency. The training also includes usage of personnel protective equipment.

iii) All operating personnel shall be given training on Live Fire training at any of the reputed institutes having facilities for simulations representing fire scenarios likely to occur at plant. Security as first respondent may also be considered for above live fire training.

iv) Every employee or authorized person of contractor working in the installation shall be familiarized with fire siren codes and the location of fire siren operating switch nearest to his place of work.

v) Instructions on the action to be taken in the event of fire should be pasted at each siren point and familiarity with these instructions ensured and recorded.

vi) Monthly fire drills considering various scenarios shall be conducted regularly with full involvement of all employees of the installation. The mock drill shall include the full shut down system activation once in six months.

vii) The offsite disaster mock drills shall be conducted periodically as per local statutory requirements. The company should approach and coordinate with the district authority for conducting “Offsite Mock Drills”.

viii) The post drill analysis should be carried out and discussed emphasizing areas of improvements.

ix) The record of such drills should be maintained at the location.

x) Mock drill scenarios shall include all probable scenarios and the key areas like tank Farm, Rim seal fire, Gantry, Pump House, Tank Wagon gantry etc., shall be covered at least once in six months.

xi) Security staff should be trained as first responders for firefighting and rescue operation along with plant operating personnel through oil industry approved reputed institute.

c) Mutual Aid:
Installation shall have a ‘Mutual Aid’ arrangement with nearby industries to pool in their resources during emergency.

Mutual Aid agreements (valid for a maximum period of 2 years) shall be prepared and signed by all Mutual Aid members. Fresh agreement shall be made on expiry of 2 years or whenever there is change in the signatories to the agreement. Quarterly meeting of Mutual Aid members shall be conducted and the minutes shall be recorded. The minutes shall be reviewed in the subsequent meetings.

7.20 FIRE EMERGENCY MANUAL

i) Each installation shall prepare a Comprehensive fire emergency manual covering all emergency scenarios outlining the actions to be taken by each personnel in the event of fire emergency for effective handling and the same shall be available to all personnel in the installation.

ii) The key action points of this manual shall be displayed at strategic locations in the installation for ready reference.

7.21 FIRE PROTECTION SYSTEM, INSPECTION AND TESTING

a) FIRE PROTECTION SYSTEM, INSPECTION AND TESTING

i) The fire protection equipment shall be kept in good working condition all the time.
ii) The fire protection system shall be periodically tested for proper functioning and logged for record and corrective actions.

iii) One officer shall be designated and made responsible for inspection, maintenance and testing of fire protection system.

iv) The responsibilities of each officer shall be clearly defined, explained and communicated to all concerned in writing for role clarity.

v) In addition to the following routine checks/maintenance, the requirements of OISD-STD-142 in respect of periodic inspection, maintenance and testing of fire-fighting equipment shall be complied with.

a) Fire water pumps

i) Every pump shall be test run for at least half an hour or as per OEM guidelines, whichever is higher twice a week at the rated head and flow.

ii) Each pump shall be checked, tested and its shut-off pressure observed once in a month.

iii) Each pump shall be checked and tested for its performance once in six months by opening required nos. of hydrants/monitors depending on the capacity of the pump to verify that the discharge pressure, flow and motor load are in conformity with the design parameters.

iv) Each pump shall be test run continuously for 4 hours at its rated head and flow using circulation line of fire water storage tanks and observations logged once a year.

v) The testing of standby jockey pump, if provided shall be checked weekly. Frequent starts and stops of the pump indicate that there are water leaks in the system which should be attended to promptly.

b) Fire water ring mains

i) The ring main shall be checked for leaks once in a year by operating one or more pumps and keeping the hydrant points closed to get the maximum pressure.

ii) The ring mains, hydrant, monitor and water spray header valves shall be visually inspected for any missing accessories, defects, damage and corrosion every month and records maintained.

iii) All valves on the ring mains, hydrants, monitors and water spray headers shall be checked for leaks, smooth operation and lubricated once in a month.

c) Fire water spray system (if applicable)

i) Water spray system shall be tested for performance i.e. its effectiveness and coverage once in six months.

ii) Spray nozzles shall be inspected for proper orientation, corrosion and cleaned, if necessary at least once a year.

iii) The strainers provided in the water spray system shall be cleaned once in a quarter and records maintained.

d) Fixed/semi fixed foam system

Fixed/Semi fixed foam system on storage tanks should be tested once in six months. This shall include the testing of foam maker/chamber. The foam maker/chamber should be designed suitably to facilitate discharge of foam outside the cone roof tank. After testing foam system, piping should be flushed with water.

e) Clean agent system

Clean agent fire extinguishing system should be checked as under:-
i) Agent quantity and pressure of refillable containers shall be checked once every six month.

ii) The complete system should be inspected for proper operation once every year (Refer latest NFPA 2001 (latest edition) for details of inspection of various systems.

f) Hoses

Fire hoses shall be hydraulically tested once in six months to a water pressure as specified in relevant IS/UL/Equivalent codes.

g) Communication system

Electric and hand operated fire sirens should be tested for their maximum audible range once a week.

h) fire water tank/reservoir

i) Above ground fire water tanks should be inspected externally and internally as per OISD-STD-129.

ii) The water reservoir shall be emptied out and cleaned once in 3 years. However, floating leaves, material or algae, if any shall be removed once in 6 months or as and when required.

iii) fire extinguishers

   Inspection, testing frequency and procedure should be in line with OISDSTD-142 and in this Std.
8.0 MAINTENANCE AND INSPECTION OF EQUIPMENT

8.1 GENERAL:
This section covers the maintenance and inspection practices to be followed to ensure safe and trouble-free operation of various equipment.

8.2 MAINTENANCE SCHEDULES:
To facilitate the maintenance service to be rendered in a planned manner, a preventive maintenance schedule covering the necessary work to be done, mentioning the periodicity i.e. daily, weekly, monthly, half yearly and yearly schedules, must be worked out. Basic recommendations given by the manufacturers should be considered and modified bearing in mind the local conditions.

8.3 PERSONAL PROTECTIVE EQUIPMENT:
Personnel protective equipment such as safety shoe, hand gloves, apron, safety goggles, safety belt, helmet, ear muffs, dust respirator, self-contained breathing apparatus (SCBA), resuscitator etc. as applicable shall be worn while carrying out maintenance. Such equipment shall be checked periodically and maintained for ready use in normal and emergency situations.

For details refer OISD STD-155.

8.4 WORK PERMIT SYSTEM:
Any maintenance, inspection, disassembly or removal of fittings shall not be carried out without a proper work permit and approved procedure.

a. All Maintenance/Inspection jobs shall be carried out in line with OISD Standard, OISD-STD-105 on "Work Permit System".
b. Working at heights shall be as per provisions of OISD-GDN-192.

8.5 Applicable Standards
- Electrical maintenance/inspection, provisions of OISD-STD-137 shall be adhered to.
- OISD STD-130 on Inspection of pipes, valves and fittings shall be followed.
- OISD Standard No. OISD-120 on Selection, Operation and Maintenance of Compressors
- OISD Standard No. OISD-119 on Selection, Operation and Maintenance of Pumps
- "OISD Standard No. OISD-123 on "Inspection and Maintenance of Rotating Equipment components"

8.6 INSPECTION and MAINTENANCE OF VARIOUS FACILITIES IN OIL INSTALLATIONS:

A. Storage tanks:
OISD Standard OISD-STD-129 on "Inspection of storage tanks shall be followed for details. Salient inspection and maintenance requirements are given below:-

Types of inspection: The post-commissioning inspections of a storage tank shall be as under:

a) Routine In-Service Inspections
b) External Inspection
c) Internal Inspection

INSPECTION INTERVALS:

Routine In-Service Inspection:
The interval of such inspection shall be consistent with conditions at a particular site but shall not exceed one month. Operations personnel, who have knowledge of the storage tank operations, shall carry out this inspection.

External Inspection:
All storage tanks shall be given a Visual External Inspection at least once in a year by a qualified and experienced authorized person.

The Detailed External Inspection along with ultrasonic thickness survey of tanks shall be conducted as under:

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Fluid Stored</th>
<th>External Inspection Interval (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>With Corrosion Rate Based Assessment</td>
</tr>
<tr>
<td>1</td>
<td>Class-B, LDO, Lube Oils, Grease</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Furnace Oil, LSHS and slops</td>
<td>3</td>
</tr>
</tbody>
</table>

Internal inspection:
All storage tanks shall be subjected to a detailed internal inspection after an interval as detailed below. Where the inspection intervals are prescribed in the Quality Control Manual, the same shall over ride the table below:

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Fluid Stored</th>
<th>External Inspection Interval (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>With Corrosion Rate Based Assessment</td>
</tr>
<tr>
<td>1</td>
<td>Class-B, LDO, Lube Oils, Grease, Furnace Oil</td>
<td>Years determined by Corrosion Rate and Integrity Assessment or 15 years, whichever is lower</td>
</tr>
<tr>
<td>2</td>
<td>slops</td>
<td>-do-</td>
</tr>
</tbody>
</table>

INSPECTION OF UNDERGROUND STORAGE TANK

Prior to entering an underground tank, it shall be cleaned internally of its product and adequate air circulation provided. The man entry should be preceded by ensuring that the tank is Hydrocarbon and gas free. The tank shall be visually inspected for general corrosion/ pitting/ deterioration on internal surfaces.

Ultrasonic thickness measurements shall be carried out on shell plates, end plates and nozzles from inside the tank once in ten-year period or to meet industry’s quality control requirements whichever is less. The external inspection of the underground tank shall be performed once in twenty-year period or to meet industry’s quality control requirements whichever is less.

After the repairs, the tank shall be hydrostatically tested of at 0.75-kg/sq.cm-test pressure and checked for leaks

Timely inspection and preventive maintenance of these storage tanks assume high importance. Accordingly, the inspection schedules of storage tanks are to be prepared and implemented.
This standard covers the minimum inspection requirements for atmospheric and low-pressure storage tanks constructed as per standards IS-803, API-STD-620, API-STD-650, IS 10987 or equivalent. The various types of storage tank inspections along with types of repairs and areas of inspections have been covered in this standard.

B. Pipes, valves and fittings

OISD Standard OISD-Std-130 on “INSPECTION OF PIPING SYSTEMS” shall be followed for details. Salient inspection and maintenance requirements are given below:-

Safety in petroleum installations comes through continuous efforts at all stages and as such it can be ensured by observing that plant and equipment are designed, constructed, tested and maintained as per Engineering Standards and subsequent modifications and repairs are conforming to the same standard.

This standard covers minimum inspection requirements for plant piping as per Standard ANSI B-31.3 or equivalent. Areas to be inspected, facilities needed for inspection, frequency of inspection, likely causes of deterioration of pipelines in service and inspection of pipe fittings and repairs have been specified. Also included briefly are the inspection and testing requirements for the pipelines post commissioning.

It is necessary to draw up and adhere to an inspection programme to avoid failures and inconveniences in operation. The authorized person(s) shall carry out the On Stream and Comprehensive Inspections. The experience and qualification of the authorized person(s) shall be in line with the applicable inspection standards and procedures.

Type of Inspection: The post-commissioning inspections of pipelines shall be as under;

a. External inspection
b. Comprehensive inspection

Inspection intervals: Pipelines in plant mainly comes under class-III category (OISD Std 130) and inspection interval are as under:

<table>
<thead>
<tr>
<th>Class</th>
<th>Service</th>
<th>Maximum Inspection Interval in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>External on stream</td>
</tr>
<tr>
<td>Class-III</td>
<td>Class –B, Lubes, Furnace, asphalt etc</td>
<td>4</td>
</tr>
<tr>
<td>Class-III</td>
<td>Air process, cooling water and fire water etc</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: 1. Any other service which is not covered in the above tables shall be included under appropriate class as the case may be.

2. In case, high corrosion rates are observed and half the remaining life is less than the above mentioned scheduled intervals, then the comprehensive inspection interval shall be suitably reduced to ensure that maximum inspection interval shall not be more than half the remaining life

C. Boiler: Inspection, testing and maintenance shall be as per manufacturer’s guidelines and requirement in line with IBR norms. All applicable statutory norms as per requirement of inspector of boiler shall be followed.
D. Pressure vessels: Inspection, testing and maintenance shall be carried out as per statutory requirement.
E. Weigh Bridge: Inspection and maintenance shall be as per manufacturer’s guidelines. All statutory norms as per requirement of Inspector of legal metrology shall be followed.
F. Hoist, EOT and joist: Inspection and maintenance shall be as per manufacturer’s guidelines. All statutory norms as per requirement of Inspector of Factory shall be followed.
G. Fork lift: Inspection and maintenance shall be as per manufacturer’s guidelines. All statutory norms as per requirement of Inspector of Factory shall be followed. Periodical eye testing shall be carried out in line with requirement of Inspector of Factories and record maintained.
H. Inspection, testing and maintenance of thermic fluid heater, cooling tower etc. shall be done as per manufacturers guide lines and record maintained.
I. Ladder safety (portable or fixed-OISD 192)
   A ladder is primarily a means of gaining access to a work place. The foot ladder should be properly supported on the firm surface and the top end should be securely fixed to prevent its slippage. At a time, only one person should use the ladder. The ladder should be checked periodically for its fitness for use. The ladder should extend at least one meter above the platform for landing place. The ladder should be placed at suitable safe angle to minimize the risk of slippage (ideally 75 deg angle to the horizontal). The heavier objects should not be carried up the ladder.
J. Strainers and filters
   Strainers and filters shall be inspected and cleaned as per following frequency, unless sluggish operation warrants earlier inspection:
   Frequency of inspection and cleaning.
   Upstream of Pump Suction: Quarterly
   Upstream of PD meter quarterly
   Water spray strainer quarterly
K. Safety relief valves
   Safety Relief valves shall be tested once in a year. Further, an on stream visual inspection should be carried out at least once in every 6 months to check the following:
   • Blinds do not exist.
   • Upstream and downstream isolation valves, if any, are opened and sealed.
   • Seals protecting the spring setting have not been broken.
   • Relief device is not leaking. This shall be checked visually or by thermography or contact thermometers or by hand touch at outlet nozzle wherever practicable.
   • The continuous operation of heat tracing provision, if any, provided for low temperature application on valve and discharge piping.
   • Condition of insulation and cladding on the heat traced piping and valves.
   • Provisions of OISD-STD-132 on “Inspection of Pressure Relieving Devices” shall be followed.
L. Rotary equipment:
i) Compressors:
Periodic maintenance checks, as detailed in Annexure-2 to be followed.

ii) Pumps:

Periodic checks as detailed in Annexure-2 to be followed.

iii) Diesel Engines:

For maintenance of Diesel Engines Original Equipment manufacturer guidelines and OISD-STD-127 shall be followed.

iv) Pressure gauges:

Pressure gauges shall be checked daily for its proper functioning and shall be calibrated once in 6 months.

v) Flow measuring devices:

All flow measuring devices shall be checked daily for proper functioning. Calibration of the flow measuring devices shall be carried out in line with requirement of Department of Legal Metrology of concern state.

8.7 Firefighting equipment (portable and trolley mounted)

Portable fire extinguishers are not expected to deal with large fires. Nevertheless, these are very valuable in the early stages of fire. The most important features of these extinguishers are their immediate availability and can be used by one / two person(s). A fully charged fire extinguisher shall not be more than 17 kgs. The extinguishing medium is discharged and directed into fire by storage pressure or release of pressurized charged stored in a cartridge.

Extinguishers shall be classified by the types of extinguishing medium which they contain. At present, the main types of extinguishers are a) water and or foam based b) powder c) carbon dioxide and d) clean agents.

Relevant IS code for fire extinguishers and schedule for hydraulic pressure testing of fire extinguishers

<table>
<thead>
<tr>
<th>#</th>
<th>Type of extinguisher</th>
<th>IS Code</th>
<th>Test interval (Year)</th>
<th>Test pressure (kg/sq.cm)</th>
<th>Pressure maintained for (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanical foam type (gas cartridge)</td>
<td>15683/13386/14951</td>
<td>3</td>
<td>35</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>Mechanical foam type (stored pressure)</td>
<td>15683</td>
<td>3</td>
<td>35</td>
<td>2.5</td>
</tr>
<tr>
<td>3</td>
<td>Dry powder (stored pressure)</td>
<td>15683</td>
<td>3</td>
<td>35</td>
<td>2.5</td>
</tr>
<tr>
<td>4</td>
<td>Dry powder (gas cartridge)</td>
<td>15683/10658/11833</td>
<td>3</td>
<td>35</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>Carbon dioxide</td>
<td>15683</td>
<td>5</td>
<td>250</td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>Clean agent</td>
<td>15683</td>
<td>3</td>
<td>35</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Note: Extinguisher’s should be hydraulically tested with cap.

Each extinguishing media shall comply respective IS code (given in following matrix):
<table>
<thead>
<tr>
<th>#</th>
<th>Extinguishing media</th>
<th>Respective IS code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Foam concentrate</td>
<td>IS 4989 or ISO 7203</td>
</tr>
<tr>
<td>2</td>
<td>Powders (Class –BC)</td>
<td>IS 4308</td>
</tr>
<tr>
<td>3</td>
<td>Powders (Class –ABC)</td>
<td>IS 14609</td>
</tr>
<tr>
<td>4</td>
<td>Carbon dioxide</td>
<td>IS 15222</td>
</tr>
</tbody>
</table>

Propellants: The propellants for stored pressure and cartridge operated extinguishers shall be air, carbon dioxide, nitrogen or mixtures of these gases having a max dew point of (-) 55 deg centigrade.

Life of fire extinguishers: (IS 2190:2010)

<table>
<thead>
<tr>
<th>#</th>
<th>Type of extinguisher</th>
<th>Life time (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Foam type</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Powder type</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Carbon dioxide</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Clean agent</td>
<td>10</td>
</tr>
</tbody>
</table>

Note:
1. Life of extinguishers shall be considered from date of manufacture of extinguishers
2. In case failure in hydraulic pressure testing, extinguisher shall be rejected immediately before the life time given above.

Carrying handle: An extinguisher having a total mass of 1.5 kg or more and having a cylinder diameter of 75 mm or more shall have a carrying handle.

Mounting: Each extinguisher intended for wall mounting shall be provided with a means of mounting.

Further for detail guidelines for inspection, testing etc, OISD-STD-142 shall be referred.

8.8 Electrical equipment
Proper functioning of electrical equipment can only be ensured by means of periodic preventive and predictive maintenance of the equipment. This enhances equipment life and also ensures safety of the equipment, installation and operating personnel.

Maintenance shall be daily, weekly, quarterly or annual depending upon the type of equipment. Adequate logs shall be maintained to ensure that maintenance is carried out as per approved checklists. Preventive maintenance shall be carried out as per schedules laid down in OISD-STD-137. Special emphasis shall be laid on the maintenance of equipment installed in hazardous areas.

All electric apparatus and wiring in a hazardous area shall at all times be so maintained as to retain the characteristic on which their approval has been granted.

Precautions to be taken for repairs and testing of flameproof equipment shall be as below:

i. No Flame proof or intrinsically safe apparatus shall be opened and no work likely to impair the safety characteristics of such apparatus or electric wiring connected thereto shall be carried out until all voltage has been cut off from said apparatus or wiring. The voltage shall not be restored thereto until the work has been completed and the safety characteristics provided in connection with the apparatus and wiring has been fully restored.

ii. Use of soldering apparatus or other means involving flame, fire or heat or use of industrial type of apparatus in a zone “1” area shall be permitted for the purposes of effecting repairs and testing and alterations, provided that the area in which such apparatus or wiring has been installed, has first been made safe and certified by a competent person after testing with an approved gas – testing apparatus...
to be safe and free from inflammable vapours, gases or liquids and is maintained in such conditions, so long as the work is in progress.

iii. No alteration that might invalidate the certificate or other document relating to the safety of the apparatus shall be made to any apparatus. Replacement fasteners, nuts, studs and bolts shall be of the type specified by the manufacturer for the particular apparatus. No attempt shall be made to replace or repair a glass in a flameproof enclosure e.g. in a luminaire or other enclosures, except by replacement with the complete assembly or part obtainable from the manufacturer, complying with the approval certificate. If replacement components such as cable glands, conduit or conduit accessories, are available only with thread forms which differ from those provided on the apparatus, suitable adaptors having necessary certification and approval shall be employed.

iv. Equipment enclosures and fittings shall be examined to see that all stopping plugs and bolts are in position and properly tightened. Locking and sealing devices shall be checked to ensure that they are secured in prescribed manner.

v. If at any time, there is a change in the area classification or in the characteristics of the flammable material handled in the area or if the equipment is relocated in the area, the area classification drawing should be correspondingly revised and a check shall be made to ensure that the equipment selection corresponds to the revised area classification.

vi. A system shall be established to record the results of all inspections and the action taken to correct defects.

8.9 LADDERS:

A. INSPECTION AND TESTING:

i) Wooden ladders shall be inspected at least once in a week for damage and deterioration.

ii) Metal ladders shall be inspected at least once in three months and all parts checked for wear, corrosion and structural failure.

B. STORAGE AND MAINTENANCE:

i) Ladders shall be stored in dry location and protected from weather. Ladders shall be supported during storage so as to avoid sagging and permanent set.

ii) Wooden ladders shall be periodically treated with a clear preservative such as varnish, shellac or linseed oil. Painting shall not be adopted as defects and cracks are likely to be covered up by the coating.

iii) Metal rungs shall be cleaned to prevent accumulation of materials which may destroy non-slipping properties.
9.0 MANAGEMENT OF CHANGE (MOC)

9.1 INTRODUCTION

Lube plants are subjected to continuous modifications to achieve higher efficiency, improve operability and safety, and improve reliability, improvement of the plant machineries and equipment and to accommodate technical change.

The hazards connected with any change are to be identified and controlled efficiently through an appropriate hazard management system. These guidelines lay down procedures covering various aspects of change and address the following:

- Minimize the mishaps caused due to non-compliance of procedures.
- Improve optimization and utilization of facilities.
- Decrease downtime.
- Increase favorable public opinion.
- Increase knowledge of plants and process activities.


These guidelines describe the procedures to be adopted for systemic management of change of process/technologies, change of hardware, change in working environment, change of personnel, change of operating procedures etc.

9.2 TYPES OF CHANGES

a) Changes in Facilities

- Addition, alteration or removal of equipment / instrument or, a part thereof.
- Modification in piping system including valves
- Changes in product / material specifications
- Changes in software in computerized environment

b) Changes in Operating Procedures

Deviations from the annualized operating procedures / approved SOPs

c) Changes in Personnel

Changes in operating personnel (newly recruited / re-assigned officers and workmen)

9.3 MOC DOCUMENT SHALL BE PROCESSED IN RESPECT OF ANY CHANGES TAKING PLACE AT THE LUBE PLANTS

The changes could be:

- Permanent
- Temporary
- Emergency
9.4 PROCEDURE FOR MANAGEMENT OF CHANGE (MOC)

Following steps shall be followed while processing MOC document:

- Identification of possible improvements to existing processes
- Initiation of Change Request with justification
- Scrutiny and Approval Procedure
- Execution of Change
- Commissioning, training and updating of documents

9.5 MOC DOCUMENT

Whenever changes are envisaged at the plant, MOC document in the prescribed format shall be initiated. Depending upon the critical nature of impact the document shall be routed to the appropriate authority for approval. No changes shall be permitted without approved MOC. In order to handle any emergency situations suitable MOC mechanism shall be developed and records maintained.

9.6 INITIATING CHANGE REQUEST

The format (Annexure-3) shall be initiated with the following information

- Description of proposed change, including object of change (facilities / procedure/ new manpower etc.)
- Technical reason for the proposed change.
- Potential impact of the change on health, safety, works environment and product quality.
- Compliance to guiding Standards and Regulatory requirements.
- Nature of the change: temporary / permanent, normal / emergency etc.
- Proposed documents incorporating the changes: revised PandID (for facilities change) or, revised SOP (for changes in procedures) with revised PFD (Process Flow Diagram), if required.
- For introduction of new personnel, details of training imparted to the personnel on the changed facility / process and the related health, safety and emergency response issues.

A. Scrutiny and Approval Procedure

The MOC Request will be reviewed and approved / rejected by the appropriate competent authorities as given in the Limits of Authority (LOA) table in Annexure-4. Any change in the existing process or new processes is required to be discussed and suggestions / acceptance of the Committee are to be recorded in the MOC application. Competent authorities shall ensure that the proposed changes in design / process are completely safe through appropriate checks / evaluations, which may include process hazard analysis and HAZOP (Hazard and Operability study).

B. Execution of Change

On approval of the MOC Request, modifications / changes in facilities/ procedures can be executed / effected. Physical inspection of the changes done in line with the MOC approval shall be conducted by appropriate official and confirmed through a signed document.

C. Commissioning, Training and Updating of documents
On completion of the modifications and inspection as stated above, facilities can be commissioned for regular operations, after ensuring that the concerned officers, operators including contract workmen and security personnel - wherever applicable are adequately informed and suitably trained on the impact of these changes.

As built records with the approved MOC, revised Plan ID and layout drawings shall be maintained properly.
10.0 EMERGENCY PREPAREDNESS PLAN AND RESPONSE

10.1 GENERAL

Several major accidents leading to grave disasters have occurred across the world in the past. The lessons learnt from the disasters made it essential to draw an Emergency Management Plan to handle such eventuality. An Emergency Management Plan is essential to obviate such an eventuality by providing the measures to contain the incident and minimise the after affects.

The best way to manage any emergency is to prevent it. Following guidelines for emergency prevention shall be followed:

- Sound engineering practice in the design, fabrication, installation and maintenance of facilities.
- Careful selection and correct use of equipment.
- Observance of safety and security regulations.
- Deployment of eligible/qualified manpower.
- Development and adherence to site specific operating procedure (SOP).
- Proper and constant training and guidance to all personnel working in the installation with particular reference to product knowledge and maintenance practices.
- Following Management of change (MOC) procedure.
- Good House-keeping.
- Constant supervision and alertness.

10.2 STATUTORY AND OTHER REQUIREMENTS

The relevant provisions of the concerned Acts and Rules as indicated in para 4.0 shall apply.

Further guidelines have been provided in Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010, published by Petroleum and Natural Regulatory Board shall be referred for further details.

A detailed guideline on the subject is also provided in OISD-GDN-168, which may be referred for guidance.
11.0 TRAINING

11.1 GENERAL

Products handled at the plant are hazardous in nature. Therefore, safety education and training requires great attention. Training courses including the refresher courses shall be conducted to develop the skills and safety awareness of employees, contractor workers, security staff and crew members.

11.2 DESIGNATED/DEDICATED SAFETY OFFICER (DSO)

A designated / dedicated, qualified and experienced plant officer should be deployed as ‘Safety Officer’ of the plant after training. He should be given exposure to Hazop, Risk Assessment, Safety Audit and upkeep of firefighting facilities and conducting Safety Meetings.

Duties and responsibilities of the dedicated/designated safety officer shall be to build and ensure a safe working environment at the plant, and also to advise and assist the plant in-charge in complying statutory requirements or otherwise concerning health, safety, security and environment of the plant. These duties shall include the following:

a) Advise various functions within the location in planning and organizing measures necessary for safe and secure work environment, including effective prevention and control of personal injuries.

b) Identify, co-ordinate and organize safety related trainings for all section of personnel connected in terminal activities.

c) Conduct routine safety checks on Depot/Terminal facilities and equipment to ensure conformity with prevalent norms/guidelines.

d) Up-dation and facilitate implementation of fire organization chart (FOC), Disaster Control Management Plan (DCMP), Risk Assessment and other statutes related to fire and safety, training etc.

e) Co-ordinate and conduct regular mock drill, DCMP drill, Mutual aid meeting with neighbouring industries/ oil marketing companies.

f) Conduct safety meeting and monitor compliance with statutory and OISD norms.

g) Implementation of sound safety culture to promote safe practices including wearing of personnel Protective Equipment (PPEs) amongst all section of personnel at the location-employees, contract labour, TT crew, Security staff and Visitors.

h) Conduct safety audit and co-ordinate/facilitate for conducting other internal and external audits.

i) Prepare and Monitor periodical compliance status of various audit recommendations.

j) Prepare and submit to appropriate authorities various periodical reports on safety, security, health, environment including training. Maintain all related records for the purpose of reference and audits.

k) Monitor the appropriate administration of security measures (gate passes, CCTVs, area surveillance, antecedent verification, access control procedures).

l) Ensure and monitor implementation of effective work permit system and record maintained.

m) Near miss analysis with specific focus on the root causes, reporting, dissemination of finding with all concerned across the location and corrective action required for preventive measures.

Appropriate reward and recognition scheme may be introduced encouraging employees to identify and reporting near miss events.
11.3 SPECIFIC REQUIRED TRAINING FOR EMPLOYEES

All operating personnel including the contract workmen, security, TT crew, shall be given training, including refresher courses as per OISD STD 154. However, following specific trainings are also to be imparted to the plant personnel. Training should be based on the needs of the job. Training on live fire simulation in an area designated for this purpose. Training through Fire Department. Training on first aid by recognised agencies.

For supervisors, intimate knowledge of the operator’s job is essential and this should be ensured. For terminal managers, safety training should include areas like:

i. Basics of safety management system
ii. The causes and effects of accidents
iii. Hazard identification
iv. Risk assessment and risk mitigation
v. Controlling risks and preventing accidents
vi. Emergency preparedness
vii. Critical task analysis
viii. Crisis management
ix. Importance of trip/alarm and safety procedures and systems
x. Learning from case histories

For training needs of various operating personnel refer Annexure-(5).

11.4 TRAINING TECHNIQUES

Appropriate training techniques on the following basis should be selected and used in order to attain the objectives of the various training courses outlined in this document:

11.5 COURSE DIRECTOR and FACULTY

The guidelines provided in this Section shall be used by Faculty in preparation and execution of safety training courses whether separately or as part of functional training programmes.

11.6 GUIDELINES FOR COURSE DIRECTOR

A) Course Objective:
The course objective should clearly and explicitly identify the outcomes a training programme is expected to produce. For example, the aim of basic safety course is:

a) To provide good understanding and identification of the hazards associated with the job.
b) To provide clear understanding of the safe way to perform the job.
c) To evoke correct and prompt response in any emergency situation.

The objective of the course will be that on completion of the course, the trainee should be able to:

i) Recognize hazardous condition at his place of work;
ii) Perform his job in accordance with the safe operating procedure;
iii) Help rectify an unsafe condition;
iv) Escape safely in case of release of toxic gases;
v) Operate firefighting equipment etc.

The more accurately and clearly the objective specifies the training outcome, the more helpful it will be to Course Directors and Faculties in designing their program. The objective of the program should be written down and communicated to the participants in the beginning.

B) Target Group:

The courses mentioned in this document are intended for different groups of persons. In a target group, the academic background, proficiency in language likely to be used in a course and levels of comprehension of subjects to be discussed may vary. Therefore, while inviting participants to a course, it should be clearly stated what is the expected level of knowledge/experience that one should have before he can derive full advantage of the intended course.

If the participants in a group are more or less at the same mental level of comprehension, then it is easier to select the training technique that would be most useful for that target group.

C) Climate Setting

Effective learning requires setting a climate in a training situation that is conducive to learning. The following factors which help create such climate should be considered:

i. Persons are more open to learning if they feel respected and not being talked down to, embarrassed or ridiculed.
ii. Participation in group exercises where trainees see themselves as mutual helpers rather than rivals.
iii. Mutual trust and friendliness between trainees and faculty.
iv. Care of human needs such as peaceful environment, comfortable seats, adequate breaks between training sessions, proper lighting and ventilation.

D) Course Design

The course design should include following factors:

a. Program layout
b. Selection of faculty
c. Arranging course material/training aids
d. Selection of training techniques
e. Field Visits: In case of new entrants, safety devices and procedures should be explained at site also. Adequate time for field visits should be allotted. Field visits during refresher course may also be arranged wherever necessary.
f. Evaluation methodology

11.7 GUIDELINES FOR FACULTY

I) Essential Factors

The faculty should take in to consideration following factors while preparing and presenting a topic:
a. Course objective
b. Target group
c. Time available
d. Feedback from earlier programs
e. Sequence and structuring of training material.

II) Training/Lecture Notes

Well written notes are useful training materials and should be made available for ensuring easier learning by the trainees. Since a substantial portion of the course is to be covered in classrooms it is very essential that Training Notes are carefully prepared.

A Training Note should primarily comprise of three sections as follows:

Introduction: Gets the trainees ready to learn and preview what is to be learned

Explanation: Presents the information to be learned, including examples and practices.

Summary: Reviews the information taught, and helps trainees remember and apply it.

The following matters should be considered while preparing a Training Note:

A) Introduction Section:

a. Tell the trainee how the content will help him.
b. Cite authors, research or industry practice on which the notes are based. This is to establish credibility.
c. Start the objectives in terms of skills the trainees will gain.
d. State how the information being taught is related to what trainees already know.
e. Present the information to be learnt in brief yet accurate in form.

B) Explanation Section:

a. Divide the total information into groups, each with a heading. Research shows that trainees can perceive not more than seven pieces of information at one time. Only the information that one needs to know, as related to the training objectives, should be included in the notes. Trainees must not be burdened with unnecessary information.
b. Combine text with illustrations, diagrams photographs etc.
c. Give examples, typical instances of the concepts being taught.
d. Use tables, charts, highlight key points, provide double space between typed lines that help rapid scanning, reading and retrieval.
e. Provide exercises or questions at the end for practice.

   Include feedback to indicate whether the response to the exercise was correct or not.

C) Summary Section:

a. Give a summary of the information, but in a slightly different way. Highlight the key points.
b. Give job-aid/checklist/references of documents that can be used by trainees back on the job.
11.8 COURSE OUTLINE:

This section specifies the minimum safety inputs to be included in safety or functional training course for various categories of employees in selected areas through individual Course Modules. Hazardous/high risk operation should be specifically highlighted indicating the risks and precautions.

The following points shall also be kept in view:

I) Safety Officers/Fire Officer’s Training:

It is likely that a new incumbent may not have been exposed to the type of safety training prescribed in this standard before taking up his assignment. It shall, therefore, be ensured that such persons are also exposed to the relevant training programs.

- OISD Standards, Guidelines and Recommended Practices

The faculties shall use the relevant OISD Standards while presenting the topics listed in the course contents, as given in the reference at the end.

11.9 REFRESHER COURSES

A number of refresher courses are listed hereafter. However, organisations themselves should select the type of courses and decide how often the refresher courses should be held but the periodicity of a refresher course should not be later than four years.

11.10 INDUSTRIAL FIRST AID

Employees shall be imparted First Aid training by recognized agencies / Institute for development of necessary skills. The requirement of minimum number of employees trained in a location shall be as per statutory requirement. Refreshment training shall be arranged as per statutory rules or once in 3 years whichever is earlier.

11.11 TRAINING FOR PERSONEL WORKING IN LUBE BLENDING / GREASE MANUFACTURING PLANT

All the employees and contractor workmen including TT crew members shall receive induction training at the site. Visitors shall be given safety briefing before entry to the location.

A) Course Module No. 13.11.1 (5.5.1 of OISD Std. 154)

Area: Lube
Area Code: 500
Course Code: 501
Intended For: Officers (including fresh entrants, supervisors and officers posted from other functions)
Duration: 2 days
Objective:

To provide knowledge on hazards associated with the job. Safe way to perform the job and to evoke correct and prompt response in any emergency situation.
Course Content:

i) Principles of Lube Blending/ Grease Manufacturing.

ii) Classification of Hazardous Areas

iii) Knowledge of Lubricants / Greases and Chemicals Used and their Hazardous Properties.

iv) Safety in Lube Blending/Grease Manufacturing and Safety Regulations (Statutory and In-Company) and Accident Prevention.

v) Safety in Filling and Packaging

vi) Occupational Health Hazards Housekeeping

vii) Personal protective equipment

viii) Work permit system

ix) Fire-causes, prevention and control

x) Electrical safety

xi) Safe operation and maintenance procedures

xii) Disaster management plan, emergency procedures and drills

xiii) Industrial first aid

B) Course Module No. 13.11.2 (5.5.2 of OISD Std. 154)

Area: Lube

Area Code: 500

Course Code: 502

Intended For: Office Staff

Duration: 1/2 day

Objective: To provide knowledge on hazards associated with the job and safe way to perform the job, to evoke correct and prompt response in any emergency situations.

Course Content:

i) Hazardous Properties of Lubricant/Grease/Chemical

ii) Fire-Causes, Prevention and Control

iii) Fire Protection Facilities - Operation and maintenance

iv) Safety Regulations (Statutory and In-company)

v) Disaster Management Plan / Emergency Procedures/Drills

vi) Industrial First Aid

C) Course Module No.13.11.3 (5.5.3 of OISD Std. 154)

Area: Lube

Area Code: 500

Course Code: 503

Intended for: Plant Workmen.

Duration: 1 day
Objective:

To provide knowledge on hazards associated with the job and safe way to perform the job, to evoke correct and prompt response in any emergency situation.

Course Content:

i) Hazardous Properties of Lubricant/Grease/Chemical

ii) Safety in Filling and Packaging.

iii) Safe Handling and Maintenance of Handling and Lifting Equipment.

iv) Safe Operating Procedures

v) Fire - Causes, Prevention and Control


vii) Personal Protective Equipment

viii) Housekeeping

ix) Emergency Procedures/Drills

x) Industrial First Aid

D) Course Module No. 13.11.4 (5.4.6 of OISD Std.154)

Area Code : 400
Course Code : 406

Intended For: Tank Truck Crew

Duration: 1 day

Objective:

To educate on safe driving and prevention of road accidents. To evoke correct and prompt response in any emergency situation.

Course Content;

i) Hazards of Petroleum Products.

ii) Safety in Transportation of Petroleum Products by Road

iii) Do’s and Don’ts in Transportation.

iv) Use of Fire Extinguishers, First Aid

v) Action in Emergency

vi) Safety in Loading/ Unloading Operations

vii) Tank Truck Fittings and their use

viii) Upkeep of Safety Equipment Provided with Transport Vehicle
11.12 EVALUATION OF SAFETY TRAINING PROGRAMME

The evaluation of safety training programs in terms of their overall effectiveness towards attainment of course objectiveness and changes necessary for improvement, should be based on the criteria and techniques explained in the OISD 154.

11.13 RECORDS OF TRAINING.

Safety training needs of persons can be assessed only if relevant information is readily available. Records of training, therefore, should be maintained in respect of every employee indicating the types and the period of training programs attended, performance evaluation (Ref. OISD 154 for details).
12.0 SAFETY AUDIT

12.1 GENERAL

Safety audit is a well-recognized tool to improve the effectiveness of safety programme and loss prevention measures by carrying out systematic and critical appraisal of potential safety hazards involving personnel, plants and equipment.

For a structured and systematic safety audit of any plant/ facility, check lists are the most important prerequisite. Check lists should cover all the operational areas, major equipment, operating/ maintenance procedures, safety practices, fire prevention/ protection systems etc. Observations/ recommendations of safety audit team should be presented in the form of a formal report and action plan for corrective measures should be prepared and subsequently monitored for implementation.

General guidelines on safety audit methodologies and techniques are also given in OISD - GDN- 145.

12.2 OBJECTIVE and SCOPE OF SAFETY AUDITS

a) Introduction
Identification of vulnerable areas and specific potential hazards, is one of the prime function of loss prevention in oil industry. Safety audit is an important tool in undertaking this function.

b) Objectives of safety audits
While the basic aim of safety audits is to identify the areas of weaknesses and strengths, safety audits are undertaken to meet different specific objectives viz.-

- To identify any design deficiencies and also any weaknesses which might have cropped up during modifications additions of facilities.
- To ensure that fire protection facilities and safety systems are well maintained.
- To ensure that operating / maintenance procedures, work practices are as per those stipulated in the manuals and standards, which might have degraded with time.
- To check on security, training, preparedness for handling emergencies and disaster management etc.
- To check on mutual aid scheme, preparedness practice with district authority/fire brigade.
- To check the compliance of statutory regulations, standards, codes, etc.
- As a social objective to cater to public opinion and concern for safe environment. This also improves public relation of the organization.

c) Cope of safety audits
A safety Audit subjects various areas of a company's activities to a systematic critical examination with the objective of minimizing loss. This includes all the components of the system viz. management policy, attitudes, training, design aspect (Process, Mechanical, Electrical, etc.), layout and construction of the plant, operating Inspection and Maintenance procedures, emergency plans, personal protection standards, accident records.

d) Types of safety audits

Two types of Safety Audits are proposed to be carried out as below

1) Internal Safety Audit
2) External Safety Audit
Audit conducted by Internal Audit teams of the organization is categorized as Internal Safety Audit. Internal Safety Audits will be coordinated by local management under the overall direction from the respective Corporate Offices. External safety audits will be carried out by outside teams consisting of technical experts from other organizations in Oil Industry, professional bodies and statutory authorities under the overall coordination of OISD.

12.3 METHODOLOGY OF INTERNAL SAFETY AUDITS

a) Frequency of audits

The facilities in a depot/terminal should be covered minimum once every year. However, facilities’ design can be audited every 3 years or after any major modification or additions. For this purpose, the individual organization/ installation should draw up a calendar in advance for carrying such audits for every calendar year which should be made known to all the Departments and concerned Managers. The areas to be audited should be clearly identified and logically grouped.

b) Formation of Multidisciplinary teams

The Internal Audits should be carried out through multidisciplinary audit team. The composition of the Internal Safety Audit may vary depending on the Group and areas to be audited, however, person(s) concerned should have necessary experience and background to undertake in-depth audit in a particular discipline. A team of minimum 3 experienced officers from various disciplines viz. Operation / Maintenance /Inspection / Electrical / Instrumentation /HSE and with the active involvement of concerned in-charge of the installation to carry out internal safety audit. One of the team members should be nominated as the leader of the audit team.

c) Duration of audit

Depending on the nature of audit and type / complexity of the installations in the selected group, the duration of internal safety Audit can be fixed. This may vary from 2 to 3 working days for facilities under each group.

d) Use of safety audit check lists

Check lists are the most useful tools for undertaking systematic Safety Audit. Even for a skilled and well qualified engineer a good check list would be necessary as a guide. Like a code of practice, a Check List is a means of pooling the knowledge and hard won experience and ensures that no important aspect is overlooked or forgotten. Such check lists help maintaining uniformity and speeding up the audits.

At the end of this section area specific sample checklist is given and that maybe further developed based on the facilities in the depot/terminal

e) Preparation before site visits for internal safety audits

The safety Audit team visits any particular facility for carrying out Safety Audit, it would be essential to study all relevant documents as below to get complete picture :

- Layouts
- P and IDs
- Operating Manuals/SOP
- Maintenance / Inspection Manuals
- Fire and Safety Manuals etc.
- Earlier internal audit / external inspection reports

Depending upon the nature of audit more emphasis can be given to study specific documents. All the audit team members should study these documents in advance to know the details of the installation.

f) Briefing

Before beginning of each audit, all concerned persons of the area/installation be briefed by the team leader about the purpose of the audit. No impression should be left that audit will throw bad light on them.

g) Site inspections

Most of the information could be gathered through site inspection using ready-made check lists. The auditors should enter their observations under the remarks column and not simply state “yes” / “no”. Wherever necessary, observations should be recorded in separate sheet. Inspection should be carried out accompanied by Installation Manager/Incharge or the assigned officials.

h) Discussions

Further information can also be gathered through discussions (formal and informal), with site personnel and Installation / Plant Manager, who is in-charge of the area or other site officers. The audit team should interact with persons from various disciplines such as Operations, Maintenance, Electrical, Instrumentation, etc.. Formal discussions could be in the form of brief periodical sessions while informal discussions could be over a cup of tea with personnel working in the area.

i) Study of documents

In addition to the documents which are already studied before inspection of the facilities, other documents, such as standard Operating Instructions, Standing Orders, Log Books, Log sheets, Accident Records, Minutes of Safety Committee Meetings etc. may also be studied as required.

j) Preparation of audit reports

The work of the Internal Safety Audit item should be presented in the form of a Safety Audit Report for each group which should contain observations and recommendations and also in brief the modalities adopted in conducting audit and the names of the audit team members.

Before finalizing the report, the Safety Audit Team can give a presentation as feedback to the Operating / Management personnel of the Area / Installation. Additions or deletions could be made in the draft report based on the discussions and comments received during the presentation. This approach is always constructive and does not undermine the technical competence of the audit team.

k) Follow up of audit reports

Generally, the Internal Safety Audit Reports are submitted to the concerned authority who appoints the audit team for undertaking needful follow up actions. Only the appointing authority should exercise judgment in rejecting any of the recommendations. The appointing authority shall be of senior management level (General Manager and above ).

The crux of the safety audits lie in removing the weakness identified during the audit. Sometimes audit reports identify only the problem / weakness, but not the solution.
In such cases, it would be necessary to undertake a detailed study of the specific area and to identify the rectification measures. Wherever the necessary in-house expertise is not available for detailed studies, help of consultants / professional bodies should be sought for.

I) Implementation of recommendations
The final and most important phase is the implementation of recommendations. A senior person should be nominated for coordinating implementation of all accepted recommendation under a time bound program. Senior management should review the progress of implementation of recommendations periodically through Management Safety Committee meetings and other review meetings.

<table>
<thead>
<tr>
<th>#</th>
<th>Type of Safety Audit</th>
<th>By whom</th>
<th>Frequency</th>
<th>Check List Annexure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Safety inspection of plant</td>
<td>Safety officer</td>
<td>Monthly</td>
<td>Annexure-6</td>
</tr>
<tr>
<td>2</td>
<td>Safety inspection of plant</td>
<td>In-charge of plant</td>
<td>Quarterly</td>
<td>Annexure-6</td>
</tr>
<tr>
<td>3</td>
<td>Electrical audit</td>
<td>Accredited electrical Engineers /Authorized Class A Electrical engineer</td>
<td>Once in 3 years or as per statutory requirement whichever is earlier?</td>
<td>Annexure-7</td>
</tr>
<tr>
<td>4</td>
<td>Internal safety audit</td>
<td>Multi-disciplinary team</td>
<td>Yearly</td>
<td>As per OISD-STD-145</td>
</tr>
<tr>
<td>5</td>
<td>Pre-commissioning inspection</td>
<td>OISD</td>
<td>Before commissioning and any major addition of facilities such as increase in storage or dispatch facilities.</td>
<td>OISD Pre-Com check list</td>
</tr>
<tr>
<td>6</td>
<td>External safety audit</td>
<td>OISD</td>
<td>Two inspections at an interval of 5 years, there after a request audit.</td>
<td>OISD ESA check list</td>
</tr>
<tr>
<td>7</td>
<td>Surprise inspection</td>
<td>OISD</td>
<td>As and when decided</td>
<td>Random Checks</td>
</tr>
<tr>
<td>8</td>
<td>Special Inspection by senior officers</td>
<td>Officers of the level of Executive Director/ General Manager of respective oil company.</td>
<td>At least one major plant per year</td>
<td>Random Checks</td>
</tr>
</tbody>
</table>

**VARIOUS AUDITS AND FREQUENCY OF AUDITS**
REFERENCES:

i. OISD STD-105: Work permit system
ii. OISD STD-108: Recommended practices on Oil storage and handling.
iii. OISD STD-110: Recommended practices on static electricity
iv. OISD STD-113: Classification of areas for electrical installations at hydrocarbon processing and handling facilities.
v. OISD STD-117: Fire protection facilities for petroleum depots, terminals, pipeline installations and lube oil installations.
vi. OISD STD-118: Layout for Oil and Gas installations.

vii. OISD STD-129: Inspection of storage tanks.

viii. OISD STD-130: Inspection of piping systems
ix. OISD STD-135: Inspection of loading and unloading hoses for petroleum products
x. OISD STD-137: Inspection of electrical equipment.

xi. OISD STD-140: Inspection of jetty pipelines

xii. OISD STD-142: Inspection of firefighting equipment and systems

xiii. OISD STD-145: Guide lines on internal safety audits (procedures and checks)

xiv. OISD STD-154: Safety aspects in functional training

xv. OISD STD-155: Personnel protective equipment (Part -I: Non respiratory equipment and part-II: Respiratory Equipment)

xvi. OISD STD-156: Fire protection facilities for ports handling hydrocarbons

xvii. OISD STD-163: Safety of control room for hydrocarbon Industry

xviii. OISD STD-168: Emergency preparedness plan for marketing locations of oil Industry

xix. OISD STD-178: Guidelines on management of change


xxi. API STD 620: Design and construction of large, welded, low pressure storage tanks.

xxii. API STD 650: Welded tanks for oil storage

xxiii. API RP2350: Overfill protection for storage tanks in petroleum facilities.


xxv. IS/IEC: 60079-1: "Explosive atmospheres-part-1: Equipment protection by flameproof enclosures “d”

xxvi. IS 10987: Code of practice for design, fabrication, testing and installation underground /above ground horizontal cylindrical storage tanks for petroleum products.

xxvii. IS 4308: Dry Chemical Powder for Fighting B and C Class Fires--Specification

xxviii. IS 10658: Specification for Higher Capacity Dry Powder Fire Extinguisher (Trolley Mounted)

xxix. IS 11006: Flashback arrestor (Flame arrestor)-specification.

xxx. IS 10810: Method of test for cables, part 43-Insulation resistance.
xxxii. IS 15683: Portable fire extinguishers --performance and construction spec.
xxxiii. IS 2190: Selection, installation and maintenance of first –aid fire extinguishers- code of practice.
xxxiv. IS 2546: Specification for Galvanized mild steel fire bucket.
xxxv. IS 3043: Code of practice for earthing
xxxvi. IS 5571: Guide for selection of electrical equipment for hazardous areas
xxxvii. IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installations.
xxxix. IS 12709: Specification for glass fiber reinforced plastics (GRP) pipes for use for water supply and sewerage.
x. IS 4989:2006: Multiple aqueous films forming foam liquid concentrate for extinguishing hydrocarbon and polar solvent fires –specification.
x. IS 803: Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks.
x. NFPA 11: Standard for Low-, Medium-, and High-Expansion Foam
xx. NFPA 13: Standard for the Installation of Sprinkler Systems
xxii. NFPA 30: Flammable and Combustible Liquids Code
xxiii. NFPA 72: National Fire Alarm and Signaling Code
xxiv. UL162: Foam equipment and liquid concentrate
ANNEXURE: 1
CHECKLIST FOR BULK /PACKED LUBE TRUCKS AT LOADING / UNLOADING POINTS.

<table>
<thead>
<tr>
<th>#</th>
<th>Item</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily Checks</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether driver is having requisite / mandatory documents required for vehicle and driver?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether the vehicle has at least one driver and one helper as its crew member?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether the vehicle has two fire extinguishers?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether vehicle’s cabin is checked for presence of any flammable/explosive substance being carried by the crew?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether there are any sources of ignition like matches etc. in the vehicle?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether the engine exhaust is wholly in front of bulk truck and has ample clearance from fuel oil system and combustible material.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether approved quality flame arrester provided on the engine exhaust and muffler/silencer is properly bolted and without any sign of leaks?</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether each compartment of tank is fitted with independent vacuum and pre-operated vents (PV Valve)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Additional Checks:</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether the vehicle has a cutoff switch for electrical system?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether all electric wiring is properly insulated and all junction boxes are sealed properly?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether there is a quick shut off facility for the drain valves in case of emergency?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether the vehicle has First Aid Box, Tool Box and Emergency search light?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Whether the driver has a copy of standing instructions and TERM card?</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Whether electrical equipment like generator switches, fuses and circuit breakers are located inside the cabin or engine compartment?</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whether battery is in easily accessible position with a heavy duty switch close by, to cut off the battery in emergency?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Whether battery terminals have protective rubber covers?</td>
<td></td>
</tr>
</tbody>
</table>
ANNEXURE-2

MAINTENANCE SCHEDULE OF CRITICAL EQUIPMENTS:-

COMPRESSOR

<table>
<thead>
<tr>
<th>#</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daily Weekly Monthly Quarterly</td>
</tr>
<tr>
<td>1.</td>
<td>Check Lube Oil Level of plunger pump unit and top up if necessary.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Check the oil level in the crank case and top up if necessary.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Before start check flow of cylinder jacket cooling water.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Check oil flow from plunger pump to gland packing assembly and compressor cylinder.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Check for flow rate from plunger pump</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Drain water from receiver/liquid trap</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Check belt tension and adjust if necessary.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Ensure tightness of foundation bolts.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Flush out lube oil system:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Crank case,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Pump chamber and fill fresh oil.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Flush jacket water cooling system.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Check alignment of compressor and motor pulleys.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Change lube oil filter and clean Suction filter.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Clean oil strainer</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Clean Breather</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Open and inspect suction and discharge valves.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Check instrumentation calibrate if necessary</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Check safety release valve.</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Suction and discharge valves of compressor cylinder</td>
<td></td>
</tr>
<tr>
<td>#</td>
<td>Equipment Parameters to check</td>
<td>Periodicity</td>
</tr>
<tr>
<td>----</td>
<td>-------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>19</td>
<td>Interlock with High level alarm</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>All Trips</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Pressure and Temperature Gauges</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Control Panel</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Complete over-haul.</td>
<td></td>
</tr>
</tbody>
</table>

**MAINTENANCE SCHEDULE**

**CENTRIFUGAL PUMP**

<table>
<thead>
<tr>
<th>#</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Equipment Parameters to check</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Periodicity</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daily</td>
<td>Weekly</td>
</tr>
<tr>
<td>1.</td>
<td>Check lub oil and top up level if necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check cooling water flow (where provided).</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Check mechanical seal/ gland leakage.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Check the &quot;AMPS&quot; are within limits</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Change lubes oil every 800 running hours.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Check coupling and coupling bolts and replace worn out parts.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Check tightness of foundation bolts.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Clean suction strainer of:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Product pumps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Other pumps</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Check alignment of pump and motor.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Overhauling</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Greasing of Bearings.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>High Level Alarm</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Relief Valve</td>
<td></td>
</tr>
</tbody>
</table>
Diesel Engines: MAINTENANCE STEPS

1. Keep the dirt out of the engine.
2. Maintain a lubricating film on all bearing surfaces.
3. Regulate the engine's fuel.
4. Control operating temperatures.
5. Guard against corrosion.
6. Let the engine breathe.
7. Prevent over speeding.
8. Know your engine's condition.
9. Correct troubles while they are simple.
10. Schedule and control your maintenance.

Diesel Engines:
“A” Daily Checklist

<table>
<thead>
<tr>
<th>#</th>
<th>Maintenance Steps</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check previous day’s engine log book.</td>
<td>Correct as required</td>
</tr>
<tr>
<td>2</td>
<td>Drain water and sediment from fuel tank and fuel filter through drain cock.</td>
<td>Before starting engine.</td>
</tr>
<tr>
<td>3</td>
<td>Check engine oil level and top up if necessary</td>
<td>Must be slightly less than or equal to “h” mark on dip stick when engine is stopped and has stood for 20 minutes or more (must be measured after all oil is drained back into oil pan).</td>
</tr>
<tr>
<td>4</td>
<td>Check for fuel, oil, water</td>
<td>Correct if leaking.</td>
</tr>
<tr>
<td>5</td>
<td>Fill radiator/ surge tank with treated water (Chromate concentration 3500 ppm).</td>
<td>Radiator cap must be firmly tightened back into the radiator/surge tank neck engine must not be operated without the radiator cap since this will cause aeration and overheating of the coolant.</td>
</tr>
<tr>
<td>6</td>
<td>Check air cleaner oil level and change oil, if required (if oil bath type) clean dust pan and pre-cleaner of day type air cleaner.</td>
<td>Use clean engine oil</td>
</tr>
<tr>
<td>7</td>
<td>Check air line connections for leaks</td>
<td>Correct as required</td>
</tr>
<tr>
<td>8</td>
<td>Remove and clean air compressor breather, if equipped.</td>
<td>Fill with clean oil, upto mark.</td>
</tr>
</tbody>
</table>
Drain air receiver tank at the beginning of each shift and then close the drain cock.

<table>
<thead>
<tr>
<th>Clean crankcase breather</th>
<th>Discard paper type element, if clogged.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check oil level in hydraulic governor, if provided.</td>
<td>Check for leaks, use specified engine oil for topping up.</td>
</tr>
<tr>
<td>Start the engine and note the oil pressure both at idling and maximum speed</td>
<td>If there is a change in oil pressure from that recorded in the long book on earlier occasion then stop engine and check through trouble shooting technique the cause for oil pressure change and correct if necessary (for Assistance in diagnosing the change in oil pressure call your service representative if necessary.</td>
</tr>
<tr>
<td>Record oil pressure</td>
<td>Refer OEM Manual for Lube. Oil pressure limits.</td>
</tr>
<tr>
<td>Fill fuel tank at the end of the shift.</td>
<td>Use clean fuel and a strainer. Also clean the cap and surrounding area before opening the filler cap.</td>
</tr>
</tbody>
</table>

Note: In addition, Diesel Engine “B”, “C”,“D” and “E” checks shall be carried out as per manufacturers guide lines
ANNEXURE-3

FORMAT FOR REQUEST FOR MANAGEMENT OF CHANGE

Location:__________________ Request No.: __________

Request Date: __________

1. Description of Proposed change :
2. Technical Reason for the proposed change :
3. Potential benefit after effecting the change :
4. Impact of the proposed change on :
   a) Safety [HAZOP findings, if applicable]
   b) Health
   c) Work Environment
   d) Product Quality
   e) Any other aspect
5. Compliance status to OISD and Statutory Regulations :
7. Revised documents as applicable :
   a) P and ID Drawing ☐
   b) Layout Drawing ☐
   c) PFD Drawing ☐
   d) SOP ☐
8. Change of manpower :
   a) No. of new personnel :
   b) Category [ Officer / Operator / Clerical ] :
   c) Details of training imparted on the new role :

____________________________________________________________________________

Name and Designation of Initiator

Signature of the Initiator

____________________________________________________________________________

Comments of the Reviewer

____________________________________________________________________________

Name and Designation of Reviewer

Signature of the Reviewer

____________________________________________________________________________

Comments of the Approver

____________________________________________________________________________

Name and Designation of Approver

Signature of the Approver

____________________________________________________________________________
## Limits of Authority (LOA) for MOC: Lube and Grease plants

<table>
<thead>
<tr>
<th>#</th>
<th>Category of change</th>
<th>Details of change</th>
<th>Addl. Requirements / Remarks</th>
<th>Initiator* of MOC request</th>
<th>Reviewer*</th>
<th>Approver*</th>
<th>Post execution Inspection for confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Facility</td>
<td>Augmentation of Storage Tanks of product, additives</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Facility</td>
<td>Modification in Piping system – sizing / routing / Pressure Relief ratings / type and specs of valves</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Facility</td>
<td>Modification in Pumps – addition / deletion, Changes in capacity, Changes in suction / discharge piping configuration</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Facility</td>
<td>Addition / modification of Calibration Tower, Sealing Platform, Utility sheds, Utility water pumps etc.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Facility</td>
<td>Changes in Electrical Systems – reduction in contract demand, transformer rating, new DG set, synchronization of load etc.</td>
<td>Electrical Audit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Facility</td>
<td>Handling of Additional Product Grades excluding Lubes and associated fuels/ additives</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Operating Procedure</td>
<td>Any changes in operating procedures other than that given in Operation Manual, approved SOPs or, convention followed in the location. Probable examples: Line-up for PLT, receipts / deliveries thru’ TT, TW, Gauging of Tanks, Water Draining, Calibration of TTs and Flow meters etc.</td>
<td>Risk Assessment, if felt required by Safety Officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Operating Procedure</td>
<td>Changes in dosing / doping level of additives for branded fuel, gasohol etc.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Operating Procedure</td>
<td>Any change / new operations involving maintenance of product storage tanks including water</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Operating Procedure</td>
<td>Any change in Safety procedures including Fire Organization Chart, Mutual Aid Plan, maintenance of firefighting facilities etc.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Operating Procedure</td>
<td>Any change in product accounting practices including pipeline qty., calculation modality, calibration chart etc. In variance with Accounting Manual / Opns Manual</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Facilities</td>
<td>Any changes in software, ERP system / invoicing / documentation and computer hardware changes affecting operating processes</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Facilities</td>
<td>Any changes in automation set points, logic, processes, calibration / accuracy requirements for TAS, TFMS and other IT systems</td>
<td>Opinion of TAS/ TFMS vendor, plus Risk Asses. if required by Safety Officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Personnel</td>
<td>Introduction of new officer, clerical staff, workmen including new security, contract personnel</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Operating Procedure</td>
<td>Cleaning / Repairs of the Fire Water Storage Tanks</td>
<td>Risk Assessment by Safety Officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Operating Procedure</td>
<td>Change in working hours / Addition/Deletion of shifts</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Facilities</td>
<td>Development of new settlement in the vicinity of Location</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note : Designations of requisite authority for the initiator, reviewer and approving authorities shall be assigned by the respective OMC depending upon the MOC items' relevant functional area/s. However the logic of successively higher authority levels for the three stages viz. Initiator, reviewer and approver shall be maintained. The MOC change area list is not exhaustive but illustrative.*
**RECOMMENDED TRAINING REQUIREMENTS:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Who Needs This Training (minimum)</th>
<th>Minimum Requirements</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near Miss Program Training</td>
<td>All employees.</td>
<td>Within 6 months of assignment</td>
<td>None, Not required if you have had ASA (Advanced Safety Auditing) training.</td>
</tr>
<tr>
<td>First Aid</td>
<td>All Supervisory personnel and emergency crews.</td>
<td>Within 6 months of assignment</td>
<td>3 Years based on third party training requirements, Refresher may vary based upon certificates held.</td>
</tr>
<tr>
<td>HSE Orientation for New Hires and transferees</td>
<td>All personnel newly hired or transferred</td>
<td>Within 1 week</td>
<td>None, HSE Orientation for New Hires and transferees</td>
</tr>
<tr>
<td>Orientation Program for Personnel arriving at site/facility for the First Time</td>
<td>All Personnel arriving at site of facility.</td>
<td>Prior to entering site/facility</td>
<td>None, Specific for facility/site and locally determined.</td>
</tr>
<tr>
<td>Incident Investigation and Root cause Training</td>
<td>All Supervisors and Safety Coordinators, Selected Management and HSE Advisors.</td>
<td>Prior to leading a formal Incident Investigation or within 1 year of assignment.</td>
<td>As changes in the program or policy, This training is required for full knowledge of system and is critical for supervisors.</td>
</tr>
<tr>
<td>Defensive Driving</td>
<td>All employees who are required to drive a company vehicle or who drive their own vehicle on company business 3 or more times a year.</td>
<td>Within 3 months of assignment</td>
<td>Dependent on designation, Only with company approved instructors</td>
</tr>
<tr>
<td>Hazard Identification/Risk Assessment training</td>
<td>All employees</td>
<td>Within 6 months of assignment</td>
<td>None, Subjects can be included in ASA/Behavioral Safety Auditing (BSA) or STOP or Near Miss Program</td>
</tr>
<tr>
<td>Legislative Requirements</td>
<td>All Extended Leadership Team and designated environmental coordinators</td>
<td>Within 1 year of assignment</td>
<td>Every 3 years</td>
</tr>
<tr>
<td>General Environmental Awareness / Waste Management</td>
<td>All Staff other than Leadership team</td>
<td>Within 1 year of assignment</td>
<td>Every 2 years</td>
</tr>
<tr>
<td>Work permit system</td>
<td>Personnel that will be assigned to issue or receive work permits</td>
<td>Prior to performing task</td>
<td>2 Years</td>
</tr>
<tr>
<td>Personal Protective Equipment (PPE)</td>
<td>Personnel required to use PPE.</td>
<td>Prior to using PPE</td>
<td>As Required</td>
</tr>
<tr>
<td>Fire Training - Hose Line (Fire Brigade)</td>
<td>Personnel assigned to field locations. The level of training will be based upon the facility location and/or the assigned responsibilities of the individual.</td>
<td>Upon assignment to a job that requires fire fighting</td>
<td>3 Years</td>
</tr>
<tr>
<td>#</td>
<td>CHECK POINTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>LICENSES/APPROVALS/CERTIFICATES/DISPLAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether all employees are aware of SH and E policy and displayed at prominent places?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether safety committee exists? And meeting is conducted once in a quarter?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether action points discussed in safety committee meeting are compiled?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether at least 50% of the safety committee members area from non-management staff?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether updated PESO License is available? Or applied for renewal in time?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether updated valid factory license is available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether Pollution Control Board consent for air and water exist / applied for renewal?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether Boilers are certified by the Boiler inspector or the person authorized by competent authority and valid License/Certificate available for their operations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether effluent is discharged through OWS only and found within permissible limit and test results available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether daily structured safety check of location being done and reviewed By L-I-C. Monthly inspection by LIC and quarterly safety inspection by so carried out as per ho guidelines, records maintained and points complied as per the target dates?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether Boiler competency certificate for the Boiler operator available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether authorization from State Pollution Control Board for handling hazardous waste is available/applied for renewal in time?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Whether hydrant hose are tested once in six months and certificate(s) available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Whether transformer oil tested annually and records available as per IS: 335 IS: 1866 The condition of Silica Gel is in acceptable condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whether on shift and off shift (including holidays) Fire Organization Chart is displayed at prominent place. All employees are aware off their role as in Fire Organization Chart.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Whether Fire Hydrant Layout and location of firefighting equipment’s is displayed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Whether disaster management land based on risk analysis is available and submitted to concerned Authority/Record of Submission/Dispatch available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Whether Mutual Aid Scheme is available and meeting is conducted every six months and records available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Whether layout of blocks and facilities meets the distance requirement as per OISD-118 (Pre- OISD location are exempted.)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Whether Anti-Lock Brake System (Abs) provided in N-3 category of vehicles other than tractor trailor combination manufactured on and after 01.10.06 and N-3 category vehicles with tractor trailor combination manufactured on and after 01.10.07?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Whether Hydrostatic Pressure Testing of air receiver Tank (S)/Vessel(S) of compressor done by authorized person and test certificates available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Whether safety relief valves of Boiler are tested annually and/or as per schedules/statutory guidelines and test certificates are available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Whether the required no of First Aid trained personnel available and their names displayed as per factories Acts/Rules or minimum 20% of total strength?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Whether Safety Audit Check list as per OISD-145/117/118 has been evaluated and all observations to be complied within targeted date. The audit check list is enclosed with observations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Whether safety committee meeting is conducted once in two a months or as per Factory Rules/Guidelines issued time to whichever is having more frequency?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Whether chain pulley blocks. Fork Lift, Lifting and hoisting equipment's are tested annually or as per Statutory stipulations and other technical requirements and authorized test certificates for load bearing are available and records maintained?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Whether lux level study carried out and illumination provided as per recommendation at all work places?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B. ACCIDENT REPORTING AND INVESTIGATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether all accidents have been reported in time and investigated as per latest guidelines of S and EP, Ho.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether lessons learnt from accidents/near miss incidents took place at same location and other locations as circulated through safety bulletins/SandEP intranet site are implemented and discussed during safety committee meetings and monthly arts submitted to S and EP.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether reportable accident during last financial year is 'Nil'?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether accident statistics are maintained in a register as per factory Act/Ruler?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether near misses are reported and records available?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. TANK TRUCK LOADING/UNLOADING AREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether bulk truck entering operational area has been approved spark arrestor?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether each bulk truck is equipped with is-marked working 9/10 Kg DCP Fe and 1 or 2 Kg CO2/ DCP FE.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether bulk truck have enclosed type battery cut off switch and the same is found in &quot;Off&quot; position during loading/unloading operations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether safety checks of tank trucks are carried out regularly and records maintained?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether violation of safety requirements by TT are monitored and penalty imposed as per transport discipline guidelines/contract????</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether drivers(S) / Cleaners/Helpers in TLF area found to be observing all safety norms of TLF area including wearing of safety helmet and shoes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether emergency Gate/Escape routes available. If not available, then plan for Tank/Container trucks evacuation within two minutes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether all TTs having fabricated as per PESO approved drawing.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether battery terminals have protective rubber cover?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether all electrical equipment's of TTs like generator Switches, Fuse, Circuit Breaker and battery located inside the cabin or engine????</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether hand brakes of TT are in working condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether self-starter of TTs are in working condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Whether fill pipe (100 Mm Dia) of TTs is extended up to 25mm from bottom. Calibration check list?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Whether all TTs are having valid fitness certificate from the concerned competent Authority(ies) for exhaust Emission/Mechanical fitness.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TANK WAGON SIDING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether rail sleepers in tank wagon sidings are of concrete/metalllic construction/other approved material?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether dummy wagons used during placement/withdrawal of tank wagon and caution boards are provided and the rake/tank wagon(s) are not connected with any shunting/haulage deice while loading/unloading is in progress?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether rail tracks are provided with bonding strips and connected to well-maintained earthing system?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether alternate hydrant and water cum-foam monitors are provided on both sides of railway gantry/siding as per OISD/statutory requirements. Pre -OISD location exempted due to space constraint.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether rail tracks insulation provided at 30m from first loading/unloading point, to insulate wagon siding rail track from electric traction system of the railways.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether overhead electric traction terminates 15m ahead of first loading/unloading point of Tank Wagon Siding?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether the oil soaked ballast is being periodically replaced in coordination with railways?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether if working beyond sunset, proper lighting arrangement is available in railway siding.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether metallic bonding jumpers provided across the flanges of hoses during unloading of T/W.?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>TANK FARM AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether tank dyke capacity is as per OISD-118 (pre OISD locations exempted)?</td>
</tr>
<tr>
<td>2</td>
<td>Whether roads are available around the tank farm for movement of fire tender (exempted for pre OISD location)?</td>
</tr>
<tr>
<td>3</td>
<td>Whether condition of earthing provided to storage tanks found as per guidelines. Minimum two earth pits provided and connected to earthing grid. Earth pits are provided outside the tank dyke.?</td>
</tr>
<tr>
<td>4</td>
<td>Whether tank bottom sludge is disposed off within six months from the date of cleaning?</td>
</tr>
<tr>
<td>5</td>
<td>Whether storage tanks are painted as per schedule/ and or as per need?</td>
</tr>
<tr>
<td>6</td>
<td>Whether tank farm dyke is impervious. Dyke wall is leak proof.?</td>
</tr>
<tr>
<td>7</td>
<td>Whether tank dyke valves provided with position indicator (open or close) and found in working condition. Display panel is available at location in charge and control room?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>COMPRESSORS/BOILERS/MIXING KETTLES/FORK LIFT TRUCKS/ LIFTING EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether low suction/high discharge/high temperature and low lube oil trip of compressor are provided and found in working condition. Records of their workability and calibration as applicable are available?</td>
</tr>
<tr>
<td>2</td>
<td>Whether trips of Boiler (low feed water flow, high pressure and temperature) inspected, tested regularly and also as required under statutory rules and records available?</td>
</tr>
<tr>
<td>3</td>
<td>Whether all steam/ hot product pipelines are provided proper?????</td>
</tr>
<tr>
<td></td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Whether housekeeping in boiler room is satisfactory and no combustible materials found stored in the room?</td>
</tr>
<tr>
<td>5</td>
<td>Whether weekly routine boiler inspection carried out as per OISD-131 format?</td>
</tr>
<tr>
<td>6</td>
<td>Whether oxygen content of boiler feed water kept below 0.02 ppm?</td>
</tr>
<tr>
<td>7</td>
<td>Whether observation post (visual check of feed water level) in Boiler found clean?</td>
</tr>
<tr>
<td>8</td>
<td>Whether air/fuel ratio maintained properly as per OEM's recommendation?</td>
</tr>
<tr>
<td>9</td>
<td>Whether demineralization plant for feed water is working?</td>
</tr>
<tr>
<td>10</td>
<td>Whether daily soot blowing of boiler carried out and records maintained?</td>
</tr>
<tr>
<td>11</td>
<td>Whether feed water tested for suitability of boiler use as Per OISD?</td>
</tr>
<tr>
<td>12</td>
<td>Whether all gauges, indicator lamps and alarms of boiler found in working condition?</td>
</tr>
<tr>
<td>13</td>
<td>Whether blending kettles are provided with protective grill at the top?</td>
</tr>
<tr>
<td>14</td>
<td>Whether no leaks found in the hydraulic hoses of fork lift trucks?</td>
</tr>
<tr>
<td>15</td>
<td>Whether brakes, lights, horns steering of fork lift trucks functioning?</td>
</tr>
</tbody>
</table>

**G. ELECTRICAL INSTALLATION**

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether earthing pits are as per relevant OISD Stds?</td>
</tr>
<tr>
<td>2</td>
<td>Whether all equipment's and appliances are provided with earthing as per provision of electricity act and OISD?</td>
</tr>
<tr>
<td>3</td>
<td>Whether only flameproof portable/Intrinsically safe torches/equipment's are in use in hazardous area?</td>
</tr>
<tr>
<td>4</td>
<td>Whether emergency lights are available in critical areas (security cabin, DG room, Elec. Switch room, fire PH, control room)?</td>
</tr>
<tr>
<td>5</td>
<td>Whether the list of authorized persons being maintained as per CEA safety regulation (latest regulation) 2010?</td>
</tr>
<tr>
<td>6</td>
<td>Whether all the substation equipment's are provided with double earthing. Neutral of transformer and generator separately double earthed and not in grid with appropriate insulated cables?</td>
</tr>
<tr>
<td>7</td>
<td>Whether the fuses used are of HRC type and of ratings specified in individual?</td>
</tr>
<tr>
<td>8</td>
<td>Whether circuit identification marks/tags are provided for each cable?</td>
</tr>
<tr>
<td>9</td>
<td>Whether cable insulation test carried out annually or as prescribed and certificates available?</td>
</tr>
<tr>
<td>10</td>
<td>Whether electrical relays are tested annually and records are available?</td>
</tr>
<tr>
<td>11</td>
<td>Whether no loose wire/temporary electrical connections are observed?</td>
</tr>
<tr>
<td>12</td>
<td>Whether electrical shock treatment chart and caution board displayed in electrical switch room?</td>
</tr>
<tr>
<td>13</td>
<td>Whether ISI marks insulation mats are provided in electrical switch room and their conditions satisfactory (rubber mats are acceptable till)?</td>
</tr>
<tr>
<td>14</td>
<td>Whether rubber hand gloves (with is mark or conforming to is) are in use which are tested/replaced annually?</td>
</tr>
<tr>
<td>15</td>
<td>Whether generators are in working condition and their fuel tanks are secured away from the exhaust of dg sets (exempted for all weather acoustic type DG sets)?</td>
</tr>
<tr>
<td>16</td>
<td>Whether safety trips wherever provided like cooling water temperature, low lube oil etc. Of dg set are provided and in working condition?</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>17</td>
<td>Whether updated single line electrical layout drawings displayed in PMCC?</td>
</tr>
<tr>
<td>18</td>
<td>Whether electrical audit is conducted as prescribed and audit points are complied as per approved target. Approval from competent authority obtained for any deviation?</td>
</tr>
<tr>
<td>19</td>
<td>Whether power to electrical siren, yard light, admin. Bidg. And tube well remains 'on' during cut off of complete electricity supply?</td>
</tr>
<tr>
<td>H</td>
<td>FIRE FIGHTING SYSTEM/SAFETY ITEMS</td>
</tr>
<tr>
<td>1.</td>
<td>Whether ensure full opening of pump suction and delivery valves. Check water level in fire water tanks and record. ?</td>
</tr>
<tr>
<td>2.</td>
<td>Whether check fuel level in fire engine fuel tanks and check health of fire engine batteries?</td>
</tr>
<tr>
<td>3.</td>
<td>Whether simulation test of fire engines with pressure drop in hydrant line i.e in auto mode?</td>
</tr>
<tr>
<td>4.</td>
<td>Whether check functioning of fire sirens?</td>
</tr>
<tr>
<td>5.</td>
<td>Whether check work permit at field and availability of supervisor / fire equipment in random for the ongoing jobs. ?</td>
</tr>
<tr>
<td>6.</td>
<td>Whether check oil presence in the drain / OWS and action?</td>
</tr>
<tr>
<td>7.</td>
<td>Whether random check of workers for use of PPEs?</td>
</tr>
<tr>
<td>8.</td>
<td>Check availability of foam vs requirement. ?</td>
</tr>
<tr>
<td>9.</td>
<td>Action taken if any for replenishment?</td>
</tr>
<tr>
<td>10.</td>
<td>Whether water storage is available as Per OISD-117 pre OISD?</td>
</tr>
<tr>
<td>11.</td>
<td>Whether fire engines available as per OISD -117?</td>
</tr>
<tr>
<td>12.</td>
<td>Whether sequential operation procedures of fire pump/engines are established/displayed and found in working condition during?</td>
</tr>
<tr>
<td>13.</td>
<td>Whether diesel fuel tanks of fire engines are regularly topped up and proper vent provided. Position of diesel tanks is outside of Fire engine room?</td>
</tr>
<tr>
<td>14.</td>
<td>Whether inspection and maintenance of fire extinguishers done as per laid down/prescribed schedules?</td>
</tr>
<tr>
<td>15.</td>
<td>Whether fire drills conducted monthly and full shut down system checked once in six and records maintained?</td>
</tr>
<tr>
<td>16.</td>
<td>Whether sand buckets are provided near electrical substation, transformer yard and TLF gantry and found filled with dry sand?</td>
</tr>
<tr>
<td>17.</td>
<td>Whether fire extinguishers are provided as per OISD/Statutory requirements and functioning properly?</td>
</tr>
<tr>
<td>18.</td>
<td>Whether effective communication system like pa paging/Walkie-Talkie provided and working satisfactorily. Only intrinsically safe/ flame proof equipment's are used in hazardous area?</td>
</tr>
<tr>
<td>19.</td>
<td>Whether emergency response drill conducted once in six months. Records available?</td>
</tr>
<tr>
<td>No.</td>
<td>Question</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>20.</td>
<td>Whether firefighting pumps are operated minimum twice a week continuously for 30 minutes or as prescribed by OEM whichever is ???.</td>
</tr>
<tr>
<td>21.</td>
<td>Whether condition of battery for fire engines/DG sets etc. is satisfactory?</td>
</tr>
<tr>
<td>22.</td>
<td>Whether first AID firefighting trolley is available as per OISD -117 (contents should be as per inventory sheet)?</td>
</tr>
<tr>
<td>23.</td>
<td>Whether at farthest point of hydrant line 7 kg/cm2 pressure is maintained when fire engine is running?</td>
</tr>
<tr>
<td>24.</td>
<td>Whether hydrant /monitors are properly distributed in critical areas?</td>
</tr>
<tr>
<td>25.</td>
<td>Whether hydrants/monitors are easily accessible and operable?</td>
</tr>
<tr>
<td>26.</td>
<td>Whether quantity of co2 cartridges and DCP are sufficient and kept in a store room (as per OISD-117)?</td>
</tr>
<tr>
<td>27.</td>
<td>Whether history of fire extinguishers are maintained and records available?</td>
</tr>
<tr>
<td>28.</td>
<td>Whether fire hoses are available as per oisd-117?</td>
</tr>
<tr>
<td>29.</td>
<td>Whether manual operated fire sirens are provided at critical areas (as per OISD-117)?</td>
</tr>
<tr>
<td>30.</td>
<td>Whether fire siren codes are displayed at prominent place. All employee or authorized person of contractor working are familiar with siren code positioning and operation?</td>
</tr>
<tr>
<td>31.</td>
<td>Whether in fire hydrant main, isolation valve exist for isolation of each section?</td>
</tr>
<tr>
<td>32.</td>
<td>Whether all valves on the fire water ring main/hydrant /monitor valves checked for leaks/operation and lubricated once in a month and record maintained and no leaks observed?</td>
</tr>
<tr>
<td>33.</td>
<td>Whether explosimeter calibrated yearly and officers are conversant of its operation?</td>
</tr>
<tr>
<td>34.</td>
<td>Whether alternate water cum foam monitor/hydrant valve provided for tlf and manifold as per OISD -117 cl. 4.37 (iv) or this Std for lube plants?</td>
</tr>
<tr>
<td>35.</td>
<td>Whether return line to tank is available in fire water tank for flushing the hydrant line as per Mandl guidelines or section wise flushing is done?</td>
</tr>
<tr>
<td>36.</td>
<td>Whether fire hydrant system is in healthy condition and kept under pressure with jockey pump. No leakage/corrosion observed?</td>
</tr>
<tr>
<td>37.</td>
<td>Whether consumptions/receipt of safety equipment is updated on sap every month?</td>
</tr>
<tr>
<td>38.</td>
<td>Whether alarm indication system like low lube oil, high water temperature, for firefighting engines is provided and annunciation working?</td>
</tr>
<tr>
<td>39.</td>
<td>Whether control room manned on continuous basis. Control room and computer room protected by fire extinguishing system?</td>
</tr>
<tr>
<td>40.</td>
<td>Whether the offsite disaster mock drills conducted or participated periodically as per local statutory requirement?</td>
</tr>
<tr>
<td>41.</td>
<td>Whether the responsibility of each officer including DSO clearly defined and communicated to all concerned in writing for role?</td>
</tr>
<tr>
<td>42.</td>
<td>Whether fire water pumps checked, tested as per OISD -117. Records maintained?</td>
</tr>
<tr>
<td>43.</td>
<td>Whether emergency kit available as per this Std?</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>44.</td>
<td>Whether water fixed water spray system provided at hazardous product/additive storage area in barrels/containers?</td>
</tr>
<tr>
<td>45.</td>
<td>Whether water spray system provided at lube blending plant area in barrels/containers?</td>
</tr>
<tr>
<td>1</td>
<td>CONSTRUCTION and MAINTENANCE SAFETY</td>
</tr>
<tr>
<td></td>
<td>Whether do's and don'ts displayed at construction site in local and Hindi/English languages. (if construction work is going on). Employees working there are aware about safety norms?</td>
</tr>
<tr>
<td>2</td>
<td>Whether installation of electrical equipment's/System and repairs or modifications in existing electrical system of the location is carried out through licensed electrical contractor(s)?</td>
</tr>
<tr>
<td>3</td>
<td>Whether for construction/maintenance job PPE including safety shoes, safety helmets, hand gloves, safety goggles etc. Are in use.</td>
</tr>
<tr>
<td>4</td>
<td>Whether all maintenance works and construction works are done under the supervision of competent persons of contractor and /or representative of Company officer and work permit for hot/cold working at height etc. Is in use?</td>
</tr>
<tr>
<td>5</td>
<td>Whether daily safety talk before start of work at site is given by the site supervisor and records maintained?</td>
</tr>
<tr>
<td>6</td>
<td>Whether no unauthorized contract worker is allowed free access in operating area?</td>
</tr>
<tr>
<td>7</td>
<td>Whether power connection provided to the contractor is through approved type of isolators, cables, glands and earthing devices no loose/temporary connections observed?</td>
</tr>
<tr>
<td>8</td>
<td>Whether while carrying out the work adjacent to the operating area all requisite safety precautions including provision of fire screen. Firefighting equipment's, running water etc. As required for the jobs are complied. Fire tender is to be provided if required?</td>
</tr>
<tr>
<td>9</td>
<td>Whether while working at height, full body safety harness with life line is in use by workers?</td>
</tr>
<tr>
<td>10</td>
<td>Whether painting and welding jobs not carried out simultaneously at same work area/location/system.?</td>
</tr>
<tr>
<td>J</td>
<td>General/House Keeping/Hygiene</td>
</tr>
<tr>
<td>1</td>
<td>Whether frisking of all personnel is done before their entry at the gate of the location?</td>
</tr>
<tr>
<td>2</td>
<td>Whether safety briefing is done to all personnel before entry at the gate of the location?</td>
</tr>
<tr>
<td>3</td>
<td>Whether pump house manifold/sumps are free from oil leakage. No containers are kept at pump house?</td>
</tr>
<tr>
<td>4</td>
<td>Whether do's and don'ts and operating instructions duly approved by location-in-charge displayed at all work places. For all operating equipment including TT parking area?</td>
</tr>
<tr>
<td>5</td>
<td>Whether all rotary equipments have been provided with coupling guard?</td>
</tr>
<tr>
<td>6</td>
<td>Whether pipeline, pipeline joints and storage tanks found without any leakage or sweating?</td>
</tr>
<tr>
<td>7</td>
<td>Whether scraps/unserviceable materials are kept in marked yard only and same are disposed off regularly records available?</td>
</tr>
<tr>
<td>No.</td>
<td>Question</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8</td>
<td>Whether all employees and contractor labourers/casual labourers/security/TT crew etc. are trained as per OISD - 154 modules and ???</td>
</tr>
<tr>
<td>9</td>
<td>Whether all structures, buildings, pipelines and facilities are painted as per schedules and are found acceptable?</td>
</tr>
<tr>
<td>10</td>
<td>Whether hygiene maintained in canteen i.e. Wash area, refrigerator/fridge, kitchen and dining area?</td>
</tr>
<tr>
<td>11</td>
<td>Whether all structured meetings precede with safety related information sharing and records available?</td>
</tr>
<tr>
<td>12</td>
<td>Whether safety observations are complied in the intranet regularly?</td>
</tr>
<tr>
<td>13</td>
<td>Whether standard operating practices duly approved by location charge is displayed at all work stations?</td>
</tr>
<tr>
<td>14</td>
<td>Whether utensils/crockeries used in canteen found clean and in acceptable hygienic condition?</td>
</tr>
<tr>
<td>15</td>
<td>Whether quality of canteen food found hygienically acceptable?</td>
</tr>
<tr>
<td>16</td>
<td>Whether water cooler maintained and found working properly?</td>
</tr>
<tr>
<td>17</td>
<td>Whether portability test for drinking water carried out at every six month and test results are available?</td>
</tr>
<tr>
<td>18</td>
<td>Whether all procedures as per manual are followed for product receipt through ocean tanker and check list properly filled up and records maintained?</td>
</tr>
<tr>
<td>19</td>
<td>Whether proper communication between jetty and plant is available?</td>
</tr>
<tr>
<td>20</td>
<td>Whether jetty pipelines are under supervision during tanker discharge and log is available?</td>
</tr>
<tr>
<td>21</td>
<td>Whether CP system if provided for pipeline protection is in working condition and records available?</td>
</tr>
<tr>
<td>22</td>
<td>Whether in LPG cylinder bank for canteen, 10 kg DCP FE, double wire mesh made of copper or non-corroding metal of not less than 11 to linear cm (11 mesh per linear cm) available and isolation one valve is outside the canteen/cylinder bank and another in the canteen is provided closing/opening sign displayed.?</td>
</tr>
<tr>
<td>23</td>
<td>Whether safety awareness of officers is more than 75%?</td>
</tr>
<tr>
<td>24</td>
<td>Whether all observations of last safety Inspection/Audit are complied as per approved target (Deviation Up to 20%) but within the guidelines to the time frame in this regard?</td>
</tr>
<tr>
<td>25</td>
<td>Whether no ESA (OISD/authorized agency from factory directorate) points pending more than two years?</td>
</tr>
<tr>
<td>26</td>
<td>Whether housekeeping in and around the plant is found acceptable?</td>
</tr>
<tr>
<td>27</td>
<td>Whether storm water drain, Other Run Off Drains Found Free From Obstacles. Drains In Operating Area/Hazardous Area Are Covered With Slabs/Cheque red Plates Etc.?</td>
</tr>
<tr>
<td>28</td>
<td>Whether MSDS of all products handled is made available to operating personnel?</td>
</tr>
<tr>
<td>29</td>
<td>Whether CCTV cameras installed and all are in working condition?</td>
</tr>
<tr>
<td>30</td>
<td>Whether management of change procedure established at location?</td>
</tr>
<tr>
<td>31</td>
<td>Whether tool box talk is being done at work places before start of work. Records maintained.</td>
</tr>
</tbody>
</table>
Whether T/W siding and TT Loading/Unloading Pipeline are inspected, tested and maintained as per Mandl circular No Ho/Mandl/45a dated 18/03/2005. Regular inspection of tanks and pipelines including thickness survey and pipeline support system is carried out and record maintained?

<table>
<thead>
<tr>
<th>CRITICAL PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>17</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>19</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>21</td>
</tr>
</tbody>
</table>
ELECTRICAL AUDIT OF PLANT

ANNEXURE-7

Location __________________ Date ____________
Audit done by____________________________

<table>
<thead>
<tr>
<th>#</th>
<th>Item description</th>
<th>Auditors remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. ELECTRICAL SUBSTATION/ SWITCH ROOM

1. Is updated painted line diagram of power / lighting distribution provided?
2. Are proper rated hand gloves kept and in use?
3. Is the equipment easily accessible for operation, inspection and maintenance?
4. MCC Panel condition:
   a. Are panel doors okay and properly closed?
   b. Are Dust / soot / cobwebs not existed?
   c. Are Lugs existing at each cable end and termination is not loose?
   d. Are visual condition of switch contact fuses good?
   e. Are control wiring condition satisfactory?
   f. Are jumper condition between bus and distribution good?
   g. Is grounding proper?
   h. Is alarm / trip circuit working?
5. Are live parts of equipment inaccessible by barriers / shrouds?
6. Is any, temporary electrical connection existing?
7. Condition of cable duct
   a. Are cables are on rack?
   b. Is cable deck clear?
   c. Is sealing of duct is proper?
   d. Are cable identification tags existing?
8. Are insulation mats (with ISI mark) provided at all required places?
9. Are protective relays tested once in a year and set at recommended value?
10. Are all fuses of proper type and rating as specified in single line diagram?
11. Are fire extinguishers provided as per OISD norms? Are they of proper type and in working condition?
12. Is illumination (lux level) meets the requirement and fixtures, tubes and switches in good working condition?
13. Is emergency lighting panel fed independently both from normal and DG supply?
14. Are all energized equipment provided with caution boards?
15. Condition of transformer:
   a. Is grounding proper?
   b. Is there any oil leak?
   c. Is condition of Silica gel Ok?
   d. Is Oil level OK?
   e. Is terminal box earthed properly?
   f. Is Oil / winding temperature Ok?
   g. Is periodic Oil quality test conducted?
16. Whether location / type of transformer in conformity with area classification drawings.
17. Is housekeeping well?

B. MOTORS IN PUMP HOUSE / COMPRESSOR ROOM

1. Is double independent earthing connection provided for all motors?
2. Are joints of grounding strip / wire having rigid surface contacts and proper size?
3. Is terminal box and glands in proper condition?
4. Is electrical integrity of flame proof equipment maintained and not tampered?
5. Is existing cable termination are proper?
6. Is push button JBs earthed properly?
7. Is earthing resistance value for equipment measured periodically and within limit?
8. Are there any abnormal sound from motor Vibration, bearing?
9. Are pump motor coupling guards proper and covering the entire moving parts?
10. Are motor fan condition, body temperature Ok?
11. Is preventive maintenance schedule exist and maintenance carried out as per schedule?
12. Is earthing resistance test schedules and measured earth resistance satisfactory?
13. Is condition of earth pits proper?

C. UNIT LIGHTING

1. Are all lighting fixtures flame proof as per area classification (if applicable)?
2. Whether flame proof condition of fixtures ensured?
3. Whether proper earthing to the fixtures provided?
4. Whether condition of strip / wire sound?
5. Does water enter and accumulate in fixture distribution boxes?
6. Whether lighting DB, switches, MCB well maintained?
7. Any other unsafe practice observed?

D. HIGH MAST LIGHTS (AREA LIGHTING)

1. Whether two impendent earth connection from grid for each mast provided?
2. Whether electrical JBs provided proper earth connection?
3. Whether condition of junction boxes, switch board, fuses etc. proper?
4. Whether ladder condition is sound and safe?
5. Condition of flood lights:
   a. Is gasket present?
   b. Is glass cover in good condition?
   c. Is control gear condition OK
6. Is earthing electrode of mast OK and its connection with mast proper?

E. TANFARM AREA, PIPELINES, LOADING / UNLOADING GANTRY

1. Are the earth pits in tank farm area in a grid?
2. Is electrical continuity maintained by providing jumpers across pipeline, valve joints?
3. Is earthing connection at termination joint maintained rigid connectivity and free from any rusting?
4. Is condition of grounding electrode and connections Ok?
5. Is electrical continuity of loading hoses periodically tested and record maintained?

F. GENERAL

1. Statutory requirements (as applicable)
   a. Is area classification drawings duly approved by PESO?
   b. Are there any conditions, specified by PESO for electrical substation, switch room etc. and their compliance?
   c. Is CEA approval available?
   d. Is DG operating approval from state authority (if any) available?
2. Is loose / temporary electrical connections exists?
3. Is certificate in respect of FLP for each electrical equipment- records maintained?
4. Is earthing network diagram available and facility wise earthing diagram displayed?
5. Are records for electrical testing/ checks maintained up-to date?
6. Is work permit system adhered to and effective and record maintained?
7. Are the persons authorized for handling electrical system having requisite qualification and names displayed?
8. Is electrical shock treatment chart is displayed and disseminated to the persons working their?
Annexure-8

Below given are various Safe Operating Practices (SOP) / work instruction which are indicative and not exhaustive.

User company should modify/ edit/add based on site specific operating condition and requirement.

A. Work instruction / procedures for Blending Operations:

1. Handle additives with care wearing required PPE as per respective additive MSDS as their contact with skin and eyes may cause harm.
2. Sustained exposure to some additives may lead to respiratory problems. Thus special care while handling such additives needs to be taken as per MSDS.
3. When come in contact with skin, immediately wash with soap and water.
4. When comes in contact with eyes, use plenty of water to wash away using eye wash facility.
5. If excessive vapors of additive inhaled, take the person to open area with fresh air.
6. Use DCP in case of fire observed near blending area.
7. For oil leakage / spillage, close the nearest concerned valve and intimate officer in-charge.

B. Charging of base Oils in blending kettles

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open the primary valve of base oil tank (s) and make the line thru’ for blending.</td>
</tr>
<tr>
<td>2</td>
<td>Use the required safety appliances as per requirement.</td>
</tr>
<tr>
<td>3</td>
<td>Take the base oils in kettle as per formulation and record the weight in log book.</td>
</tr>
<tr>
<td>4</td>
<td>Start stirring and heating of kettle. Heat the kettle up to recommended temperature of respective grades.</td>
</tr>
<tr>
<td>5</td>
<td>After reaching desired temperature, ask the LAB for sampling of base oil for moisture test.</td>
</tr>
<tr>
<td>6</td>
<td>After getting confirmation from LAB regarding moisture free base oil, start additive charging as per formulation.</td>
</tr>
<tr>
<td>7</td>
<td>In case of moisture present in base oil, first dehydrate the base oils by using air stripping in kettle and reconfirm the moisture freeness of base oil from LAB by giving other sample from kettle before charging of additives.</td>
</tr>
<tr>
<td>8</td>
<td>After mixing of Base oil, transfer the entire material in F.P. tank followed by pigging of transfer line after completion of transfer line.</td>
</tr>
<tr>
<td>9</td>
<td>All above operation to be carried out under intimation / supervision of operation officer.</td>
</tr>
</tbody>
</table>

C. CHARGING OF ADDITIVES IN BLENDING KETTLE

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First take the base oil in blending kettle as per formulation. Record the weight in logbook. Start stirring and heating of kettle. Heat the kettle up to recommended temperature. Confirm moisture freeness of base oil from LAB before charging of additives.</td>
</tr>
<tr>
<td>2</td>
<td>Use the required safety appliances as per requirement.</td>
</tr>
<tr>
<td>3</td>
<td>Keep stirrer/pump/circulation/Air purging on.</td>
</tr>
<tr>
<td>4</td>
<td>Charge the barrels additives through DDU as indicated in Form. In case of bulk additive, take the additive from respective tanks as per formulation.</td>
</tr>
<tr>
<td>5</td>
<td>After charging of additives through DDU, Rinse the line with base oil in process by taking it in rinsing tank.</td>
</tr>
<tr>
<td>6</td>
<td>Additives less than 20 kg may be taken directly in blending kettle after proper weighing.</td>
</tr>
<tr>
<td>7</td>
<td>Mix Dye with material in process in a bucket and add in respective finished product tank directly as per instruction slip.</td>
</tr>
</tbody>
</table>
Return the form duly completed to Foreman / Officer in process control room.

After charging of additives through DDU and rinsing the line with process base oil, pig the DDU line. Close all DDU line Valve after returning pig to home.

After mixing of Base oil, transfer the entire material in F.P. tank followed by pigging of transfer line after completion of transfer line.

Record the actual charged qty of additives in production log book

All above operation to be carried out in the knowledge of operation officer production

### D. DOs AND DON'Ts IN AIR DRIER OPERATION

<table>
<thead>
<tr>
<th>#</th>
<th>DOs</th>
<th>DON'Ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always ensure open position of inlet and outlet line of cooler in drier.</td>
<td>Do not start Drier if compressor is not in operation.</td>
</tr>
<tr>
<td>2</td>
<td>Always ensure open position of inlet valve and outlet valve for compressed air entry from compressor.</td>
<td>Do not continue running of drier if temperature alarm or any other alarm is sounded.</td>
</tr>
<tr>
<td>3</td>
<td>Always ensure working of changeover valve of adsorption bed in auto mode.</td>
<td>Do not carry out electrical repairing jobs through unauthorized Electrician.</td>
</tr>
<tr>
<td>4</td>
<td>Always ensure power and control supply “ON” before start of the air drier.</td>
<td>Do not leave operating air drier unattended.</td>
</tr>
<tr>
<td>5</td>
<td>Always de-pressurize drier unit after shutting down the drier.</td>
<td>Do not leave the power/control panel of the drier in “ON” condition when not in operation</td>
</tr>
<tr>
<td>6</td>
<td>Always ensure periodic draining of moisture content when drier is in operation.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Always ensure clean surroundings around air drier and its panel, for smooth operation and movement around the drier area.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Learn use of firefighting equipment in compressor house for appropriate use in case of emergency.</td>
<td></td>
</tr>
</tbody>
</table>

### E. DOs AND DON'Ts IN COMPRESSOR OPERATION

<table>
<thead>
<tr>
<th>#</th>
<th>DOs</th>
<th>DON'Ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always ensure open position of valve of cooling water supply to cylinder jackets, intercooler and after cooler of the compressor.</td>
<td>Do not start compressor if crank case oil level is below the level mark</td>
</tr>
<tr>
<td>2</td>
<td>Always ensure open position of delivery valve of the compressor.</td>
<td>Do not start compressor if belts are sagging or disengaged from pulley.</td>
</tr>
</tbody>
</table>
3. Always ensure crank case oil level up-to the mark before start of compressor

   Do not try to touch belt / pulley, motor body etc. during compressor operation.

4. Always ensure removal of moisture content from all drain points in compressor and Air receiver system before start of compressor

   Do not continue running of compressor if there is abnormal sound or heavy vibrations.

5. Always ensure working of gauges of lube oil pressure, cooling water pressure, discharge air temperature and cooling water temperature

   Do not shut down cooling water system / cooling tower before shut down of compressor.

6. Always ensure running of cooling tower fan and cooling water pump before start of compressor

   Do not run compressor without air suction filter.

7. Always ensure removal of moisture content from all drain points in compressor and Air receiver system before start of compressor

   Do not carry out electrical repairing jobs through unauthorized Electrician.

8. Always ensure running of cooling tower fan and cooling water pump before start of compressor

   Do not shut down cooling water system / cooling tower before shut down of compressor.

9. Always ensure clean surroundings around compressor and its panel, for smooth operation and movement around the compressor area.

   Do not leave operating compressor unattended.

10. Learn use of firefighting equipment in compressor house for appropriate use in case of emergency.

### F. DOs AND DON’Ts IN BARREL FILLING OPERATION

<table>
<thead>
<tr>
<th>#</th>
<th>DOs</th>
<th>DON'Ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always ensure checks for running of in feed and out feed conveyor by pressing start / stop switches in panel.</td>
<td>Do not start filling operation with control switch in “OFF” position.</td>
</tr>
<tr>
<td>2</td>
<td>Always ensure “0” display after setting of filling weights/data in the panel.</td>
<td>Do not press nozzle down button, if the opening of barrel is not in line with nozzle.</td>
</tr>
<tr>
<td>3</td>
<td>Always ensure glowing of LED against “Auto” and “Power” in panel of the filling machine after weight is set.</td>
<td>Do not try to operate conveyor system in manual mode in between the filling operation /cycle.</td>
</tr>
<tr>
<td>4</td>
<td>Always ensure out feed conveyor is empty before start of filling operation.</td>
<td>Do not operate filling of part fill barrel in auto mode.</td>
</tr>
<tr>
<td>5</td>
<td>Always ensure sufficient compressed air in filling system before start of filling operation.</td>
<td>Do not lean on barrels / touch or push barrel or pallet, while filling operation in auto mode is on.</td>
</tr>
<tr>
<td>6</td>
<td>Always ensure no oil spills, dirt, foreign materials on the weighing platform before start of filling / positioning of drums for filling.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Always ensure control selector switch is in “ON” position and mode switch in “Auto” before start of filling operations.</td>
<td></td>
</tr>
</tbody>
</table>
8. Always monitor the weight display on panel during filling operations for acting immediately by pressing emergency switch in emergency situation.

9. Learn use of firefighting equipment for appropriate use in case of emergency.

G. **DOs AND DON'Ts IN FORKLIFT OPERATION**

<table>
<thead>
<tr>
<th>#</th>
<th><strong>DOs</strong></th>
<th><strong>DON'Ts</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always ensure engine oil level upto the mark before operating the forklift.</td>
<td>Do not start Drier if compressor is not in operation.</td>
</tr>
<tr>
<td>2</td>
<td>Always ensure full water level in radiator and sufficient diesel in diesel tank before operation.</td>
<td>Do not continue running of drier if temperature alarm or any other alarm is sounded.</td>
</tr>
<tr>
<td>3</td>
<td>Always ensure working of lifts/tilt movement and brake function before actual forklift operation.</td>
<td>Do not carry out electrical repairing jobs through unauthorized Electrician.</td>
</tr>
<tr>
<td>4</td>
<td>Always ensure no oil spills, dirt, foreign materials on the weighing platform before start of filling / positioning of drums for filling.</td>
<td>Do not leave operating air drier unattended.</td>
</tr>
<tr>
<td>5</td>
<td>Always ensure conveyor motors in running condition before start of filling operations.</td>
<td>Do not run drier without change over of adsorption bed when operated in manual mode.</td>
</tr>
<tr>
<td>6</td>
<td>Always ensure closing of bypass valve when drier is in operation.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Always ensure clean surroundings around air drier and its panel, for smooth operation and movement around the drier area.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Learn use of firefighting equipment in compressor house for appropriate use in case of emergency.</td>
<td></td>
</tr>
</tbody>
</table>

H. **Dos AND DON'Ts FOR AIR COMPRESSOR OPERATIONS**

I) **Air Receiver:**

1. The Safety Valve may get clogged during the operational suspensions (long idle period) of the compressor. Please make sure it is not clogged or choked due to freezing of moisture (in cold zones only.) and only then start the compressor.
2. The safety valve must be operated manually, at least once a day to check its operational efficiency and to detect fault with it, if any.

II) **Air Compressor:**

1. Do not run the air compressor on full load conditions.
2. Check the crank – case oil level. If it is not up-to the mark, then do not start the air compressor.
3. Check the cooling water supply to cylinder jackets, Intercooler and After cooler. Ensure the valve is open for water supply and then run the air compressor, otherwise do not operate the air compressor.
4. Cooling water should not have impurities like mud, sand etc. check the water quality.
5. Fan of cooling tower should be started and cooling water pressure should be around 3 to 4 kg/cm².
6. Remove the moisture content from all the drain points given in Air Receiver Tank, Intercooler, After cooler, Moisture Separator, Air Dryers and drop leg system.
7. Daily run the air compressor at least for ½ to 1 hr., to prevent rusting of component / spares of air comp. (since the air compressor is of Non Lub Type).
8. Observe for abnormal sound and heavy vibrations. If it is found in doubtful situation then immediately stop the air compressor running.
9. Start the Air Compressor in No Load condition.
10. Ensure that the delivery valve of the air compressor is open. And then only start the air compressor.
11. Put the Air Compressor in Load condition after 2min., if in manual mode. The air compressor will switch over to the load condition in Auto mode as soon as the electrical circuit changes from star to delta mode and adequate Lub. Oil pressure has developed.
12. Note the motor current reading and ensure that it is within limit. Also note the discharge air temp., Lub. Oil pressure, cooling water temp. and pressure. Maintain log book after every hour.
13. Before switching off the air compressor, first put in on 'No Load' condition.
14. At the end of the day note down the cumulative working hrs. of the air compressor.

III) Daily Check for air compressor:

1) Oil level in the Crank Case.
2) Cooling water supply to Intercooler, After cooler and Cylinder Jackets.
3) Inter stage and Final Temp. and Pressure of the discharged air.
4) Cooling water supply temp. and Pressure.
5) Daily run the air compressor at least for ½ hr. to 1 hr. to prevent rusting of spares since compressor is of on lubricating type.
6) All 'V' belt tensions.
7) Abnormal sound in the air compressors.
8) Clean air suction filter element at least after 15 Days / 100 hrs.
9) Drain water daily after few hrs. from all drain points of Moisture Trap, Moisture Separator, Coolers and Receiver Tank.
10) Check the safety valve blows off.
11) Check the loading and unloading of the air compressor.
12) Check the suction and discharge valve leakages from L.P. and H.P. Cylinder.
13) Non Return Valve functioning to be checked on daily basis.

I. Receipt of Base Oil and Additives

I. By volume

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Obtain the information for arrival of the base oil, additive and Bulk loading T/T’s from the main gate security.</td>
</tr>
<tr>
<td>2</td>
<td>Information about point (1) will be communicated to SandD, Operations and PIC through report slip.</td>
</tr>
<tr>
<td>3</td>
<td>Control room officer will inform to SandD and main gate security through internal communication (COM) regarding the entries of incoming material including T/T’s.</td>
</tr>
<tr>
<td>4</td>
<td>Security will carry out the thorough checking of the T/T’s safety fittings and other incoming materials as per checklist provided at the main gate. The details are recorded in the incoming material register.</td>
</tr>
<tr>
<td>5</td>
<td>After clearance from security, T/T’s and other incoming material will go to weighbridge for Weighmen. The details will be monitored and recorded by SandD.</td>
</tr>
<tr>
<td>6</td>
<td>After clearance form SandD, T/T’s and incoming material will be send to unloading platform. The respective operators will check the seal, Dip (if required) as per challan and will request to QC for drawing of sample (Base oil, Bulk Additive etc.). Barrel additive will be unloaded in assigned area of warehouse and after unloading QC will be requested to draw the sample for clearance.</td>
</tr>
</tbody>
</table>
Based on the QC report and advice from Control room officer, the operator will unload the Bulk T/T's in respective tanks.

II. By weight

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On receipt of Base oil/Additives unloading Form No., position the Tank lorry / Container for unloading.</td>
</tr>
<tr>
<td>2</td>
<td>In case of receipt by volume check dip and temperature of Tank lorry/Tank wagon as per the challan. In case it is not tallying follow.</td>
</tr>
<tr>
<td>3</td>
<td>In case of receipt by weight, ensure Weighmen as per. Tolerance of +/- 20 Kgs. is allowed, variation more than 20 kgs to be recorded on the challan.</td>
</tr>
<tr>
<td>4</td>
<td>Connect the clean hose between pump suction and Tank Truck / Container / Tank wagon manifold and Steam / Air line connection as Per Form no.</td>
</tr>
<tr>
<td>5</td>
<td>Line up discharge of base oil/additive from Tank lorry/Container/Tank wagon to the Storage tank/Drum by opening required valves.</td>
</tr>
<tr>
<td>6</td>
<td>Open the Tank lorry/Container/Tank wagon manifold valve and start pump or discharge by gravity in case of unloading in drums.</td>
</tr>
<tr>
<td>7</td>
<td>Stop pump when suction is lost as indicated by empty pump sound/by physical verification of Truck/Container/Tank wagon.</td>
</tr>
<tr>
<td>8</td>
<td>Close storage tank and pump suction valves.</td>
</tr>
<tr>
<td>9</td>
<td>Disconnect the hose from Tank lorry/Container/Tank wagon and keep its end in a clean barrel or on catwalk.</td>
</tr>
<tr>
<td>10</td>
<td>Fill form no and return to Officer in-charge.</td>
</tr>
</tbody>
</table>

J. RECEIPT/UNLOADING OF EMPTY BARRELS/PACKAGING MATERIALS

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Obtain the information for arrival of the empty barrels, packaging materials from the main gate (security).</td>
</tr>
<tr>
<td>2</td>
<td>Information about point (1) will be communicated to SandD, Operations and PIC through report slip.</td>
</tr>
<tr>
<td>3</td>
<td>Officer in-charge will inform to SandD and main gate security through internal communication regarding the checking and entries of empty barrels trucks, packaging material.</td>
</tr>
<tr>
<td>4</td>
<td>Security will carry out the thorough checking of the trucks and other incoming materials as per checklist provided at the main gate. The details are recorded in the incoming material register.</td>
</tr>
<tr>
<td>5</td>
<td>After clearance from security, truck and other incoming packaging material will report to SandD officer. The details will be monitored and recorded by SandD in register.</td>
</tr>
<tr>
<td>6</td>
<td>After clearance from SandD, truck and incoming packaging material will be send to unloading platform. The respective operators will check the quantity, quality, and weight as per challan and record the details in logbook. Any deviation from the challan with respect to quantity, quality and weight will be reported to HOD (P).</td>
</tr>
</tbody>
</table>

K. TRANSFER, MIXING AND DEHYDRATION OF BASE OIL
# Description
0. Transfer the base oil from receipt tank to designated dehydration tank as per ALBP/OPN/DOC/02.

1.0 MIXING

1.1 Open steam inlet of tanks used for both receipt as well production and having dehydration facility, open condensate bypass for about 2 minutes and close, allow condensate to go through steam trap.

1.2 Start pump circulation in tanks

1.3 Crack open air valve into tank, visually check air blowing

1.4 Continue air blowing and circulation for about 30 minutes, close steam, close air and stop pump, send sample as per /WI/.

1.5 In dedicated production tank do re-circulation for 30 minutes and send sample as per /WI/.

2.0 DEHYDRATION IN OPEN TANKS.

2.1 For dehydration of tanks used for both receipt as well production, follow steps 1.1 to 1.4. Dehydration is required if storage tank has medium moisture or more, Ref. and/or Visual appearance shows turbidity/Haziness.

2.2 Transfer the base oil from receipt tanks to respective dehydration tanks

2.3 On attaining min 50 degree C, give vigorous air blowing till water vapors are seen emanating from the top of the tank.

2.4 Do not increase temperature beyond 80 °C.

2.5 Check product sample visually for clarity.

2.6 When sample is clear as per 2.4 send sample to laboratory for moisture check with label.

2.7 Stop steam when laboratory gives OK for moisture check.

2.8 Continue to blow air for cooling to required temperature.

2.9 Transfer the base oil from dehydration tank to production tank

L. CHARGING OF BASE OILS IN BLENDING KETTLES

# Description
1. Open the primary valve of base oil production tanks and make the line for blending

2. Use the required safety appliances as per

3. Take the base oils in kettle as per formulation and record the weight in log book

4. Start stirring and heating of kettle. Heat the kettle up to recommended temperature of respective grades

5. After reaching desired temperature, ask the LAB for sampling of base oil for moisture test.

6. After getting confirmation from LAB regarding moisture free base oil, start additive charging as per formulation

7. In case of moisture present in base oil, first dehydrate the base oils by using air stripping in kettle and reconfirm the moisture freeness of base oil from LAB by giving other sample from kettle before charging of additives.

8. After mixing of Base oil, transfer the entire material in F.P. tank followed by pigging of transfer line after completion of transfer line.

9. All above operation to be carried out in the knowledge of operation officer

M. CHARGING OF ADDITIVES IN BLENDING KETTLE

# Description
1. First take the base oil in blending kettle as per formulation. Record the weight in logbook. Start stirring and heating of kettle. Heat the kettle up to recommended temperature. Confirm moisture freeness of base oil from LAB before charging of additives.
2. Use the required safety appliances as per
4. Charge the barrels additives through DDU as indicated in Form No. In case of bulk additive, take the additive from respective tanks as per formulation.
5. After charging of additives through DDU, Rinse the line with base oil in process by taking it in rinsing tank.
6. Additives less than 20 kg to be taken directly in blending kettle after proper weighing.
7. Mix Dye with material in process in a bucket and add in respective finished product tank directly as per instruction slip.
8. After charging of additives through DDU, Rinse the line with base oil in process by taking it in rinsing tank after completion of transfer line.
9. Record the actual charged qty of additives in production log book.
10. All above operation to be carried out in the knowledge of operation officer production.

N. CLEANING OF LINES (PIGGING)

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>After transfer of finished product from blending kettle (ABB) to finished product tank or additives from DDU to blending kettle, close the inlet valve of transfer line.</td>
</tr>
<tr>
<td>2.</td>
<td>Ensure that the inlet valve of finished product tank or blending kettle is open</td>
</tr>
<tr>
<td>3.</td>
<td>Insert the pig stopper of F.P tank and retract the pig stopper of pigs at home</td>
</tr>
<tr>
<td>4.</td>
<td>Open the valve of air inlet line to push the pig(s) towards FP tank / kettle</td>
</tr>
<tr>
<td>5.</td>
<td>When pig(s) will reach to the desired position, close the inlet valve of FP tank / kettle</td>
</tr>
<tr>
<td>6.</td>
<td>Close the air inlet line valves and open the vent valve. Wait for 2 minutes for de pressurizing the transfer line</td>
</tr>
<tr>
<td>7.</td>
<td>Open the air inlet line near inlet valve of FP tank / kettle to bring the pig(s) back in home</td>
</tr>
<tr>
<td>8.</td>
<td>When pig will come back to home, close the air inlet valve and open the vent valve to demister for 2 minutes than close the vent valve.</td>
</tr>
<tr>
<td>9.</td>
<td>Insert the pig stopper of pigs at home</td>
</tr>
<tr>
<td>10.</td>
<td>All above operation to be carried out in the knowledge of operation officer</td>
</tr>
</tbody>
</table>

O. STORAGE AND HANDLING OF PACKED MATERIALS

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Store empty barrels in warehouse in the assigned area as per Warehouse plan.</td>
</tr>
<tr>
<td>2.</td>
<td>Store empty containers along with cartons in the assigned area as per Warehouse plan.</td>
</tr>
<tr>
<td>3.</td>
<td>Store liquid additives, base oils in barrels belly wise at assigned area and on Pallets in the warehouse as per Warehouse plan.</td>
</tr>
</tbody>
</table>
4. Store solid additives in gunny bags and kegs and liquid additives in carboys in warehouse at assigned area on pallets or on Mezzanine floor as per Warehouse plan.

5. Store finished products in barrels and stack them in the assigned area in the warehouse. Care should be taken to keep Barrels clean.

6. Transfer Finished Product to clean new Barrel if the filled Barrel is damaged before Storage.

7. Using forklift carries out stacking and de-stacking of packed products.

P. BARREL FILLING (Automatic Filling Machines)

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>On receipt of barrel filling Form no. arrange required number of barrels in the filling area.</td>
</tr>
<tr>
<td>2.</td>
<td>Wipe the top with cotton waste to remove dust/moisture if required.</td>
</tr>
<tr>
<td>3.</td>
<td>Inspect each barrel visually for cleanliness.</td>
</tr>
<tr>
<td>4.</td>
<td>Tight the small bung and sealed with barrels</td>
</tr>
<tr>
<td>5.</td>
<td>Stencil the barrels on top as well as on the side by using the required stencil and care should be taken to keep the stencils clean.</td>
</tr>
<tr>
<td>6.</td>
<td>Before starting filling operation, carry out set up verification as per</td>
</tr>
<tr>
<td>7.</td>
<td>Check the power supply to the machine is on.</td>
</tr>
<tr>
<td>8.</td>
<td>Check compressed air pressure i.e. 5 KG/cm²</td>
</tr>
<tr>
<td>9.</td>
<td>Connect the arms to the finished product tank from which product is to be filled.</td>
</tr>
<tr>
<td>10.</td>
<td>Check the pig position</td>
</tr>
<tr>
<td>11.</td>
<td>Start the in feed and out going conveyor</td>
</tr>
<tr>
<td>12.</td>
<td>Feed the name of grade to be filled and net weight in the machine’s computer</td>
</tr>
<tr>
<td>13.</td>
<td>Before start filling, fill 2 Brls for slop</td>
</tr>
<tr>
<td>14.</td>
<td>Start the related tank’s pump</td>
</tr>
<tr>
<td>15.</td>
<td>Now machine goes to <strong>start position</strong>. Press <strong>automatic buttons</strong> to go into base position.</td>
</tr>
<tr>
<td>16.</td>
<td>After filling first two barrels, ask the Lab to draw the sample.</td>
</tr>
<tr>
<td>17.</td>
<td>After getting the clearance from Lab start the filling.</td>
</tr>
<tr>
<td>18.</td>
<td>Cross Check the weight of filled barrel at manual weighing machine installed near the filling machine and record.</td>
</tr>
<tr>
<td>19.</td>
<td>Give instruction to F/L Driver for stacking the filled barrels at particular place.</td>
</tr>
<tr>
<td>20.</td>
<td>When the product is finished start the pigging system.</td>
</tr>
<tr>
<td>21.</td>
<td>Inform to Control Room after empty out the Tank.</td>
</tr>
</tbody>
</table>
In the event of any problem the machine will indicate the type of problem the operator should try to rectify and if not possible contact maintenance.

Q. DESPATCH OF FINISHED PRODUCT BARRELS

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Instruct the security (main gate) for the entry of Trucks to be loaded in- side the plant</td>
</tr>
<tr>
<td>2</td>
<td>Check the Truck thoroughly as per checklist and record the details in register</td>
</tr>
<tr>
<td>3</td>
<td>Send the Trucks to SandD for weighing and preparation of loading advice after security check</td>
</tr>
<tr>
<td>4</td>
<td>Check the acknowledgement of previous load, all applicable licenses and certificates of Trucks to be loaded. For any non-conformity report the same to SandD in-charge. After getting permission from SandD in-charge, take the trucks for loading. Record the details in Register</td>
</tr>
<tr>
<td>5</td>
<td>Prepare loading advice grade wise as per indent and availability of stock</td>
</tr>
<tr>
<td>6</td>
<td>Take the first weight of trucks to be loaded at Weigh Bridge and record the same in register</td>
</tr>
<tr>
<td>7</td>
<td>Send the Trucks to loading plate-form for loading along with loading advice</td>
</tr>
<tr>
<td>8</td>
<td>Check the loading advice and instruct the operator for loading of trucks as per loading advice. Record the details in register</td>
</tr>
<tr>
<td>9</td>
<td>Check the SEALS, RANDOM WT and GRADES of barrels being loaded as per loading advice. Record the details in register and take the signature of representatives of respective trucks.</td>
</tr>
<tr>
<td>10</td>
<td>Seal the truck after rechecking of qty as per loading advice and take joint signature of operator and truck representative on loading advice and loading register. Record the details in register along with seal number</td>
</tr>
<tr>
<td>11</td>
<td>Send the truck to SandD along with loading details for second Weighment and preparation of challan.</td>
</tr>
<tr>
<td>12</td>
<td>Take the second weight of truck and prepare the challan as per loading details. Check the net weight of Brls, if variation in net weight is not within permissible range, trucks to be sent back to loading platform for rechecking. Record the details in register.</td>
</tr>
<tr>
<td>13</td>
<td>Rechecking of trucks will be carried out in presence of W/H in-charge after opening of seal. Reason of variation will be recorded and corrected if required before sending back the truck to SandD</td>
</tr>
</tbody>
</table>

R. LIQUIDATION OF SLOP

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
</table>

116
1. Slop generated from various sources are stored in designated tanks.

2. Send the sample to lab for moisture test. If moisture is there, start re-circulation and heating of slop tank. Start air purging for half an hour and then again send the sample to lab for moisture check.

3. As per QC advice, take the appropriate quantity of slop into suggested grade.

4. The liquidated quantity will be recorded in blending logbook and SAP.

---

### S. INSPECTION OF PACKAGING MATERIALS

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DRUMS:</td>
</tr>
<tr>
<td>1.1</td>
<td>Pick up at random 6 barrels from the truck.</td>
</tr>
<tr>
<td>1.2</td>
<td>Open individual barrels, check for: a) Colour, b) External and internal cleanliness, c) Weight</td>
</tr>
<tr>
<td>1.3</td>
<td>Record observation in “EMPTY BARRELS RECEIPT AND INSPECTION REPORT”</td>
</tr>
<tr>
<td>1.4</td>
<td>If any one of the tested barrels do not meet the requirements, pick up 3 more barrels and repeat steps 1.2 and 1.3.</td>
</tr>
<tr>
<td>1.5</td>
<td>If all the 3 tested barrels are OK, unload the consignment in allocated area.</td>
</tr>
<tr>
<td>1.6</td>
<td>If anyone is not OK, report to Officer in-charge</td>
</tr>
</tbody>
</table>

---

### T. OPERATION and MAINTENANCE OF R.O. PLANT

#### START UP:

1. Check Overhead Water Tank level – should be above 8 feet level.
2. All incoming valves should be in open condition.
3. All Chemical Drums should contain respective chemicals.
5. Start High Pressure Pump.
6. Set Reject Pressure – 12 Kg.
7. After Soft Water Tank is filled, Start Soft Water Pump along with Softener Pump.
8. After Soft Water Tank is empty, Stop Soft Water and Softener Pump.
9. Wait till Soft Water Tank is again full and then repeat Step No. 7.
10. Step No. 7 and 8 is to be repeated till Boiler Feed water Tank is full.

#### STOPPING:

1. Open Reject Valve.
2. Close High Pressure Pump.
6. Close Water Valve after High Pressure Pump.
7. Switch Off Panel.

---

### U. OPERATION and MAINTENANCE OF BOILER:
START UP:
1. Open both the LDO valve (before burner).
2. Check water level in Boiler – Level Gauge Indicator should be above half level mark.
3. Check level in LDO Tank – Level should be above 100 Lit mark.
4. Check for any leakage or noise in and around the Boiler.
5. Switch on the Boiler Panel.
7. Start Blower.
8. Open Feed Water Check Valve.
9. Start Boiler Feed Pump.
10. Start Fuel Pump (No. 1 / No.2).
11. Switch on Firing Control.
12. Switch on Auto Switch – Ignition and Firing will follow.
13. If urgent steam is required operate modulation. Stop modulation after 5 KG pressure.
14. After 5 Kg pressure start blow down.
15. Open steam header slowly.
16. Now Boiler will come on working load.
17. After recommended maximum pressure Boiler should Auto-cut.
18. Always wear gloves before touching any heated parts.
19. Boiler pressure and temperature should be monitored regularly and value should be entered in the logbook.
20. Any leakage of Steam, Water or LDO should be attended immediately.

STOPPING:
1. First stop Fuel Pump.
2. Switch Off Firing Control.
3. Switch Off Auto Switch.
4. Don’t Switch Off Feed water Pump till 1.0 Kg Pressure.
5. After 1.0 Kg Pressure fill some water in the Boiler then stop Feed Water Pump.
6. Close Feed Water Check Valve.
7. Close both LDO Valve.
8. After 1.0 Kg pressure close Steam Header Valve.

V. OPERATION and MAINTENANCE OF COMPRESSOR

START UP:
2. Start Cooling Tower Fan if Temperature is high.
3. Open Compressor Air Release Valve.
5. Acknowledge all alarms.
7. After Compressor comes on running mode then close Air Release Valve.
8. Start Air Dryer.

STOPPING:
1. Switch Off Panel Switch.
2. Switch Off Main Switch.
3. Stop Air Dryer.
4. Stop Cooling water Pump.
5. Stop Cooling Tower Fan.

W. OPERATION and MAINTENANCE OF DG SET

START UP:
1. Switch Off the HSEB Main Circuit Breaker.
2. Check DG Engine Oil.
3. Check Water Level in DG Radiator.
4. Check Belt Tension, Oil Leakage, Battery Condition, and Foundation Bolt etc.
5. DG Load Circuit Breaker should be in off condition before starting DG.
6. Rotate DG Set Panel Self Starting Key clockwise.
7. After completion of Running Cycle of Self Starting panel, Keep Start Button on DG AMF panel in pushed position.
8. When DG comes in full running condition then Switch On the DG Load Circuit Breaker.

CLOSING
1. Switch Off DG Set Load Circuit Breaker.
2. Run the DG in Idle Condition for 5 minutes.
3. Switch on HSEB Breaker.
4. Switch Off DG.