STORAGE AND HANDLING OF PETROLEUM PRODUCTS AT DEPOTS AND TERMINALS

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 Uttar Pradesh, India
Website: - www.oisd.gov.in
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These documents are intended to supplement rather than replace the prevailing statutory requirements.
FOREWORD

At the time of development of this document, 111 Codes and Standards, Recommended practices and guidelines are applicable to the oil and gas installations of Public sector oil companies in India. 11 of these standards have been adopted by Petroleum and Explosives Safety Organisation (PESO) in various rules administered by them and thus the provisions of these standards are mandatory for entire Oil & Gas sector to that extent. A few serious accidents have occurred in the recent past in India and abroad including vapour cloud explosion and fire at oil terminal near Jaipur emphasised the need for the industry to review the existing provisions of various guidelines and statutory requirements.

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, of depots and terminals being run by marketing divisions of Oil companies with an objective to strengthen the existing system.

This document on “STORAGE AND HANDLING OF PETROLEUM PRODUCTS AT DEPOTS AND TERMINALS” has been prepared by the functional committee based on, existing standards, guidelines and recommended practices of OISD, the recommendations arising out of major accidents and their analysis, the accumulated knowledge and experience of industry members and updation of National and International codes and practices.

This document will be reviewed periodically for improvements based on the new experiences and better understanding. Suggestions may be addressed to:

The Coordinator,
Committee on “POL”
Oil Industry Safety Directorate,
8th Floor, Tower-A, OIDB Bhawan
Plot No: 2, Sector-73
NOIDA - 201301 Uttar Pradesh, India
Website:- www.oisd.gov.in
# FUNCTIONAL COMMITTEE

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<thead>
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<td><strong>LEADER</strong></td>
<td></td>
</tr>
<tr>
<td>Sh. B.P Singh</td>
<td>Bharat Petroleum Corporation Ltd., Mumbai</td>
</tr>
<tr>
<td>Sh. H C Mehta effective 16.1.12</td>
<td>Hindustan Petroleum Corporation Limited</td>
</tr>
<tr>
<td><strong>MEMBERS</strong></td>
<td></td>
</tr>
<tr>
<td>Sh. S S Mishra</td>
<td>Indian Oil Corporation Limited</td>
</tr>
<tr>
<td>Sh. H C Mehta (till 15.1.12 as member)</td>
<td>Hindustan Petroleum Corporation Limited</td>
</tr>
<tr>
<td>Sh. A.K.Gupta</td>
<td>Bharat Petroleum Corporation Ltd., Mumbai</td>
</tr>
<tr>
<td>Sh. P C Kanal</td>
<td>Indian Oil Corporation Limited</td>
</tr>
<tr>
<td>Sh. L K Vijh</td>
<td>Engineers India Limited</td>
</tr>
<tr>
<td>Sh. V K Bhatli</td>
<td>Engineers India Limited</td>
</tr>
<tr>
<td>Sh. R K Bhutda</td>
<td>Engineers India Limited</td>
</tr>
<tr>
<td>Sh. U K Chakraborty</td>
<td>Oil &amp; Natural Gas Corporation Limited</td>
</tr>
<tr>
<td>Sh. V Jagdish</td>
<td>Underwriters Laboratories</td>
</tr>
<tr>
<td>Sh. Paresh Thakkar</td>
<td>B P India</td>
</tr>
<tr>
<td>Sh. Nagendra Rao</td>
<td>Shell India</td>
</tr>
<tr>
<td>Sh. Dibyendu Gupta</td>
<td>Reliance Industries Limited</td>
</tr>
<tr>
<td>Sh. K C Nandi</td>
<td>Oil Industry Safety Directorate, New Delhi</td>
</tr>
<tr>
<td>Sh. Rakesh Agrawal</td>
<td>Oil Industry Safety Directorate, New Delhi</td>
</tr>
<tr>
<td><strong>MEMBER COORDINATOR</strong></td>
<td></td>
</tr>
<tr>
<td>Sh. D K Adhikari (w.e.f 01.05.2012)</td>
<td>Oil Industry Safety Directorate, New Delhi</td>
</tr>
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STORAGE AND HANDLING OF PETROLEUM PRODUCTS AT DEPOTS AND TERMINALS

1.0 INTRODUCTION

The Petroleum Depots and Terminals are generally located in the remote areas, outside of locality and near railway sidings. However, the experience shows that with the passage of time, these get surrounded by residential/industrial installations.

It can be impractical and prohibitively costly to design fire protection facilities to control catastrophic fires. The usual requirement of a good system is to prevent emergencies from developing into major threat to the oil installation and surroundings.

In India, there had been a major explosion and fire at POL Terminal in Rajasthan in the year 2009, thereafter a need was felt to consolidate and develop a comprehensive standard covering all aspects including Design, Operation, Maintenance and Safety in Storage and Handling of Petroleum Products at Depots and Terminals on the lines of OISD-STD-144.

2.0 SCOPE

2.1 This standard lays down the minimum Safety requirements in design, layout, automation, storage, loading / unloading operation, inspection & maintenance, fire protection, training, emergency planning & response and safety audit systems of Petroleum Depots and Terminals.

2.2 This standard does not cover:

a) Depots and Terminals located inside the Refineries and/or Oil/Gas Processing Plants under the same management for which OISD-STD-118 and OISD-STD-116 shall be referred for layout and fire protection facilities respectively.

b) Independent Storage & handling facilities of Crude Oil.

c) Fire fighting facilities of Ports Handling hydrocarbons for which OISD-STD-156 shall be referred.

d) The facilities on cross-country pipelines that include sectionalizing valve station, pig launching / receiving station, intermediate pumping station, dispatch and receiving facilities without storage for which OISD-STD-141 shall be referred.

e) Lube Oil Installations, Grease Manufacturing & Filling Facilities.

f) Design, Layout, Operation and maintenance practices of double walled storage tanks.

2.3 Provisions of this standard shall be applicable to all petroleum depots and terminals

2.4 The fire protection facilities for petroleum depots and terminals shall be as per OISD STD 117.

2.5 Requirement of green belt /buffer zone beyond the installation boundary is outside the scope of this standard. Such provisions are to be considered based on local/ state government / MOEF requirements.

3.0 DEFINITIONS

Clean agent - Electrically nonconductive, volatile or gaseous fire extinguishant that does not leave a Residue upon evaporation and meets the requirements given in the latest NFPA 2001 on clean agent
fire Extinguishing systems in line with environmental considerations of Kyoto and Montreal Protocol & latest MOEF regulations (Ministry of Environment & Forest)

Explosive mixture

It is a mixture of combustion agent (oxidising product gas, vapour, liquid or solid) and a fuel (oxidisable product - gas, liquid or solid) in such proportions that it could give rise to a very rapid and lively oxidization reaction liberating more energy than is dissipated through conduction and convection.

- **Lower explosive Limit (LEL)**

  Is the minimum concentration of a vapor in air (or other oxidant) below which propagation of flame does not occur on contact with an ignition source. This is usually expressed as volume percentage of the vapor in air. This is also referred as Lower Explosive Limit (LEL).

- **Upper Explosive Limit (UEL)**

  Is the maximum concentration of a vapor in air (or other oxidant) above which propagation of flame does not occur on contact with an ignition source. This is usually expressed as a volume percentage of vapors in air. This is also referred as Upper Explosive Limit (UEL)

- **Flammable Liquid**

  A liquid capable of producing a flammable vapour or mist under any foreseeable operating conditions.

- **Flammable Mist**

  Droplets of flammable liquid, dispersed in air, so as to form an explosive atmosphere.

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.

- **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 ‘solidly earthed’ when it is electrically connected to earth electrode without a fuse, switch, circuit-breaker, resistance or impedance in the earth connection.

- **Bonding**

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

Facility

This refers to any building, structure, installation, equipment, pipeline, or other physical feature used in oil storage terminals, transportation and distribution.

Flameproof Enclosure (Ex-d)-(Ref : IS : 2148)

An enclosure for electrical apparatus that will withstand, when the covers or other access doors are properly secured, an internal explosion of the flammable gas or vapour which may enter it or which
may originate inside the enclosure, without suffering damage and without communicating the internal
flammation to the external.

- **Intrinsically Safe:**

A circuit or part of a circuit is intrinsically safe when any spark or thermal effect produced normally
(that is, by breaking or closing the circuit) or accidentally (for example, by short circuit or earth fault) is
incapable, under prescribed test conditions, of causing ignition of a prescribed gas or vapour. An
**intrinsically safe apparatus** is one in which all electrical circuits are intrinsically safe. (For details, IS:
5780 shall be referred)

**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).

- **General Classification of Petroleum Products**

  Petroleum products are classified according to their closed cup FLASH POINTS as given below:

  - **Class-A Petroleum:** Liquids which have flash point below 23°C.
  - **Class-B Petroleum:** Liquids which have flash point of 23°C and above but below 65°C.
  - **Class-C Petroleum:** Liquids which have flash point of 65°C and above but below 93°C.
  - **Excluded Petroleum:** Liquids which have flash point of 93°C and above.

  Liquefied gases including LPG do not fall under this classification but form separate category.

  Note: In the following cases, above classification does not apply and special precautions should
be taken as required:

  (i) Where ambient temperatures or the handling temperatures are higher than the flash point of
the product.

  (ii) Where product handled is artificially heated to a temperature above its flash point.

**Fire Safe**

As applied to valves, it is the concept of controlling the leakage to an acceptable level after damage
encountered during and after the fire achieved by dual seating.

**Fire Station**

A building housing facilities of parking fire tenders and keeping other ready to use fire-fighting
equipment for meeting plant emergencies, fire control room with required communication
capabilities/mimic panel.

**Fire Water pump house**

A building housing fire Engine, water pumps, jockey pumps, communication and alarm system,
instrumentation and the required operating & supporting personnel.

**Hazardous Area**

An area in which an explosive gas atmosphere is present, or likely to be present, in quantities such as
to require special precautions for the construction, installation and use of electrical apparatus.

- **Non-Hazardous area**
An area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

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.

GPM
Denotes US gallons (1GPM=3.785 lpm)

Kerb wall:
A wall of appropriate height and size constructed of suitable material and designed to contain the Oil spillage and to direct it to ETP/OWS.

Petroleum Depots & Terminals
A portion of the property, where combustible / flammable liquids are received by tanker, pipelines, tank wagons, tank trucks and are stored or blended in bulk for the purpose of distribution by tankers, pipelines, tank wagons, tank trucks, portable drums.

Sample Room / Additive storage:
Building housing storing packed additives / flammable materials, retention sample chest & rack/s.

Service Building
Building/s housing facilities for inspection/maintenance/other supporting services which are directly required for operation of the installation.

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.
- Low Voltage (LV)
The voltage which does not normally exceed 250 volts.

- Medium Voltage (MV)
The voltage which normally exceeds 250 volts but does not exceed 650 volts.

- High Voltage (HV)
The voltage which normally exceeds 650 volts but does not exceed 33 KV.
Slop

Off-specification products obtained from market, during any disturbance in operation and draining etc. from various equipment / tanks / pumps containing oil - water mixture are called slops.

This does not include interface generated during pipe line transfer operations.

- **Oil water separator (OWS)**

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

- **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.

**Risk Analysis / Assessment**

“risk analysis” means the identification of undesired events that lead to the materialization of a hazard, the analysis of the mechanisms by which these undesired events could occur and, usually, the estimation of the extent, magnitude, and likelihood of any harmful effects;

“risk assessment” means the quantitative evaluation of the likelihood of undesired events and the likelihood of harm or damage being caused by them, together with the value judgments made concerning the significance of the results;

A variety of scenario analysis tools such as **hazard and operability study (HAZOP)** and **Hazard Analysis (HAZAN)** are used for fire scenario analysis.

- **HAZOP**

A Hazard and Operability (HAZOP) study is structured and systematic examination of process and operation of a facility by applying a set of “Guide Words” in order to identify and evaluate safety and operability problem that may pose risk to personnel or equipment, or prevent efficient operation.

- **HAZAN**

Hazard Analysis (HAZAN) is simply the application of numerical methods to obtain an understanding of hazards in terms of:

How often a hazard will manifest itself
With what consequences for people, process and plant.

**Tanks**

Storage tanks are defined as “ATMOSPHERIC PRESSURE STORAGE TANK” and “LOW PRESSURE STORAGE TANK”.

- **Atmospheric pressure storage tank**

Tanks designed as per API STD 650 or equivalents are called ATMOSPHERIC STORAGE TANKS. These tanks are designed to operate in its gas and vapour spaces at internal pressure approximately equal to atmospheric pressure.
These tanks can also be sub-divided into two categories:

- Atmospheric storage tanks with open vent to atmosphere i.e. goose neck type vent
- Atmospheric storage tanks with blanketing facilities

**Low pressure storage tank**

Tanks designed as per API STD 620 or equivalent is called LOW PRESSURE STORAGE TANK. These tanks are designed to operate at pressure in its gas or vapour spaces exceeding those permissible in API STD- 650.

**Tank height**

Tank height is the height from tank bottom to top of the kerb angle for cone roof tanks. For floating roof tanks, it is the height from tank bottom to top of tank shell.

**Tank capacity**

- **Nominal Capacity of a Tank**

  Nominal capacity shall mean the geometric volume of the tank from bottom up to Kurb angle in case of fixed roof tanks and the underside of roof deck up to the maximum floating position of floating roof in case of floating roof tanks.

- **Overfill Level (Nominal Capacity)**

  The maximum fill level of product within a tank as measured from the gauging reference point (that is, striker plate) above which any additional product will overfill and spill out of the tank; or at which level, contact or damage will occur between the floating roof and the tank structure or appurtenances.

- **Normal Fill Level (Normal Capacity)**

  The level up to which the tank is allowed to receive product at the maximum allowable receiving flow rate for a predetermined time prior to reaching the safe fill level.

- **Safe Capacity of a Tank**

  Safe Capacity (stored volume) is the capacity of the tank up to the maximum safe filling height (safe filling level) of the tank or the statutory requirements whichever is lower.

  The safe fill level is established by determining the amount of time required to take the appropriate action necessary to completely shut down or divert product flow before the level of product in the tank reaches the overfill level. The safe fill level shall be established for each specific tank that will depend on the type of tank, diameter, its internal configuration and condition, rate of filling and the operating practices.

- **Aggregate capacity**

  Combined safe capacity of storage tanks in an installation.

- **Pumpable Capacity (Net Capacity)**

  Pumpable capacity (Net Capacity) is the capacity of the tank during operation after subtracting the volume of tank bottom contents up to the top of pump out nozzle from safe filling capacity of the tank.

**Tank vehicle / Wagon loading / unloading**

Facility for loading / unloading of Petroleum product to / from tank truck or tank wagon.
• **Stabling Line**
  It is an additional railway line/spur reserved for additional rake/stabling.

• **Sick wagon**
  Sick wagons are those which are declared defective because of leaky bottom valve, missing safety valve, leaking body or any other mechanical failure.

“**Unconfined Vapour Cloud Explosion (UVCE)**”:
Means the formation of vapour cloud due to release of significant quantity of hydrocarbon vapours into the atmosphere and its explosion due to delayed ignition.

**Utilities**:
Utilities consisting of administrative building, QC Laboratory, canteen, parking shed, air compressors with or without dryers, dryers etc. shall be separated from other POL facilities and located as per the separation distance as specified in this standard.

**Shall**
Indicates provisions that are mandatory.

**Should**
Indicates provisions that are recommended as good engineering practice but are not mandatory.

**4.0 STATUTORY ACTS AND RULES**
The Petroleum Oil Depots and Terminals & their various facilities are covered under many regulations and require specific approval/licence from concerned statutory authorities. These statutory provisions include the following:

• The Factories rules made under The Factories Act, 1948.
• Petroleum and Natural Gas Regulatory Board (PNGRB) act, 2006.
• Central Electricity Authority (CEA) Regulations, 2010 made under Indian electricity act.
• The Standards of Weight & Measures (Packaged Commodities Rules-1977).
• Environmental Regulations under The Environment (Protection) Act–1986.
• Water (Prevention & Control of Pollution) Act, 1974 and rules made there under.
• Air (Prevention & Control of Pollution) Act- 1981 and rules made there under.
• Disaster management Act, 2005.

Environmental Protection Rules, 1986.


5.0 HAZARDOUS AREA CLASSIFICATION

The hazardous area is mainly defined for the purpose of selection and installation of electrical equipments however; definition shall be applied as specified herein after for other purposes also.

An area will be deemed to be hazardous where;

- Petroleum having flash point below 65 deg.C or any flammable gas or vapour in a concentration capable of ignition is likely to be present.
- Petroleum or any flammable liquid having flash point above 65 deg.C is likely to be refined, blended or stored at above its flash point.

Classification of Hazardous area (for the purpose of selection and installation of electrical equipments): A hazardous area shall be deemed to be-

- A zone “O” area, if inflammable gas or vapours are expected to be continuously present in the area; or
- A zone “1” area, if inflammable gases or vapours are likely to be present in the area under normal operating conditions; or
- A zone “2” area, if inflammable gases or vapours are likely to be present in the area only under abnormal operating conditions or failure or rupture of an equipment.

6.0 LAYOUT DESIGN

6.1 Design philosophy

Following philosophy should be adopted in layout of an installation:

a) Risk Analysis / 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 unconfined Vapour cloud explosion (UVCE). The outcome shall guide in preparation of onsite off site emergency plan.

Quantitative Risk Assessment (QRA) shall be done when ever major addition(s) in facilities or major changes in the surrounding areas, operating parameters, product grade takes place or once in every five years whichever is earlier.

b) Two road 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.

c) Roads inside the hazardous area of Installation shall be restricted to vehicles required for operational, maintenance and safety/security reasons and allowed only with proper safety fittings and authorization from location in-charge/designated safety officer.

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

e) Road widths, gradient and turning radii at road junctions shall be designed to facilitate movement of the largest fire-fighting vehicle envisaged in the event of emergency.
f) Rail spur shall be located close to the boundary of the installation to minimise road/pipe crossings and blockage of roads during shunting.

g) Layout shall consider the space requirements for
   - Maintenance and inspection of each equipment / facility.
   - Dedicated area for construction activities.
   - Future expansion for addition of facilities.

h) Vehicles with spark ignition engine shall not be allowed inside hazardous area. Vehicles with internal combustion engine (compression ignition) such as tank truck (fuelled by HSD) required to be permitted for business shall have PESO approved spark arrestor fitted on the vehicle.

i) Physical segregation of hazardous and non-hazardous areas shall be provided. Layout drawing indicating hazardous and non-hazardous area segregation/demarcation shall be available. Hazardous area segregation/demarcation shall be as per IS 5572:2009 & OISD 113.

6.2 Layout of facilities

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

- Storage tanks, utility requirements.
- Product receipt / dispatch and mode of transport (rail, road and pipeline).
- Warehouses, storage areas for bitumen / asphalt, lube 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.

6.3 General consideration for the layout of the facility

While locating the various facilities the following should be considered:
a) Tank farm, loading / unloading gantry, utilities, Effluent Treatment Plant (ETP) / OWS and approach roads should be suitably constructed to prevent the flooding.

b) Control room should be located in a non-hazardous area, upwind (Majority of the year) of hydrocarbon storage and handling facilities and at a distance from potential leak sources. It shall not be located on a lower level than surrounding plants and tank farms.

c) For inter-distances, refer table no 1. In case it is unavoidable to comply these requirements, the control room shall be made blast resistant as prescribed in OISD-STD-163.

d) The control room for Pipeline Tap Off Point (TOP) (if applicable) at the same location of the same company, shall be in the same building where the Control room for Depot/terminal is located. This shall be applicable only to the locations conceived after the publication of this standard.

e) Utility block(s) shall be located outside the hazardous area.

f) Overhead power transmission lines shall not pass over the installation including the tank truck parking areas. Horizontal clearance shall be in line with the Indian Electricity Rules.

g) High Tension (HT) line and HT sub-station(s) shall be terminated / located outside the hazardous area (For Distance refer table-1).

h) Tank truck movement inside the installation shall be kept to 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. Tank truck in the gantry shall be in drive out position for easy escape in case of emergency.

i) Rail loading facilities should be located along the boundary of the installation. Railway siding shall also have a boundary wall as per MOHA / government guidelines.

j) In case drains are provided around the T/T gantry the same shall be maintained clean and shall be routed to OWS/ ETP.

k) Effluent Treatment Plant should be located at a distance as per table 1. This should be closer to disposal point by the side of the boundary and at lower grade to facilitate gravity flow of effluent.

l) Roads should be provided in a symmetric manner to serve all areas requiring access for the operation, maintenance and fire fighting.

m) Smoking booths shall not be provided in the oil storage depot/terminal.

n) Firewater storage & firewater pump house shall be located upwind of hydrocarbon storage area with straight approach from outside area to enable easy receipt of mutual aid and make up water. The provision shall be made to receive the water from other sources including mutual aid / sharing of water directly into the storage tanks. Provision shall also be made to receive water in an underground tank and lifting / diverting to main water storage tanks.

o) All buildings which are not related to terminal operation shall be located at upwind of hydrocarbon storage & handling facilities and outside the hazardous area. These areas include administration, canteen with a separate entry. Special care need to be taken for canteen location where any spark or open flame is likely to exist.

p) Congestion inside the hazardous area because of buildings, structures, pipelines, trees etc. shall not be allowed. The location of such addition of facilities in existing installation shall be decided based on Risk Assessment.

q) Store rooms for hydrocarbons samples requires special care due to flammable vapour generated by low boiling point hydrocarbon. These vapours, generally heavier than air, are likely to build up concentration at ground level. Bottom exhaust should be provided for release of such flammable vapours. The racks and flooring should be made of material, which is resistant to fire. Portable
gas tester should be made available and maintained for periodically checking the presence of hydrocarbon. Smoke detectors should be installed.

Electrical fittings as well as electrical equipment should be flame-proof. Adequate number of portable fire extinguishers should be placed.

r) The additives shall be stored at the designated / segregated area as per respective Material Safety Data Sheet.

6.4 Layout of storage tanks

6.4.1 Dyked Enclosures:

a) Petroleum storage tanks shall be located in dyked enclosures. Each dyke shall have roads all around for access for normal operation and maintenance as well as for emergency handling. Aggregate capacity (Combined safe capacity) of tanks located in one dyked enclosure shall not exceed following values:

- 60,000 cum. for a group of fixed roof tanks.
- 120,000 cum. for a group of floating roof tanks

Fixed cum floating roof tanks shall be treated as fixed roof tanks. However in case these tanks are provided with windows opening on the shell and these windows will not get blocked in any case, then these should be considered as floating roof tanks.

If a group of tanks contains both fixed and floating roof tanks, then it shall be treated as a group of fixed roof tanks for the purpose of above limits.

b) Dyked enclosure shall be able to contain the complete contents of the largest tank in the dyke in case of any emergency. A free board of 200 mm above the calculated liquid level or 10% of calculated dyke capacity whichever is higher shall be provided for fixing the height and capacity of the dyke.

Enclosure capacity shall be calculated after deducting the following volumes:

- Volume of the tanks other than largest tank up to enclosure height without free board.
- Volume of all tank pads.
- Volume of fire break walls.
- Volume of pipes/supports/steps etc.

The height of tank enclosure dyke (including free board) shall be at least 1.0 m and shall not be more than 2.0 m above average inside grade level. The dyke wall made up of earth, concrete or solid masonry shall be designed to withstand the hydrostatic load and shall be impervious. Earthen dyke wall shall have not less than 0.6 meter wide flat section on top for stability of the dyke wall.

Dyke enclosure area (inside area of the dyke) shall be also impervious to prevent the ground water pollution.

c) 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.

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.
d) 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 each facility for reference.

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

f) Pump stations and piping manifold should be located outside dyke areas by the side of roads.

g) Horizontal above ground tanks mounted on pedestals shall meet separation distances and shall have dyked enclosure.

h) In case of Under Ground Tanks:
   - Kerb wall of minimum 30 cm height shall be provided in the UG tank Farm Area to contain accidental overflow.
   - A minimum of 3 M clear distance around the tank shall be maintained (from structures / boundary wall etc).
   - Vents shall be located / terminated at a distance of 15 mtrs from hazards.
   - Pressure / Vacuum vents for class A product and free vents for other class of products shall be provided. Vent shall be at minimum 4 M height from the grade 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 shall enter a tank through closed piping system / coupled electrically continuous and sound hose.
   - Under Ground tanks for Ethanol service shall be provided with Silica Gel Traps in the Vents to prevent moisture ingress.
   - The manholes should be 30 cm above the grade level.

i) Corrosion control measures shall be undertaken

6.4.2 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.

b) In case, different class of products are stored in any combination of product classification, the following shall, be applicable.
   - When class A, B and/or C are stored together, all the provisions of class A shall be applicable.
   - When class A & B are stored together, all the provisions of class A shall be applicable.
   - When class B &C are stored together, all the provisions of class B shall be applicable.

c) Excluded petroleum shall be stored in a separate dyked enclosure and shall not be stored along with Class-A, Class-B or Class-C petroleum.
d) Tanks shall be arranged in maximum two rows so that each tank is approachable from the road surrounding the enclosure. This stipulation need not be applied to tanks storing excluded petroleum class.

e) Tanks having 50,000 cum capacity and above shall be laid in single row.

f) Tertiary containment: Provision shall be made for 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. All the drain openings shall be controlled through sluice gates. Efforts should be made to minimize such opening/s for drainage.

6.4.3 Fire walls inside dyke enclosure;

- a) In a dyked enclosure where more than one tank is located, firewalls of minimum height 600mm shall be provided to prevent spills from one tank endangering any other tank in the same enclosure.

- b) A group of small tanks each not exceeding 9 meters in diameter and in all not exceeding 5,000 cum in capacity shall be treated as one tank for the provision of firewall.

- c) For excluded petroleum product storage, firewall of height not less than 300 mm shall be provided by limiting the number of tanks to 10 or the capacity of group of tanks to 5,000 cum whichever is lower.

6.4.4 General

- a) The tank height shall not exceed one and half times the diameter of the tank or 20 m whichever is less.

- b) All Piping from / to any tank including connected sprinkler / foam line shall comply the following:

  i) Shall not pass through any other dyked enclosure.

  ii) Shall run directly to outside of dyke to minimise piping within the enclosures.

  iii) Shall not pass through other tank areas / fire walls.

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 within the hazardous 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.

6.4.5 Protection of facilities:

- a) Properly laid out roads around various facilities shall be provided within the depot/terminal 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 the wall with 600 mm diameter concertina coil on top.
c) There shall be a pedestrian patrolling track along the inside perimeter of the boundary wall for security patrolling. Security watchmen tower (if provided) shall have clear access.

d) 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.

e) CCTV shall be installed in depot/terminal locations covering entry/exit gate, periphery of installation and all critical operating areas which shall be monitored continuously.

The CCTV monitoring station shall be provided in control room, Security cabin and in-charge room.

f) Proper sized TT parking area based on fleet size shall be provided with following facilities:

- Well laid out hydrant system with alternate double headed hydrant post and water or water cum foam monitors covering the parking area.
- Segregation of parking area thru’ chain link fence/boundary wall
- Separate entry and exit gate with access control.
- Parking lane demarcation / slotting to ensure independent & quick evacuation in emergency.

g) Hydrocarbon (HC) detectors shall be installed near all potential leak sources of class “A” petroleum products e.g tank dykes, tank manifolds, pump house manifold. These detectors shall be placed in a way that entire possible source of leaks and collection of products is continuously detected and alarm is set at 20% of lower explosive limit of class A. (Refer clause 9.1.a for details)

6.4.6 Separation distances:

a) Minimum separation distances between various facilities described above shall be as per Table-1. The table shall be read in conjunction with the notes specified with the table.

b) The layout shall also take into account findings/recommendations Risk Analysis / Assessment study, which shall be carried out at all the stages of facility development process.

Separation Distances between tanks / offsite facilities:

The following stipulations shall apply for the separation distances for above ground tanks storing petroleum products.

c) For larger installation, minimum separation distances shall be as specified in Table-2 and Table-3. The tables are applicable where total storage capacity for Class-A and Class-B petroleum products is more than 5000 cum or the diameter of Class-A or Class-B product tank is more than 9 meters.

d) For smaller installation, minimum separation distances shall be as specified in Table-4. This table is applicable where total storage capacity of Class-A & Class-B is less than 5000 cum and diameter of any tank storing Class-A and Class-B petroleum product does not exceed 9 meters. Table-4 shall also be applicable for the installation storing only Class-C petroleum.

e) Excluded petroleum should be treated as Class-C petroleum for the purpose of separation distances and Table-4 shall be applicable for their separation distances.

f) 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.
<table>
<thead>
<tr>
<th>S.No.</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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control Room (Note –1)</td>
<td>X</td>
<td>Note-2</td>
<td>Note-3</td>
<td>30</td>
<td>45</td>
<td>12</td>
<td>X</td>
<td>6</td>
<td>15</td>
<td>30</td>
<td>X</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Storage Tanks Class-A</td>
<td>Note-2</td>
<td>Note-4</td>
<td>Note-4</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>T2</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>Storage Tank Class-B</td>
<td>Note-3</td>
<td>Note-4</td>
<td>Note-4</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>T2</td>
<td>30</td>
<td>50</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Storage Tank Class-C</td>
<td>30</td>
<td>Note-4</td>
<td>Note-4</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>T2</td>
<td>30</td>
<td>50</td>
<td>15</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>Bulk Loading unloading POL (Rail/Road)</td>
<td>45</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>Note-5</td>
<td>30</td>
<td>Note-6</td>
<td>T2</td>
<td>60</td>
<td>50</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Fire water storage and pump house</td>
<td>12</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>X</td>
<td>30</td>
<td>12</td>
<td>12</td>
<td>50</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Rail Spur/stabling line</td>
<td>X</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>Note-6</td>
<td>30</td>
<td>X</td>
<td>30</td>
<td>6</td>
<td>50</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Boundary wall around installation</td>
<td>6</td>
<td>T2</td>
<td>T2</td>
<td>T2</td>
<td>T2</td>
<td>12</td>
<td>30</td>
<td>X</td>
<td>6</td>
<td>15</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Service buildings</td>
<td>15</td>
<td>60</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>X</td>
<td>50</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>OWS with slop tank / effluent Treatment Plant / Oil sludge pit</td>
<td>30</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>15</td>
<td>50</td>
<td>X</td>
<td>45</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>11</td>
<td>Electrical Sub Station/Transformer yard</td>
<td>X</td>
<td>60</td>
<td>30</td>
<td>15</td>
<td>30</td>
<td>6</td>
<td>6</td>
<td>15</td>
<td>12</td>
<td>45</td>
<td>X</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Utilities</td>
<td>15</td>
<td>60</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>6</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>30</td>
<td>6</td>
<td>X</td>
</tr>
</tbody>
</table>
General Notes to Table-1:

a) All distances are in meters. "T" indicates the table number to be referred.
b) 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.
c) Service building shall have minimal manning and normally no hot work would be done there.
d) "X" means any distance suitable for constructional or operational convenience

Specific notes to Table-1:

Note-1: Type of construction shall be as per OISD-STD-163.
Note-2: Shall be 60 meters for non-blast construction and 30 meters for blast resistant construction.
Note-3: Shall be 45 meters for non-blast construction and 30 meters for blast resistant construction.
Note-4: Separation distances between the nearest tanks located in two dykes shall be equivalent to the diameter of the larger tank or 30 M, whichever is more. For distances within a dyke, it shall be as per Table-2 and Table-3
Note-5: Separation distance between i) Tank truck gantry and tank wagon gantry shall be 50m. ii) Distance between two Tank truck gantries shall be 15 M. iii) Distance between two tank wagon gantries shall be 50 M.
Note-6: Separation distance between tank truck gantry and rail spur/stabling line shall be 50 M.
TABLE - 2

SEPARATION DISTANCES BETWEEN TANK / OFFSITE FACILITIES –

Applicable for large installations where total storage capacity for Class-A and Class-B petroleum products is more than 5000 kl or the diameter of Class-A or Class-B product tank is more than 9 meters.

<table>
<thead>
<tr>
<th>Tanks / Facility</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Storage Tank for Petroleum Class A / Class B.</td>
<td>T3</td>
<td>T3</td>
<td>30</td>
<td>30</td>
<td>8</td>
<td>0.5 D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min 20 m</td>
</tr>
<tr>
<td>2  Storage Tank for Petroleum Class C</td>
<td>T3</td>
<td>X</td>
<td>30</td>
<td>X</td>
<td>X</td>
<td>0.5 D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min 20 m</td>
</tr>
<tr>
<td>3  Tank vehicle loading / Unloading for petroleum class A or class B</td>
<td>30</td>
<td>30</td>
<td>X</td>
<td>X</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>4  Tank Vehicle loading / unloading for Class C</td>
<td>30</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>10</td>
</tr>
<tr>
<td>5  Flame proof Electric Motor</td>
<td>8</td>
<td>X</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6  Boundary wall</td>
<td>0.5 D</td>
<td>0.5 D</td>
<td>20</td>
<td>10</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Min 20 m</td>
<td>Min 20 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## TABLE– 3

**SEPARATION DISTANCES BETWEEN STORAGE TANKS WITHIN A DYKE**

(For large installations where total storage capacity for Class-A and Class-B petroleum products is more than 5000 cum or the diameter of Class-A or Class-B product tank is more than 9 meters)

<table>
<thead>
<tr>
<th>Item</th>
<th>Between floating Roof Tanks Class A &amp; B</th>
<th>Between fixed Roof Tanks Class A &amp; B</th>
<th>Between fixed and Floating roof Tanks Class A &amp; B</th>
<th>Between Class C Petroleum Storage tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(D+d) / 4 Min 10 m</td>
<td>(D+d) / 4 Min 10 m</td>
<td>(D+d) / 4 Min 10 m</td>
<td>(D+d) / 6 Min 6 m</td>
</tr>
<tr>
<td>2</td>
<td>(D+d) / 4</td>
<td>(D+d) / 3</td>
<td>(D+d) / 3</td>
<td>(D+d) / 4</td>
</tr>
</tbody>
</table>

**General notes to Table – 2 & 3**

a) All distances are in meters.
b) “x” indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements.

c) D & d stands for diameter of larger and smaller tanks.
d) In Table – 2 all distances shall be measured between the nearest points on the perimeter of each facility except in the case of tank vehicle loading/unloading area where the distance shall be measured from the centre of each bay.

e) In Table – 3, Distances given are shell to shell in the same dyke.
f) For different combination of storage tanks, the stringent of the applicable formulae shall be considered for minimum separation distance.
g) The distance of storage tanks from boundary wall is applicable for;

   (i) Floating roof tanks having protection for exposure

   (ii) Tanks with weak roof-to-shell joint having approved foam or inerting system and the tank diameter not exceeding 50 meters

h) Distances mentioned in table-2 are for electric pump motor located outside dyke. However, for side entry mixer attached to tank shell, the motor can be mounted on the tank shell.

i) For the facilities not covered in Table- 2, refer Table-1.
TABLE – 4
SEPARATION DISTANCES BETWEEN TANKS/OFFSITE FACILITIES

(For small installations where total storage capacity of Class-A & Class-B is less than 5000 kl and diameter of any tank storing Class-A and Class-B petroleum product does not exceed 9 meters. This table shall also be applicable for the installation storing only Class-C Petroleum and Excluded Petroleum)

<table>
<thead>
<tr>
<th></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>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Tank Class A</td>
<td>0.5D</td>
<td>0.5D</td>
<td>0.5D / 6.0</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>3</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Tank Class B</td>
<td>0.5D</td>
<td>0.5D</td>
<td>0.5D / 6.0</td>
<td>9</td>
<td>4.5</td>
<td>4.5</td>
<td>3</td>
<td>4.5</td>
<td>D Min 4.5</td>
<td>D Min 4.5</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Tank Class C</td>
<td>0.5D / 6.0</td>
<td>0.5D / 6.0</td>
<td>X</td>
<td>9</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>0.5D Min 3.0</td>
<td>0.5D Min 3.0</td>
</tr>
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General notes to Table – 4:

a) All distances are in meter and the table specifies the minimum requirement.
b) “X” indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements.
c) “D” indicates the diameter of the larger tank.
d) Distances given for the tanks are shell to shell in the same dyke.

e) Where alternate distances are specified (like 0.5 D / 6.0), the minimum thereof shall be used.

f) All distances shall be measured between the nearest points on the perimeter of each facility except in case of tank vehicle loading /unloading area where the distance shall be from the centre of each bay.

g) Pig launcher/receiver at liquid hydrocarbon handling pipeline installations should be located at least 5 m from boundary.

h) Distances mentioned in the Table-4 for electric pump motor located outside dyke. However for side entry motor attached to tank shell, the mixer can be mounted on the Tank Shell.
7.0 DESIGN CONSIDERATIONS

7.1 Types of storage tanks

i) External Floating Roof Tank (EFRT)

External Floating roof (EFRT) may be single deck pontoon roof or double deck. For designing the EFRT tanks with single deck pontoon roof or Double deck, API STD 650 shall be followed.

ii) 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 STD 620 shall be followed based on the type of the tank.

iii) Internal Floating Roof Tank (IFRT)

These tanks have a fixed roof over a floating roof. For designing these tanks, API STD 650 guidelines shall be followed.

7.2 Selection of type of storage tanks

Selection of type of tank generally depends on ambient conditions and the product handled.

The external floating roof storage tanks with Pan Roof shall not be used as these are considered unsafe.

7.3 Selection of Seals for Floating Roof Tanks

- IFRT and EFRT shall be provided with double seal with minimum vapour recovery of 96%.
- Primary seal shall be liquid or shoe mounted for EFRT and vapour mounted for IFRT. Maximum seal gap width will be 4 cm and maximum gap area will be 200 cm²/m of tank diameter.
- Secondary seal shall be rim mounted. Maximum seal gap width will be 1.3 cm and maximum gap area will be 20 cm²/m of tank diameter.

7.4 Special Considerations

Tank bottoms shall be of cone up or cone down ("Apex down").

7.5 Tank appurtenances

i. Ladders and Handrails:

   Individual tank shall be provided with access to the roof. A platform with railing should be provided from the top of the stairway to gauge well and roof ladder. On floating roof tanks, non-sparking self levelling tread type rolling ladder with suitable earthing connection are to be provided.

ii. Stairs:

   Stairs should be made of grating. All staircases shall have resting/landing platform for every 5m height.

iii. Manholes:

   Number of manholes shall depend on diameter of the tank (Refer API STD 650 for details).
iv. **Walkway on the Roof:**

Walkway with handrail on the roof of the tank should be provided to facilitate inspection/checking of vents/ flame arrestor etc. so that movement of personnel on roof is safer.

7.6 **Tank farms/manifolds**

7.6.1 **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 indication and alarm system. Refer 9.3.d for details.

7.6.2 **Tank Manifold**

i) The number of inlet/outlet connections to the tank shell should all be kept minimum.

First valve on inlet, outlet and recirculation line shall be remote operated shut off valve (ROSOV).

The second valve which is motor operated valve (MOV) on inlet, outlet and recirculation lines should be outside the dyke.

Remote operated shut off valve (ROSOV) is not a regularly operated valve and is kept normally open; the second motor operated valve (MOV) is a regular operating valve.

ii) For positive isolation a suitable Valve other than Hammer Blind shall be provided so that under no circumstances the product is exposed to atmosphere from the valve. In any case Hammer blind valves of any type shall not be used in the depot/terminals.

iii) ROSOV shall be fail safe and fire safe (shall close in case of signal failure). The cables leading to the control room shall be fire retardant.

iv) ROSOV shall have only close operation from control room or at a strategic remote location.

v) The Open/Close push buttons of ROSOV shall be provided in field i.e. just outside 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).

The push button assembly shall be mounted at a place where it is easily visible and accessible to the operator.

vi) Tank manifold(s), if provided, shall be located outside the dyke area. The floor underneath the manifold shall be paved and have Kerb walls and connected to oil water drainage system leading to ETP / OWS.

vii) 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 temp rise.

TSV outlet line or expansion line shall be connected back to tank / tank inlet /outlet line before ROSOV with suitably positioned NRV & isolation valve(s).

In case the expansion line is connected at roof top, the line shall be extended inside up to the Tank bottom to avoid free fall thru vapour space.
viii) Any electrical fittings and fixtures inside the dyke shall be as per the hazardous area classification. However such fittings and fixtures except for actuators of ROSOV/MOVs should be above the dyke height.

7.6.3 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.

7.7 Tank heaters / mixers

a) 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.

i) 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.

ii) Steam Heating

Man way heaters consist of a tube bundle, usually of hairpin type, fixed through a manhole of the tank. Manway 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.

iii) Electric Heating

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

The fired heaters shall be provided outside the hazardous area at the safe location.

7.8 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. No and details of the drains shall be as per the applicable tanks design standard.

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.

ii) Floating Roof Drains

Roof drain shall be of robust design to prevent oil coming out during draining operation.

Maximum hourly rainfall rate during the past 15 years shall be considered for designing the number and size of drains for open floating roof tank. **Rain water should not be taken directly into the tank.**
The roof drain system shall have provision for connection to the drain through a suitably designed robust system and shall include a suitable outlet valve.

Swivel joints should be avoided as it is prone to failures.

Due care to be taken while designing to ensure the system integrity and performance when roof is resting on the low legs.

The inlet for these drains shall have a check valve to prevent product from flowing to the roof in the event of failure of the system.

iii) Emergency Roof Drain

Emergency drain for floating roof tank shall be provided on the roof to take care of disposal of water in case of choking/malfunctioning of the primary roof drain. It shall have water seal arrangement to prevent oil spl on the roof.

7.9 Vents

i) Open Vents

Flash Back Arrester (Flame arrester) should be fitted to Vents as per IS: 11006:2011

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 for details refer annexure(4) and (5).

• Blending components likely to be handled in the tank

ii) Breather Valve

Breather valves shall be provided in the blanketed tanks designed as per API STD 650/2000. For low pressure tanks breather valve required shall be provided as per API STD 620. The tank breathes in air when the tank pressure is lower than the atmospheric pressure and breathes out when tank pressure is greater than the set pressure. Pressure and Vacuum Relieving Valves (PVRVs) provided on cone roof tanks usually have 20% accumulation. While designing, it is necessary to ensure that under full relieving conditions, the design pressure/vacuum in the tank is not exceeded. Set pressure of PVRV must be decided according to API STD 2000.

Breather vents/flame arrestors are known to fail through the formation of crystalline waxy / heavy hydrocarbon deposits or ice on the seats of valve diaphragms or inside the nozzle connection upon which the valve is mounted. Breather vents/flame arrestors are not recommended on these services, instead only open vents should be provided.

Where tanks are blanketed, breathing-in will be from the blanketing gas system. Necessary control valve shall be provided for supply of blanketing gas at constant pressure. The tank shall be provided with a safety valve by way of lift disc/diaphragm or any other suitable device. Gauge hatch and other manholes shall be of gas tight construction.

iii) Emergency Vents
Emergency Vents shall be provided for the tanks as per API STD 2000

7.10 Dip Hatch/Sampling

- Dip hatch or gauge hatch is used for gauging the height of the liquid in a tank as well as to take out samples for testing. Gauge hatch shall be non-sparking (or lined with non-sparking material) and self closing type.

- Gauge well pipe (with slots) should be provided for all types of tanks.

- The gauge well shall be properly supported by means of angles/straps with bottom plate of the tank. The above arrangement also makes the tank safer with respect to dissipation of static charge accumulation.

7.11 Instrumentation

i) Safety Integrity Level (SIL)

The SIL classification study shall be carried out to determine the required SIL level. SIL of the tank level, control and overfill protection shall be meeting the requirement of Part 1 of EN 61511.

The SIL level of the entire interlock loop shall also meet the requirement of EN 61511.

ii) Level controls on Tanks

High Level (H): In between Normal fill Level and Safe Fill Level.

High High Level (HH): at safe fill level.

(Refer Annexure-1 for schematic diagram indicating critical levels in the Tank.)

Tanks shall be provided with at least two numbers of independent level instruments, Out of these one shall be of radar type that shall have HH alarm. For “H” alarm separate level indicator shall be utilized. In addition to above gauges, in the tanks, an independent HH level switch shall be provided, operation of which shall auto-actuate shut off of ROSOV in inlet/outlet line of the respective tank.

“H” / “HH” and independent “HH” level switches shall have provision of audio & visual alarms on auto-actuation in the control room.

There shall be exchange of signals between the receiving and dispatch location in case of receipt of product through cross country pipe lines. Provision shall be made for monitoring of level of the receiving tank along with pressure in the pipe line and ROSOV status and to ensure safe shut down of the system in case of any abnormal situation.

Care need to be taken for tanks receiving product from ship/ cross country pipeline at high flow rates for surge pressures due to sudden closures of valves and accordingly where ever required, suitably designed Surge relief system /pump tripping to be provided.

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. For tank capacity higher than 5000 kl a minimum of two numbers of local temperature indicators should be so located (within 500 mm above the inlet/outlet nozzle) as not to sense the direct heat of the coil.
Insulation shall be provided for heat conservation. The tanks having higher surface temperature shall have insulation upto minimum 2 mts high for personal protection. Also, patch insulation should be provided on the shell along with spiral stairway.

7.12 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 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 shall pass through secondary encasing with properly sealed at both the ends.

The pipe lines should be provided with low points drains and high point vents to facilitate emptying / hydro-testing etc.

Valves:

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

Fittings:

Steel flanges and flanged fittings shall conform to relevant ASME / ASTM 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.

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.

7.13 Bulk Loading /unloading operations

i) Loading / unloading Pumps

- Pumps conforming to relevant API standards shall be used.
- Pumps shall be located in an exclusive paved area with drainage facilities routed to OWS / ETP.
- Loading Pump house shall be positioned at an elevated platform and shall be well ventilated on all four sides
• Open roof Pump house are to be provided with suitable IP protection for the equipment.

• In case of sunken pump house for Tank Wagon unloading facilities Pump house shall be so positioned that it ensures proper ventilation and efficient disposal arrangements of accumulated products.

• 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 explosion proof switch located at the strategic location in the gantry to switch off the pump in case of emergency such as over flow, fire or any other abnormal situation.

    In addition to above, locations having automation shall be provided ESD feature thru Automation system refer 9.1.c for details.

• Dedicated pumps for individual products shall be provided. Minimum one stand by pump for each product shall be provided.

• Separate pumps shall be provided for Tank truck loading/unloading and wagon loading/unloading.

• Receiving lines as well as 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 should be provided with isolation valve on either side and break flange/union on tank side.

• In case of large capacity wagon loading gantries where loading could vary from a rake to a few wagons, shall be provided a minimum flow bypass / controller on discharge line to take care of pressure fluctuations. Alternately, Variable Frequency Drive (VFD) with Inverter grade motor shall be provided.

    When more than one loading pump is required to be run to meet higher loading rates, minimum continuous flow requirement of each pump shall be considered.

ii) Tank truck and tank Wagon Loading Gentries.

• Loading points shall have quick shut-off valves viz. Cast steel Plug or Ball Valves.

• No tank vehicle shall be loaded at a rate exceeding (volumetric flow rate corresponding to linear velocity ) one meter per second at the delivery/(at the least dia fitting) and of the filling pipe until the filling pipe is completely submerged in petroleum and thereafter the loading rate should be gradually increased but it shall at no point of time exceed six meters per second at the delivery end of the filling pipe.

• Automated locations should provide suitable overfill protection system to prevent any overflow and hazards arising out of that.

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

• The provision for Kerosene and MS / Naptha loading in T/T loading gantry shall not be in the same bay.

• For safety reason the level adjustment in the tank lorry compartments should be done through suitable system wherein product is not exposed in open atmosphere at any point of time.

• In case of loading hoses, only neoprene impregnated hoses having electrical continuity between nozzle and flange shall be used.
• All tank wagons and tank trucks shall have a fill pipe extended up to the bottom to avoid splash filling.

• However, splash filling is permissible for asphalt loading in tank truck or tank wagons.

• Where bottom loading is done, deflector plates in the trucks / wagons to be ensured.

• Bottom flameproof lighting shall be provided for night time checking of wagon bottom leaks and also for proper sealing and inspection wherever loading/unloading during night is required to be done.

• Loading gantry shall be provided with at least one suitable explosion-proof telephone / paging device for communication with pump house in normal & emergency operations. In addition, operating personnel shall be provided with intrinsically safe walky-talky suitable for use in oil installations.

• Tank wagon and truck loading gantries shall be suitable for all weather conditions.

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

• Swing type loading ladders with counter weight & hand railing shall be light in construction. Neoprene packing shall be provided at the bottom rest to avoid spark generation due to impact.

• Proper handrail arrangement shall be provided on platforms & stairs for safe movement of personnel.

• Adequate safe escape ladders including from over head platform shall be provided at intervals on the gantry for emergency use. Escape ladders shall be prominently identified from distant view.

• 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 rail/road 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.

• Loading gantry area including areas below railway lines shall be paved for smooth draining and collection of spillages into drains.

• Open drains along the railway line/gantry shall be covered with gratings so as not to endanger movement of personnel.

• All trucks entering truck loading gantry shall be provided with PESO approved spark arrestor flame arrestors at the exhaust.

• 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.

• For tank wagon gantry where placement of tank wagon is by electrical LOCO, traction line must terminate 15 M short of the first loading /unloading point at all Terminal/Depot locations.

• For placement, brake van / dummy wagons shall be used. Separate segregation gate shall be provided at terminating point and area between boundary wall and segregation gate should be declared de-licensed.
• Main railway track shall be isolated from wagon gantry siding at least 15 meters from 1st loading/unloading point by providing insulation joint at terminating point and loco shall stop before the insulation joint.

7.14 Handling of Sick Wagon

Wagon: When a wagon is found leaking during loading, provision shall be kept for safe handling of such wagons. These methods should include:

- Arresting of leaks using cold weld as a first aid measure till the wagon is unloaded safely at the gantry itself. In no case such wagons to be used for transportation.
- A dedicated drain header(s) for instantaneous unloading of such sick wagons.
- A portable pump with flame proof / explosion proof motors and other electrical fittings to connect to such wagons with proper flexible hoses for quick withdrawal of products into sump tanks. Such drained products to be used as per the quality control policy of the company.

7.15 HANDLING OF SLOP

Collection and Drainage

A network of drainage system shall be provided to collect oil drains from various equipments, 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.

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.

7.16 ELECTRICAL EQUIPMENT

Electrical equipment including the lighting system shall conform to hazardous area classification. The hazardous area shall be classified as per IS: 5572 and OISD-STD-113. The electrical fittings / equipment in the respective classified area/ zone shall be of a type suitable for the particular area/zone as per classification in line with IS: 5571.

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

Cables

In order to avoid spread of fire due to cables, it is recommended that the outer PVC sheath of all cables used in industry shall be flame 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 and 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.

A. MEASUREMENT OF EARTH RESISTANCE

Earth resistance can be directly read through an earth resistance tester 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 earth resistance tester.

The testing of the Earth Pits shall be done six monthly one in dry and once in wet weather and records maintained.

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

Allowable earth-Resistance Values

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

1 Ohm for main earth grid.
1 Ohm for bonding connections between joints in pipelines and associated facilities.
2 Ohms for each electrode to the general mass of Earth.

Min. One number each calibrated earth megger & multimeter shall be kept in the location.

B. INSTALLATION EARTHING

Installation earthing design shall be carried out in accordance with the requirements of Indian Electricity Rules and IS: 3043 or equivalent system recognised by statutory authorities under the petroleum act / electricity act All earth connections should be visible for inspection to the extent possible. The earthing system shall have an earthing network with required number of earth electrodes connected to it.

Earthing system shall be designed for the following:

1. System neutral earthing.
2. Protective Equipment Earthing for personnel safety.
3. Protection against Static discharges.
4. Lightening Protection
5. Earthing for Data Processing system

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 Arrester (LA) of the Di 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 a grid. The Grid of LA shall be distinct and shall not be connected to any other earth Grid.

The Di Pole/ Four Pole structure shall be earthed with two distinct earth connections. The Gang Operated Switch shall also be earthed.
The Fencing of Di /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 shall be distinct and shall not be connected to any other earth Grid.

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 shall be distinct and shall not be connected to any other earth Grid.

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 connections to the earth. (Sub Station Panels, Motors, FLP JBs etc).

All Steel structures, loading platform / gantries etc shall have two separate and distinct connections. Connections will be made to the pit directly and then pits will be connected to each other to form a grid.

Storage Tanks etc shall have two separate and distinct connections. Each connection will be made to the respective earth pit directly. There after these earth pits should be inter-connected to form a dedicated grid for Tank Farm. The number of earth pits / connections to be increased for large tanks so that the distance between the connections does not exceed 30 meter on the tank perimeter.

For example:

For tanks upto 60 meter perimeter 2 Nos earth pits shall be provided for above 60 meter perimeter and upto 90 meter 3 earth connections shall be provided and so on.

C. BONDING:

Flanges: All flanged connections shall be effectively bonded by strips of suitable material.

Tank Wagon Loading / Unloading Gantry: Continuity between rail spur and gantry shall be ensured by checking at a suitable frequency. The gantry structure to be suitably earthed in earthing pits of standard specifications. Tank wagon siding to be insulated from main running track.

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 corrodirble 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).

SAMPLING /GAUGING: For sampling jars to be inserted into product tanks, use only manila ropes.

D. STATIC EARTHING:

Static Earthing shall be provided at Tank Lorry / Wagon Filling / Decantation Gantries, to prevent building up of Static Charges. The Static Earthing shall be segregated from electrical earthing by using insulation pads to prevent it from getting energized to the same voltage level as it wouldexist on electrical fittings in case of fault.

This earthing shall be independent of earthing system for automation.

E. LIGHTNING PROTECTIVE SYSTEM:
Lighting protection shall be provided for the equipment, 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 do not require lightning protection with aerial rod and down conductors. They shall be connected to the earthing system at two points of the base.

If lightning arrester is provided an independent earthing network shall be provided for lightning protection.

**F. 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 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.

**G. 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>50mmx6 mm GI strip</td>
</tr>
<tr>
<td>Lightening Arrester of the 2/4 Pole Structure</td>
<td>40mmx6 mm GI strip</td>
</tr>
<tr>
<td>2/4 Pole structure / Sub-Station equipments / VCB etc</td>
<td>40mmx6 mm GI strip</td>
</tr>
<tr>
<td>Fence of the 2/4 pole structure / transformer yard</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>40mmx6 mm GI strip</td>
</tr>
<tr>
<td>Fire Water Pump House</td>
<td>25mmx6 mm GI strip</td>
</tr>
<tr>
<td>Building / Structure Columns</td>
<td>40mm X 5mm GI Strip</td>
</tr>
<tr>
<td>Storage Tanks</td>
<td>40mm X 5mm 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 &amp; 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>40mmx6 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>

**H. 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>2 Nos (All metal bodies connected)</td>
</tr>
<tr>
<td>Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Neutral of the transformer</td>
<td>2 Nos independent</td>
</tr>
<tr>
<td>Neutral of the D G Set</td>
<td>2 Nos independent for each DG Set</td>
</tr>
<tr>
<td>Body of DG Set / control panel for DG Set</td>
<td>2 Nos</td>
</tr>
<tr>
<td>Sub-station –PMCC Room</td>
<td>4 Nos</td>
</tr>
<tr>
<td>Fire Pump House</td>
<td>2 Nos</td>
</tr>
<tr>
<td>Air Comp House</td>
<td>2 Nos</td>
</tr>
<tr>
<td>All structures Shed of Pump House / Fire Engine / Loading unloading Gantry / Air Compressor / Engg Store etc.</td>
<td>2 Nos for each structures</td>
</tr>
<tr>
<td>Static Earth for Loading unloading Gantry (Tank Truck)</td>
<td>1 Nos independent for each bay.</td>
</tr>
<tr>
<td>Static Earth for Loading unloading Gantry (Tank Wagon)</td>
<td>1 Nos each for 30 m section of rail gantries)</td>
</tr>
<tr>
<td>All 3 Phase Motors / FLP lights in each shed</td>
<td>2 Nos</td>
</tr>
<tr>
<td>High Mast Tower (HMT)</td>
<td>2 Nos for each HMT</td>
</tr>
<tr>
<td>Admin Blocks</td>
<td>2 Nos</td>
</tr>
<tr>
<td>Data Processing</td>
<td>One for Metallic body parts of equipments and one for neutral of isolation-transformer</td>
</tr>
<tr>
<td>Inspection Platform / Watch Tower / Weigh Bridge</td>
<td>1 Nos each</td>
</tr>
<tr>
<td>Water Storage Tanks (Fire Water Tank)</td>
<td>2 per tank</td>
</tr>
<tr>
<td>Product Storage Tank</td>
<td>Minimum 2 nos and further as defined in Cl. B above.</td>
</tr>
</tbody>
</table>

### I. General

- Fail safe Interlock / change over switch shall be provided between the Grid Power and the DG power to ensure that the equipments get supply from one source only.

- Insulation mats shall be provided in the Sub Station, control panels etc.

- Relays/Cables shall be tested once in a year and records maintained.

- Transformer oil shall be tested once in a year and records maintained.

- 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)

#### Emergency Feeder

Emergency Feeder shall host the following equipments:

- Jockey Pump, Critical lighting, Fire Siren, Borewell, Gate Barrier, safety instrumentation and interlocks such as CCTV, Hydro Carbon detector, Dyke drain valve system, UPS of automation, supply to essential fire fighting equipments.

#### 7.17 Installation lighting

Sufficient lighting shall be provided so as to enable terminal 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 fire fighting facilities such as fire water pumps, fire alarm stations etc.
- To gain access to escape route for safe evacuation of operating personnel.

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 levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main roads (Gate entry/exit, roads around TT gantry)</td>
<td>20</td>
</tr>
<tr>
<td>Secondary roads (along storage tanks &amp; Periphery etc)</td>
<td>10</td>
</tr>
<tr>
<td>Tank farm area</td>
<td>20</td>
</tr>
<tr>
<td>Pump / Compressor / Dosing Sheds / Fire Pump House</td>
<td>100</td>
</tr>
<tr>
<td>Main Operation Platforms &amp; Access Stairs (TT and TW gantry, Tank manifold)</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>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>Control Room bldg./ laboratory</td>
<td>400</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</td>
<td>50</td>
</tr>
<tr>
<td>Corridors</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.

8.0 Safe Operating Practices in Storage and handling of bulk petroleum products

8.1 GENERAL
This section deals with the safe operating practices and provisions applying to 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.

8.2 SAFE OPERATING PRACTICES.

i) Terminal/depot 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) Intrinsically safe VHF handsets shall be provided to all operating personnel working in critical areas.

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

vi) 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.

vii) 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 & experienced staff.

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

ix) The tank farm management system should be integrated with SAP/ERP provision of recording & display of TFMS inventory levels shall be made on SAP / ERP.

x) Suitable interlocks shall be provided for tripping / alarm / ROSOV 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 equipments (PPE):

   Equipments 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), resuscitator etc. as applicable shall be worn while carrying out operations in normal and emergency situations.

8.3 BULK HANDLING FOR MOVEMENT BY ROAD

i) Transportation of petroleum products by road is regulated by Department of Explosives (PESO) through The Petroleum Rules 2002 (the latest applicable version) and The Motor Vehicle Act 1988.

ii) Containers and tank trucks shall be fabricated in accordance with The Petroleum Rules 2002 and OISD-RP-167 POL Tank lorry design & Safety.

8.4 SAFETY PRECAUTIONS DURING TT LOADING / UNLOADING

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) Vapour space of not less than 5% of its capacity shall be kept in each container and 3% in each tank truck in respect of petroleum Class A&B products. Similarly minimum 3% vapour space shall be kept in containers and 2% vapour space in tank trucks in respect of petroleum Class C.

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 to provide proper earthing. Earthing shall be 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

8.5 PROCEDURES FOR 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 10 kg DCP and 1 no. 1 kg CO2 /DCP / Approved equivalent fire extinguisher).

• Spark arrestors shall be welded on the exhaust.

• No leakage in exhaust silencer pipe.

• Valid Explosive License and RTO certificate is available.

• PESO approved drawings of the tank.

• Availability of brazed copper strip for Earthing / bonding connection.

ii) Move truck to the loading bay.

iii) Place the truck on loading bay and place wheel 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 8.5(a) should be selectively carried out.

ii) Test the connections for leaks

iii) Start the Unloading operations

iv) Before empty release ensure 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 petroleum products tank Trucks at loading / unloading locations is given at Annexure-

(2)

8.6 BULK HANDLING FOR MOVEMENT BY RAIL.

i) In India, Railway Administration, acting as a carrier of Petroleum Products, is exempted from taking any licence for transporting it under Petroleum Rules.

ii) Minimum Vapour space for tank wagons carrying different classes of petroleum products shall be as given below
8.7 SAFETY PRECAUTIONS IN TANK WAGON GANTRY

i) Sufficient number of dummy wagons shall be used to avoid electric loco coming closer to the gantry. Maintain the distance of 15 m from first fill point.

ii) The first operation after positioning the wagon shall be to provide for proper earthing.

iii) For connecting and disconnecting hoses, only non-sparking tools shall be used.

iv) After the wagons are placed on the spur and before the loco is detached, the hand brakes on each and every wagon shall be applied.

v) Like-wise, before the wagons are moved from the spur, brakes on all the wagons shall be released.

vi) Ensure that electrical continuity of the system is intact.

vii) Ensure that all fittings on the wagons are checked physically.

viii) Hoses shall be tested as per OISD-STD-135 and records maintained.

ix) The loading / unloading operation shall be carried out under close supervision of authorized person.

x) No mobile phones or any other source of ignition shall be permitted near the gantry.

xi) Siding rail lines shall be properly insulated from the main line and grounded.

xii) Check wagon for mechanical condition, dents, and leaks. Report defective wagons and / or any questionable conditions to railways.

xiii) Accept the tank wagons for loading only after the railway staff declare the tank wagons as fit for loading.

xiv) Personnel shall wear Personal Protective equipment.

8.8 OPERATING PROCEDURES TANK WAGON LOADING / UNLOADING

A. LOADING OPERATIONS

i) Take the placement properly in respect of loading points to ensure safe connection thru’ hose/loading arm.

ii) Ensure that suitable sized dummy wagons are used and electrical loco does not cross isolation joint.

iii) Ask loco to move away and exhibit caution sign at suitable distance away from the wagons on both ends.
iv) Switch off loco engine, if parked nearby.

v) Apply brakes/stoppers for wagons to prevent any movement during loading operations.

vi) Ensure fire system, communication system are ready for use.

vii) Provide earthing connections to the wagons.

i) Ensure closing of internal valve (IV), bottom valve and end flanges tightened using gasket & all nuts/bolts. Metallic/Neoprene Gaskets shall be used. Cardboard or any other material shall not be used.

viii) Open the manhole cover of the wagon.

ix) Connect the filling hose or loading arm to the wagon with bonding and tie it properly with wagon.

x) Commence the pumping, Open the valves slowly and fill slowly till the fill pipe is fully submerged and ensure that there is no leakage.

xi) Increase the filling rate, however, filling speed shall not exceed 5 m/sec. Product shall be filled up to safe filling height as per CTCC chart.

xii) On completion of filling, remove the hose and keep it properly to ensure that the same does not hit wagon during draw out.

xiii) Carry out dip & sample checking, tighten all safety fittings like fill pipe, dip pipes etc.

xiv) Close the top cover of the wagon and seal it properly.

xv) Remove earthing connections from wagons.

xvi) Complete formalities for documentation, check for any leakage and release the wagons for draw out.

xvii) Remove brakes/stoppers for wagons before draw out.

B. UNLOADING OPERATIONS

i) Follow the procedure i) to vii) as above.

ii) Check that seals for wagons are intact, bottom valves are closed and there is no sign of pilferage.

iii) Open the manhole/dome covers and check the dip and tally with loading dip. Check the sample to ascertain grade of product.

iv) Connect the unloading hose to the correct header with bonding. Tighten the flanges using gasket & all nuts/bolts. Metallic/Neoprene Gaskets shall be used. Cardboard or any other material shall not be used.

v) If any leak appears, the valve should be immediately closed and corrective measures applied.

vi) Recheck the lines and connections to make sure that they are connected correctly.

vii) After the product connection is secured and tested, discharge valve should be opened slowly and completely. Pumping can be commenced.
viii) On completion of unloading stop the pumps, check dip for emptiness, disconnect hose, close wagon internal valve, bottom vales, dome cover and tighten bottom flanges using gasket to ensure no leakage en-route from left over oil traces.

ix) Remove earthing connections from wagons.

x) Complete formalities for documentation, check for any leakage and release the wagons for draw out.

xi) Remove brakes/stoppers for wagons before draw out.

8.9 HANDLING OF SICK WAGON/TRUCK TANKER

When a 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 wagon, explosion proof motor and power connection should be provided. Similar facility should be provided for unloading sick truck tanker also.

8.10 PIPELINE TRANSFER OPERATIONS

Pipeline transfer of product is carried out for receipt / delivery of products to the depots / terminals from refineries/cross country pipe line to marketing terminals within the same company or between the oil companies.

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

ii) Elimination air / vapour trapped in the receipt line shall be carried out and it should be ensured that air pockets are removed the pipeline is full.

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

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

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

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

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

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

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

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

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

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

8.11 TANKFARM OPERATIONS SAFETY PRECAUTIONS IN TANK FARM AREA

i) Whenever operations are not in progress, 100 % closure of the 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 must be periodically checked for leakages / sweating and repairs must be immediately carried out whenever scaling / pitting are observed. Ref OISD STD 129

v) Movement of floating roof must be smooth during operation. Free movement of rolling ladder must be ensured by proper lubrication of moving parts and ensure free movement of wheels.

vi) Floating roof deck must be kept clean and free from all foreign materials / dust etc so as to avoid clogging of roof drain sump

vii) Water seal must be maintained in the emergency drain in floating roof tanks & it should be ensured that there are no traces of oil in the emergency drains

viii) Proper earthing and bonding shall be maintained and ensured at all times for the tank body, electrical continuity from shell to ladder and from ladder to floating roof.

ix) Dyke drain valve shall be in closed condition and shall be operated only under supervision of a authorised person and log book maintained.

x) 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.

xi) Entry on floating roof for maintenance and inspection shall be with the following conditions:

- The roof is should half way to the top.
- Floating roof is levelled and free of oil and excessive water.
- One man shall be available as standby at the top of platform with a canister mask / breathing apparatus. A situation may arise during excess generation of vapour at the time of rim seal inspection and dip hatch seal inspection
- A life line with safety belt is used for the man going on the roof. The other end of the line held by the standby at the top platform.
- The tank is not under receipt or delivery.

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

xiii) Flow velocity at tank inlet should not exceed 1 m/s until the inlet is completely submerged.
For easy reference, permissible flow rates for initial filling are given below:

<table>
<thead>
<tr>
<th>Size (in mm) of Inlet Pipe</th>
<th>Max. Flow (kl/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>246</td>
</tr>
<tr>
<td>250</td>
<td>168</td>
</tr>
<tr>
<td>200</td>
<td>109</td>
</tr>
<tr>
<td>150</td>
<td>59</td>
</tr>
<tr>
<td>100</td>
<td>27</td>
</tr>
<tr>
<td>80</td>
<td>25.5</td>
</tr>
</tbody>
</table>

Due care shall be taken during input in floating roof (tanks) rested on legs till roof floats completely & smoothly from.

xiv) Conductive footwear e.g. leather soles or electrically conducting rubber soles, should be worn while gauging, sampling or taking temperatures.

xv) Ensure that gauge tapes with earthing provision are used for gauging.

xvi) 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.

xvii) Rope used for lowering sample bottles in the tank shall be made of non conductive / non static material. Nylon rope shall not be used.

xviii) In case of large tank farms effective communication is essential. Pagers with loud hooters should be provided on roadside at various locations. This can also be utilised for communication during emergency like fire.

xix) 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 not be permitted for Class A & B products.

The earthing and bonding connections shall be ensured during the entire process.

8.12 ETHANOL HANDLING.

All practices as being followed in handling Class `A' Petroleum Products are required to be adhered to while handling Ethanol and Ethanol Blended Motor Gasoline.

Anhydrous Ethanol is essentially Ethyl Alcohol, which is denatured and is meant for use as fuel in automobile engines. Specified percentage of anhydrous ethanol is blended with Motor Spirit facilities for storing and handling ethanol provided at installations.

A. SALIENT FEATURES OF ETHANOL :

- Ethanol is completely soluble in water, which presents potential problems for storage and handling. However, Ethanol will not be significantly degraded by small amount of clean water, though water addition dilutes its value as a fuel.

- A higher conductivity suggests that Ethanol will dissipate static charges that build up when pumping fuel during fuel transfers faster than Motor Gasoline. This gives Ethanol a theoretical safety advantage over Motor Gasoline, as static electrical charges generated will be dissipated more quickly.

- Viscosity of Ethanol is higher than that of Motor Gasoline. However, it does not pose any problem in handling in cold weather.
• The auto-ignition temperature of Ethanol is significantly higher than that of Motor Gasoline. This makes Ethanol less susceptible to ignition when spilled on hot surfaces such as Engine Exhaust Manifolds.

• The lower flammable limit of Ethanol is higher than Motor Gasoline. This is another advantage over Motor Gasoline.

• Pure Ethanol burns with a flame that is not clearly visible in bright sunlight. However, Ethanol doped Motor Gasoline flame is visible.

B. RECEIPT, STORAGE AND HANDLING OF ETHANOL:

i) Ethanol shall be received at depots in dedicated tank trucks. All care shall be taken to prevent ingress of water into the compartments during transportation.

ii) The fittings in tank trucks used for transportation of Ethanol to receiving locations shall be the same as used for storage and handling of Class 'A' Petroleum products.

iii) Ethanol can be stored in above ground or underground tank(s) depending on local requirement.

iv) The unloading operations shall be carried out through special Nitrile rubber or any other compatible hoses. Hose shall have external bonding wire to ensure electrical continuity.

v) Ethanol being hygroscopic in nature, utmost precaution needs to be taken to ensure that there is no ingress of water or humidity. Both the ends of the hoses after use shall be capped. 80 mesh strainers shall be provided before the pump / tank inlet as the case may be.

vi) Appropriate recommended dosage of Metal Deactivator and Corrosion inhibitor shall be added during the decantation of Ethanol from tank truck into the storage tank, so as to ensure homogeneity of additives with ethanol in the storage tank.

vii) Storage tanks and allied facilities for Ethanol shall be positively segregated. The tank shall be absolutely free from water at all times.

viii) Ethanol, being hygroscopic, will absorb moisture from the air, Silica Gel trap must be provided in the vent pipe of the tank to prevent ingress of moisture into the tank. Regular check on the Colour of silica gel shall be maintained (Blue Colour) and shall need immediate replacement on showing signs of saturation by way of change of colour. Say, Silica gel turns from blue to pink after it absorbs moisture.

ix) Ethanol storage tanks shall be cleaned once in two years or more frequently depending on the need.

x) Storage tank openings / pipeline fittings shall be airtight and the threaded connections if any shall be tightened with the help of Teflon paste or Teflon tapes. Bolted connections shall have gaskets of Teflon.

xi) To ensure uniform doping of Ethanol with Motor Gasoline, on line doping of Ethanol shall be carried out through a closed system, with proper interlocks, while maintaining efficacy of mixing Ethanol in the right proportion of % v/v as per specification.

xii) An 80-mesh filter shall be provided on the delivery side of Ethanol storage tank i.e. between pump and TLF Gantry point.

C. SAFETY:
• Safety requirements as prescribed in Material safety data Sheet (MSDS) shall be ensured.

• “SOP” shall be displayed. Persons handling ethanol shall be trained for handling of ethanol.

• Emergency instructions, Hazardous instruction shall be displayed and PPE as per MSDS requirement shall be in place.

9.0 FIRE PROTECTION FACILITIES

The Fire Protection Facilities for Petroleum Depots and Terminals, shall be as per OISD-STD-117.

9.1. H C DETECTION AND ANNUNCIATION, DYKE DRAIN VALVE ANNUNCIATION SYSTEM AND EMERGENCY SHUT DOWN LOGIC.

a) HYDRO CARBON DETECTION AND ANNUNCIATION SYSTEM

Hydrocarbon detectors shall be installed near all potential leak source of class-A e.g. tank dykes, tank manifolds, pump house manifold etc. Hydrocarbon detector of proper type shall be selected and also shall be proof tested and shall be maintained in good condition.

i) General

The best method of prevention of explosion is to avoid basic build up of Explosive Vapour concentration immediately on occurrence of leakage. This would require basically a reliable and continuous Hydro Carbon detection system with warning annunciation to alert the operating personnel to take timely corrective action.

The Hydro Carbon Detection System shall provide early warning on build up of Vapour concentration below the LFL limits.

ii) Application

i) Hydrocarbon (HC) detectors shall be installed near all potential leak sources of class “A” petroleum products e.g. tank dykes, tank manifolds, pump house manifold etc. These detectors shall be placed in a way that entire possible source of leaks and collection of products is continuously detected and alarm is set at 20% of lower explosive limit of class A.

ii) The detection control equipment should be provided in the control room and the field for continuous monitoring even during power failure.

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. Hydro Carbon Detectors.
2. Field Transmission units / Signal scanners.
3. Control system / PC
4. Display
5. Annunciation System etc
6. Cables, hooters, repeater, Power Supplies etc...

All the components installed in the hazardous area shall confirm to the Hazard Area Classification applicable and shall be certified by PESO / Authorized lab by the country of the origin.
v) **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. The alarms both, audio and visual can be repeated at additional location to ensure corrective action is taken.

vi) **Hydro Carbon Detectors:**

The detectors shall be able to detect the presence of Hydro Carbon Vapours well below the LEL level. Any one or more in combination from the following types can be provided.

i) Catalytic detectors  
ii) Infra-red detectors  
iii) Line / Path detectors.

The system shall be available at all times on 24 by 365 days basis.

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

The control equipment should be able to generate at least two alarms at different levels of LEL concentration of Hydro Carbons.

vii) **Inspection and Testing:**

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

2. The system shall be thoroughly inspected every month by releasing Hydro Carbon Mixture at each detector.

3. Calibration of the detectors shall be done every three months by releasing known concentration of Hydro Carbon mixture and the records maintained. The drift in the sensitivity of the individual detectors shall be recorded in maintenance history log book during calibration and the detectors with abnormal or wide drift in sensitivity shall be rectified / replaced.

b) **Dyke Drain valve Annunciation system**

All the dyke valves will be fitted with a proximity 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 uninterruptable 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 CMRI / 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) logic for Terminal Automation System (TAS):

The ESD for TAS enabled locations shall be provided in control room as well as at various strategic locations. ESD system shall be only through push buttons with wired connection.

i) Actuation / pressing of any ESD shall initiate following actions:

1. Process Shutdown
2. Power Shutdown
3. Process Shutdown shall include the following:
   - To stop loading pumps
   - Barrier gates to open
   - ROSOVs to close.
   - TLF / TWF operations through the batch controllers to stop.
   - All MOVs to close.

ii) Power Shutdown shall initiate the following:

1. Trip all the panels other than Emergency panel. The Emergency panel should host Siren, Bore wells, critical High Mast tower lights outside the licensed area, security cabin. Critical lights in TLF, Admin block, MCC room and power to the control room/Automation system.

2. 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 ROSOV / MOVs and full closure of valves shall be ensured. The time lag shall be location specific.

At pipe line locations alarm signal shall be exchanged between the two control rooms so that necessary actions are taken by the operating personnel at both ends.

iii) Inspection and Testing:

The system shall be checked during each fire drill conducted with full system shut down and records shall be maintained.

10.0 MAINTENANCE & INSPECTION OF EQUIPMENT

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

10.2 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. While basic recommendations given by the manufacturers should be considered and modified bearing in mind the local conditions.

10.3 PERSONAL PROTECTIVE EQUIPMENT:

Personnel protective equipment such as safety shoe, hand gloves, apron, safety goggles, safety belt, helmet, ear muff, dust respirator, self contained breathing apparatus (SCBA), resuscitator etc. as applicable shall be worn while carrying out maintenance. Such equipments shall be checked periodically and maintained for ready use in normal and emergency situations. For details refer OISD STD-155.

10.4 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.

10.5 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

10.6 INSPECTION & MAINTENANCE OF VARIOUS FACILITIES IN OIL INSTALLATIONS:

10.6.1 EQUIPMENT:

A. STORAGE TANKS:

OISD Standard OISD-STD-129 on "Inspection of storage tanks shall be followed.

Petroleum products and water are stored in tanks in Terminal, Depot etc. Storage tanks of various types and sizes are used. The failure of any part of a tank is not desirable.

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.
Periodicity of inspection to be added

B. PIPES, VALVES AND FITTINGS.

Safety in petroleum installations comes through continuing 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 and off-site piping constructed as per Standard ANSI B-31.3 / 31.4 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 new pipelines during fabrication and prior to commissioning.

Type of Inspection

a. External inspection

includes Visual & Ultrasonic and radiographic thickness testings

1. Visual Inspection:

Shall covers all the 10 parameters as given in OISD-130, Clause 8.1.1, (viz. Leaks, Misalignment, Supports, Vibration, External Corrosion, Bulging, Bowing & Sagging, Mechanical Damage, Paint / coating failure, Cracks, particularly near weld joints and Insulation damage

2. Ultrasonic Thickness Testing

Shall be carried out to ascertain the remaining wall thickness of pipings. Minimum readings to be taken are to be guided by OISD-130, Clause 8.1.2.

3. Radiographic Inspection:

Critical spots which cannot be inspected by UST, shall be radiographed in line with OISD-130, Clause 8.1.3.

b. Comprehensive testing

- Shall include all parameters as per External Inspections mentioned above.
- In addition, following one or, more of the tests given hereunder shall also be carried out.

Other NDT Tests

Like Dye Penetration Test, Magnetic Particle Test, Hammer Tests.

These shall be conducted only if necessitated after external checks and thru’ a competent agency.

Hydrotest

Hydrotest for all pipelines in operation shall be carried out at as per the code to which the same is designed.

For additional requirements OISD STD-130 shall be applicable

C). FLANGES, GASKETS AND BOLTS:
All valves shall be inspected and tested to ensure conformation to required specifications and for leak tightness. All new valves shall be inspected and tested as per requirements of API-STD-598. The closure torque during testing for hand wheel and gear operated valves shall not be greater than that obtainable by hand tightening.

D) HOSE AND FLEXIBLE CONNECTION:
Loading unloading hoses shall be inspected & tested at maximum interval of 6 months as detailed in OISD Standard ; OISD-STD-135 on “Inspection of Loading and Unloading Hoses for petroleum products” and records maintained thereof.

E) STRAINERS AND FILTERS :
Strainers & filters shall be inspected and cleaned as per following frequency, unless sluggish operation warrants earlier inspection:

<table>
<thead>
<tr>
<th>TYPE / LOCATION</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream of Pump Suction</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Upstream of PD meter</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Sprinkler strainer</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>

F) 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.
- Inspection and test of the valve shall be done in as received condition. This is important and helps in establishing the frequency of inspection.
- Provisions of OISD Standard ; OISD-STD-132 on “Inspection of Pressure Relieving Devices” shall be followed.

G. ROTARY EQUIPMENT :

i) COMPRESSORS :
In addition, periodic maintenance checks, as detailed in Annexure-(3) to be followed.

ii) PUMPS :
In addition, periodic checks as detailed in Annexure-(3) 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 as per OEM and Weights and measures requirements.

10.6.2 FIRE FIGHTING EQUIPMENT

Fire fighting equipment shall be inspected and tested as per OISD-STD-142 and record maintained.

10.6.3 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 have 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.

11.0 MANAGEMENT OF CHANGE (MOC)

11.1 INTRODUCTION

Oil depots and terminals are subjected to continuous modifications to achieve higher efficiency, improve operability and safety, 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 addresses the following:

- Minimise the mishaps caused due to non-compliance of procedures.
- Improve optimisation and utilisation of facilities.
- Decrease downtime.
- Increase favourable public opinion.
- Increase knowledge of plants and process activities.

Reference documents OISD-GDN-178  *Guidelines on Management of Change*

11.2 Types of Changes

i. 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 computerised environment

ii. Changes in Operating Procedures

Deviations from the manualised operating procedures / approved SOPs

iii. Changes in Personnel

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

11.3 MOC document shall be processed in respect of any changes taking place at the installations.

The changes could be:

- Permanent
- Temporary
- Emergency
11.4 **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 & Approval Procedure
- Execution of Change
- Commissioning, training & updation of documents

11.5 **MOC Document:**

Whenever changes are envisaged at the installation, 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.

11.6 **Initiating Change Request**

The format *(Annexure-4)* 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, work environment & product quality.
- Compliance to guiding Standards & Regulatory requirements.
- Nature of the change: temporary / permanent, normal / emergency etc.
- Proposed documents incorporating the changes: revised P&ID (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 & emergency response issues.

**A. Scrutiny & Approval Procedure**

The MOC Request will be reviewed & approved / rejected by the appropriate competent authorities as given in the Limits of Authority (LOA) table in *Annexure-(5)*. Any change in the existing process or, new processes are 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 thru’ appropriate checks / evaluations, which may include process hazard analysis and HAZOP (Hazard & 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 thru’ a signed document.

C. Commissioning, Training & Updation of documents

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

As built records with the approved MOC, revised P&ID and layout drawings shall be maintained properly.

12.0 EMERGENCY PREPAREDNESS PLANN AND RESPONSE

12.1 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.

12.2 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.

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

13.1 General

Products handled at the POL installations 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.

13.2 Designated safety officer

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

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

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

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

c) Update and implementation of fire organization chart, Disaster Control Management Plan, Risk Assessment & other statutory plans.

d) Co-ordinate and conduct regular mock drill, DCMP drill, Mutual aid meeting with neighbouring industries/OMCs

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

f) 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.

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

h) Prepare & Monitor periodical compliance status of various audit recommendations.

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

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

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

l) 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.

13.3 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 depot/terminal 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 operators 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-(6).

13.4 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:

13.5 Course director & 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.

13.6 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. Recognise 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 fire fighting 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 programmes. The objective of the programme 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. a) 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. c) Mutual trust and friendliness between trainees & faculty.

iv. d) 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:

i. Programme layout

ii. Selection of faculty

iii. Arranging course material/training aids

iv. Selection of training techniques

v. Field Visits: In case of new entrants, safety devices & 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.

vi. Evaluation methodology

13.7 Guide lines 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 programmes
   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 are to be covered in class rooms 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 & 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. d) Use tables, charts, highlight key points, provide double space between typed lines that help rapid scanning, reading & retrieval.

e. Provide exercises or questions at the end for practice.

f. 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 a job-aid/checklist/references of documents that can be used by trainees back on the job.

**13.8 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 programmes.

**ii) OISD Standards 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.
13.9 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.

13.10 Industrial First Aid

Employees shall be imparted First Aid training by recognised 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/once in 3 years whichever is earlier.

13.11 SAFETY IN GENERAL MARKETING (POL)

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

13.11.1 Course Modules

Area: General Marketing (POL)

Course Code: 401

Intended For: Fresh Entrants (Officers & Supervisors) and transferred employees from other locations

Duration: 2 days

Objective:

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

Course Content:

i) Industrial Safety & Accident Prevention.

ii) Safety Regulations (Statutory and In-Company)

iii) Classification of Hazardous Areas

iv) Work Permit System

v) Hazardous Properties of Petroleum Products

vi) Fire - Causes, Prevention & Control

vii) Fire Protection Facilities - Operation & Maintenance

viii) Personal Protective Equipment

ix) Safety Instruments for Detection of Hazardous Atmosphere

x) Safety in Transportation of Petroleum Products

xi) Safe Operation and Maintenance Procedures

xii) Housekeeping

xiv) First Aid session should be with simulated demonstration.

xv) Supervisor's Role in Safety

xvi) Electrical Safety

xvii) Occupational Health Hazards

13.11.2. Course Module

Area: General Marketing (POL)

Course code: 402

Intended For: All Officers and Supervisors (except those in sales) in Service

Duration: 3 days

Objective:

To refresh and update knowledge on safety and handling of emergencies.

Course Contents:

i) Industrial Safety in Petroleum Industry & Safety Regulation.

ii) Safety Regulations (Statutory and In-company) & Accident Prevention.

iii) Classification of Hazardous Areas

iv) Work Permit System

v) Hazardous Properties of petroleum Products.

vi) Fire - Causes, Prevention & Control

vii) Fire Protection Facilities Operation & Maintenance

viii) Personal Protective Equipment

ix) Safety Instruments for Detection of Hazardous Atmosphere

x) Safe Operation and Maintenance Procedures

xi) Safe Practices in Tank Cleaning

xii) Safety Audit

xiii) Housekeeping

xiv) Disaster Management Plan/Emergency Procedures / Drills

xv) Industrial First Aid

xvi) Supervisor's Role in Safety

xvii) Electrical Safety
xviii) Occupational Health Hazards.

13.11.3 Course Module

Area: General Marketing (POL)

Course code: 403

Intended For: Officers handling Aviation fuel.

Duration: 1 day

Objective:

To update & refresh the knowledge on safety in Aviation operations

Course Content

i) Course Contents of Course Code 403

ii) Hazardous Properties of Aviation Fuel

iii) Safe Operation and Maintenance Procedures with Special Reference to the Following:
   a) Receipt Operations.
   b) Refueling
   c) Work Permit System
   d) Tank Cleaning.

13.11.4 Course Module

Area: General Marketing (POL)

Course Code: 404

Intended For: Officers from Sales Discipline

Duration: 1/2 day

Objective: To update & refresh the knowledge on safety at retail outlets

Course Content:

i) Hazardous properties of petroleum products

ii) Fire – causes, prevention and control

iii) Fire protection facilities – operation and maintenance

iv) Safety regulations (statutory & in-company)

v) Disaster Management Plan/Emergency procedures/drills

vi) Housekeeping

13.11.5 Course Module
Area: General Marketing (POL)

Course Code: 405

Intended For: Office Staff

Duration: 1/2 day

Objective:

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

Course Content:

i) Hazardous Properties of Petroleum Products

ii) Fire-Causes, Prevention and Control

iii) Fire Fighting Facilities Operation & Maintenance

iv) Safety Regulations (Statutory and In-company)

v) Disaster management Plan/ Emergency Procedures/ Drill

vi) Industrial First Aid

13.11.6 Course Module

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 & 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

13.11.7 Course Module
Course Code: 407

Intended For: Workmen at Field Location including contractor staff

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 Petroleum Products.

ii) Safe Operating Procedures

iii) Fire-Causes, Prevention and Control


v) Personal Protective Equipment

vi) Housekeeping.

vii) Emergency Procedures/Drills

viii) Industrial First Aid

13.12 Evaluation of safety training programme.

The evaluation of safety training programmes 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.

13.13 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 programmes attended, performance evaluation (Ref. OISD 154 for details).

14.0 SAFETY INSPECTION/AUDIT

14.1 GENERAL

Safety audit is a well recognised 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 equipments.

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 equipments, 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.
14.2 Objective & 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) Scope 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 (Process, Mechanical, Electrical, etc.) aspect, layout and construction of the plant, operating Inspection & 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 :

- I) Internal Safety Audit
- ii) 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 Office.

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.

14.3 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 organisation/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 4 working days for facilities under each group.

d) Use of safety audit check lists

Check lists are the most useful tool 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 & IDs
- Operating Manuals/SOP
- Maint. / 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 & 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 & 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 judgement 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.

l) 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>S.No.</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 depot/terminal</td>
<td>Safety officer</td>
<td>Daily</td>
<td>Annexure-7</td>
</tr>
<tr>
<td>2</td>
<td>Safety inspection of depot/terminal</td>
<td>In-charge depot / terminal</td>
<td>Monthly</td>
<td>Annexure-7</td>
</tr>
<tr>
<td>3</td>
<td>Electrical audit</td>
<td>Authorised Class A Electrical engineer</td>
<td>Once in 3 years or as per statutory requirement whichever is earlier.</td>
<td>Annexure-8</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 despatch 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, thereafter 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 and General Manager of respective oil company</td>
<td>Two major installations per year</td>
<td>Random Checks</td>
</tr>
</tbody>
</table>
Annexure-1:
Critical Alarm Levels’ logic in Tank

- Overfill Level
- Safe Fill Level (HH)
- High Level (H)
- Normal fill Level

**Note:** Settings to be such that under no circumstances the Safe Fill level is exceeded.
## Annexure: 2

### Checklist for Bulk POL Tank Trucks at Loading Location:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Daily Checks</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether valid licence, Fitness, Calibration and explosives certificates are available in the vehicle?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether the vehicle has two fire extinguishers?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether there are any sources of ignition like matches etc. in the vehicle?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether the vehicle has at least a driver and a cleaner as its crew member?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether the driver has a valid driving licence with endorsement for having undergone training for carrying hazardous goods as per Motor vehicle act.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether approved quality flame arrester provided on the engine exhaust and muffler/silencer is properly bolted without any leaks?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether each compartment of tank is fitted with independent vacuum and pre-operated vents (PV Valve)?</td>
<td></td>
</tr>
<tr>
<td>8</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></td>
<td><strong>Additional Checks:</strong></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether the vehicle has a cut off switch for electrical system?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether there is facility to shut off the drain valves from the cabin in case of emergency?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether the vehicle has First Aid Box, Tool Box and Emergency Lighting?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether the driver has a copy of standing instructions and TERM card?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Whether the exhaust is wholly in front of tank truck and has ample clearance from fuel oil system and combustible material.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Whether all electric wiring is properly insulated?</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whether all junction boxes are sealed properly?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Whether electrical equipments like generator switches, fuses and circuit breakers are located inside the cabin or engine compartment?</td>
<td></td>
</tr>
<tr>
<td>17</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>18</td>
<td>Whether battery terminals have protective rubber covers?</td>
<td></td>
</tr>
</tbody>
</table>

### Checklist for Bulk POL Tank Trucks at Unloading Location:

**Terminals / Depots**

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether valid licence, Fitness, Calibration and explosives certificates are available in the vehicle?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether the vehicle has two fire extinguishers?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether there are any sources of ignition like matches etc. in the vehicle?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether the vehicle has at least a driver and a cleaner as its crew member?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether approved quality flame arrester provided on the engine exhaust and muffler / silencer is properly bolted without any leaks?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether vehicle’s cabin is checked for presence of any flammable / explosive substance being carried by the crew?</td>
<td></td>
</tr>
</tbody>
</table>
### Annexure-3

#### MAINTENANCE SCHEDULE OF CRITICAL EQUIPMENTS

**COMPRESSOR**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td>1.</td>
<td>Check Lube Oil Level of plunger pump unit &amp; top up if necessary.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Check the oil level in the crank case &amp; 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 &amp; 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: (a) Crank case, (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 &amp; motor pulleys.</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 &amp; discharge valves of compressor cylinder</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 &amp; 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>Sl. No.</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td>1.</td>
<td>Check lube oil &amp; top up level if necessary. 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 lube 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: (a) Product pumps (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 OVERSPEEDING.
8. KNOW YOUR ENGINE'S CONDITION.
9. CORRECT TROUBLES WHILE THEY ARE SIMPLE.
10. SCHEDULE AND CONTROL YOUR MAINTENANCE.

### DIESEL ENGINES:

#### "A" CHECK EVERY DAY

<table>
<thead>
<tr>
<th>Sin.</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 &quot;H&quot; 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 PRECLEANER 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>
<tr>
<td></td>
<td>DRAIN AIR RECEIVER TANK AT THE BEGINNING OF EACH SHIFT AND THEN CLOSE THE DRAIN COCK.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CLEAN CRANKCASE BREATHER</td>
<td>DISCARD PAPER TYPE ELEMENT, IF CLOGGED.</td>
</tr>
<tr>
<td></td>
<td>CHECK OIL LEVEL IN HYDRAULIC GOVERNOR,IF PROVIDED.</td>
<td>CHECK FOR LEAKS, USE SPECI- FIED ENGINE OIL FOR TOPPING UP.</td>
</tr>
<tr>
<td></td>
<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></td>
<td>RECORD OIL PRESSURE</td>
<td>REFER O&amp;M MANUAL FOR LUB. OIL PRESSURE LIMITS.</td>
</tr>
<tr>
<td></td>
<td>FILL FUEL TANK AT THE END OF THE</td>
<td>USE CLEAN FUEL AND A STRAIN- NET. ALSO CLEAN.</td>
</tr>
</tbody>
</table>
Shift.

The cap and surrounding area before opening the filler cap.

Note: In addition, diesel engine “B”, “C”, “D” and “E” checks shall be carried out as per manufacturers guide lines.
Annexure-4

Format for **Request for Management of Change**

<table>
<thead>
<tr>
<th>Location:__________________</th>
<th>Request No.: __________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request Date: __________</td>
<td></td>
</tr>
</tbody>
</table>

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 & Statutory Regulations:
6. Nature of Change: Temporary [ ] Permanent [ ] Normal [ ] Emergency [ ]
7. Revised documents as applicable:
   a) P&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:

<table>
<thead>
<tr>
<th>Name &amp; Designation of Initiator</th>
<th>Signature of the Initiator</th>
</tr>
</thead>
</table>

Comments of the Reviewer

<table>
<thead>
<tr>
<th>Name &amp; Designation of Reviewer</th>
<th>Signature of the Reviewer</th>
</tr>
</thead>
</table>

Comments of the Approver

<table>
<thead>
<tr>
<th>Name &amp; Designation of Approver</th>
<th>Signature of the Approver</th>
</tr>
</thead>
</table>
## Limits of Authority (LOA) for MOC : POL Depots & Terminals

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Category of change</th>
<th>Details of change</th>
<th>Addtl. 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 &amp; 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>
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</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 &amp; 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 &amp; 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 filling, repairs to tank roof &amp; tank shell, cleaning of tanks etc.</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</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Category</td>
<td>Description</td>
<td>Responsible Party</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
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<td>-----------------------------------------------------------------------------</td>
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<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 &amp; other IT systems</td>
<td>Opinion of TAS/TFMS vendor, plus Risk Assess. if reqd 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:**

1) 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.
# Annexure-6
## 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</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.</td>
</tr>
<tr>
<td>HSE Orientation for New Hires and transferes</td>
<td>All personnel newly hired or transferred</td>
<td>Within 1 week</td>
<td>None</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</td>
</tr>
<tr>
<td>Incident Investigation &amp; Root cause Training</td>
<td>All Supervisors &amp; 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.</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</td>
</tr>
<tr>
<td>Hazard Identification/Risk assessment training Detailed as well fr officers</td>
<td>All employees</td>
<td>Within 6 months of assignment</td>
<td>None</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>Authorized PTW Issuer &amp; Receiver</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</td>
<td>Upon assignment to a job that requires fire fighting</td>
<td>3 Years</td>
</tr>
<tr>
<td>location and/or the assigned responsibilities of the individual.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annexure-7
Check Lists

Safety Audit  Check List – Depot/Terminal

Location __________________
Audit/ Inspection by ___________________

A. Fire Protection System

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item</th>
<th>Observation</th>
<th>Action Plan</th>
<th>Target date</th>
<th>Review date (status)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Whether water level in static water tank is full and pump suction valves are full open? Check functioning of level gauges (if provided)</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Whether fire hydrant kept pressurized by jockey pumps and pressure (7 kg/sq.cm) Maintained?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Whether fire engine batteries including stand by (if provided) are in good working condition? Periodical health check up of batteries and maintain record.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Whether the fire engine fuel tanks are outside of pump house &amp; full of fuel and away from engine hot exhaust. Check insulation lading on engine exhaust. Check functioning of fuel tank level indicators.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Whether all fire engines are in good working condition? Run one pump and record pressure developed. Check effectiveness of the engine cooling system.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Whether engine trip mechanism is in working condition.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Whether fire engines auto start with pressure drop in hydrant and Engines starts in sequential order as per written down &amp; displayed philosophy.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Check effectiveness of ventilation of covered pump house.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Whether Fire siren (3 km range), Communication system in working condition?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Whether fire pump suction and delivery valves are kept always open?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Whether emergency/DC supply continuously available for fire siren?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Whether automatic hydrocarbon detection system exist at potential leak source of Class A products &amp; functional?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Whether regular frisking of crew members/visitors/contract workmen are done at entry gate and record maintained?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Yes/No</td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Whether DFMD/HH metal detectors at gate are functional and security is trained for proper use?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whether Portable fire extinguishers are in place as per OISD 117?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Whether CCTV provided in the location is functional?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>17</td>
<td>Whether any abnormality noticed at boundary wall/fence?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Whether Spark ignition engine vehicles are allowed up-to admin building in nonhazardous area?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Check work permit in random for the ongoing jobs in the location. Whether the same in line with relevant OISD std and intended jobs. Check presence of supervisor &amp; adequacy of fire fighting system</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Whether any unsafe practice is being followed for construction/operation jobs?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Whether communication system between fire pump house and control room/admin. exist and working?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Whether all operational gates manned adequately? Random Check of emergency gate for any obstruction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Whether Caution signs, speed limit displayed at appropriate places?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Whether control room is manned continuously/during operations?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Whether persons entering/working at hazardous areas are using PPEs?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Whether portable fire fighting equipments are deployed as per OISD 117?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Whether drains from hazardous areas connected to OWS are free from accumulation of Oil?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Whether OWS outlet drain valve remain closed and operates under supervision only?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Whether OWS functioning is effective and final discharge free of Oil?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Check TT parking area for any unsafe practice/activity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Whether illumination at the gate/fire pump house/TT parking area is adequate, random check of lux level after sun set.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Comments on housing keeping.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Any other observations?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Bulk storage area-Tank Farm
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether tank water drain line has double valve segregation and ends are blanked off when not in use?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether tank water draining is done under constant supervision and SOP is in place?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether dyke drain valve provided outside of dyke and kept in closed position?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether dyke drain valves are provided With Position indicator and indicates alarm in C/room on operations (open/close). Random check for effectiveness of it's working.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether earthing terminal connections are apparently rigid and taken below the earth?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether tank level instruments are in Working condition?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether Hydrocarbon detection system are in working condition? (Check periodically by releasing hydrocarbon and record)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Any sign of product leakage/sweating on tank surface, gland leakage etc. check the floating roof deck for any excessive vapour accumulation/leakage/abnormality etc.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether any settlement of tank, cracks on pad observed?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether ROSOV on tank delivery line on remote mode?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether dyke area &amp; underneath of manifold are free from any oil leakage/accumulation.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether isolation valve for TSV/expansion line kept open to facilitate taking care of expansion.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Whether Bonding across flange joints and floating roof deck are rigid.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Check floating roof ladder rails for proper alignment.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whether escape pathway from tank farm is free from obstruction?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Whether road round the dyke is free from any obstruction?</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Whether Hydrant/ Monitors around the dyke are in operational condition?</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Whether fire fighting equipments are deployed as per as per OISD 117?</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Whether illumination after sun set is adequate? (Check &amp; record lux level periodically)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Whether Housekeeping in order?</td>
<td></td>
</tr>
</tbody>
</table>
21. Any other observations?

C. Truck loading/unloading gantry

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether TT maintains speed limit 10 KMPH inside the premises?</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether crewmembers are carrying proper I-cards? (Random check) and wearing PPE.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether spark arrestors are of make and design approved by PESO? (Random check)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether TT engine and master switch being switches off after placement at gantry &amp; wheel chocks are used. Random check of TT cabin for presence of any match stick/flammable substances etc.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether earthing is done on the clit of TT body and not on mud guard/valve/cabin.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether swing ladders are safe for operations and has neoprene pad to avoid metal to metal contact?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether product leakage from valve/flanges/swivel joints observed? Check TT manifold valves for any leakage during loading.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether removal of excess filled product are safely handled? Check if any loose product is stored in the gantry in drums/buckets etc.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether gantry area is free from oil spillage and house keeping is good?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Whether proper bonding exist across flange connection?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether gantry communication system is functional?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether operating personnel are carrying walkie talky?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Whether the emergency shut off switch for pumps are functional? When was last checked.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Whether approach to isolation valve is free from any obstruction?</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Whether approach to hydrant/monitors around gantry are free from any obstruction?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Whether portable fire fighting equipments are deployed as per OISD 117 and in place?</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Whether illumination is adequate for after sunset operations in line with OISD 149? (Record lux level periodically).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Yes/No</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>18.</td>
<td>If hoses are used, visual check of hose condition.</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Check Whether periodical testing (hydrotest &amp; electrical continuity test) of hoses are due.</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Whether loading arms/hoses are secured properly in the gantry after loading operations and does not obstruct TT movement in the gantry?</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Whether emergency escape are marked with signage/display and approach is free from obstruction?</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Whether PPE are being used in gantry by operating personnel.</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Whether SOP is in place.</td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Any other observations?</td>
<td></td>
</tr>
</tbody>
</table>

**D. Wagon loading/unloading gantry**

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Whether loco stops at least 15 mtrs. Short from 1st loading/unloading point?</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Whether physical stopper ensured apart from hand/pneumatic brakes to prevent movement during operations?</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Whether No shunting device/caution boards positioned before start of operations?</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Whether swing ladders are safe for operations and neoprene pad provided to avoid metal to metal contact?</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Whether hydrant system are ready before start of operations?</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Whether only fit wagons having fill pipe are considered for white oil loading?</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Whether splash loading is avoided?</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Whether product leakage From valve/flanges/swivel joints observed?</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Whether removal of excess filled product are safely handled?</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Whether collection of product in open drums and buckets observed?</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Whether gantry area is free from oil spillage and house keeping is good?</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Whether accumulation in drains are observed?</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Whether covers on open drain in place?</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Whether proper bonding exist across flange connection?</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Whether Proper communication exist and functional?</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Whether walkie talky provided to the persons working at gantry area?</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Whether the ESD for automation location or explosion proof remote shut</td>
<td></td>
</tr>
</tbody>
</table>
18. Whether approach to isolation valve is free from any obstruction? Yes/No
19. Whether approach to hydrant/monitors around gantry are free from any obstruction? Yes/No
20. Whether portable fire fighting equipments are deployed as per OISD 117? Yes/No
21. Whether illumination is adequate for after sunset operations in line with OISD 149? (Record measured lux level). Yes/No
22. Whether gantry area is free from oil spillage and house keeping is good? Yes/No
23. Whether hoses are used, visual check of hose condition. Yes/No
24. Whether periodical testing (hydrotest & electrical continuity test) of hoses are due. Yes/No
25. Whether loading arms/hoses are secured properly in the gantry after operations and do not obstruct the wagon movement. Yes/No
26. Whether emergency escape are marked with signage/display and approach is free from obstruction? Yes/No
27. Whether SOP is in place. Yes/No
28. Whether PPE are being used in gantry? Yes/No
29. Any other observations? Yes/No

### E. Product Pump House (loading/unloading)

<table>
<thead>
<tr>
<th>Sin</th>
<th>Item</th>
<th>Observation</th>
<th>Action Plan</th>
<th>Target date</th>
<th>Review date (status)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether electrical connections are apparently sound?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether earthing/bonding connections are apparently sound?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether pressure gauges on pumps/compressors are in working condition?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether pump motor coupling guards are in position?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether connected drain line valves on strainer/line are closed &amp; caps in position?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Whether vales for product circulation are cracked open for loading operations?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Whether any abnormal vibration-excessive noise from pumps motors noticed?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether any visible sign of product leakage from valves/flanges/seals or any unsafe conditions observed?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Observation</td>
<td>Action Plan</td>
<td>Target date</td>
<td>Review date (status)</td>
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<tr>
<td>----------------------------------------------------------------------</td>
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<td>-------------</td>
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<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>1  Whether earthing connection terminals are apparently rigid?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2  Whether laboratory electrical fittings are Industrial type closed/tight metal clad fittings for plug and socket assembly?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3  Whether main electrical circuit are provided with ELCB?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4  Whether compressed gas cylinders are placed outside of laboratory in a well ventilated place?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5  Whether samples of Class 'A' petroleum products are kept in airtight containers?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6  Whether sample containers are stacked Properly?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7  Whether Sample room is free from Oil spillage?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8  Whether sample room is provided with exhaust fan &amp; all electrical fittings are FLP?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9  Whether laboratory is provided with emergency exit with prominent display?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Whether &quot;No smoking&quot; board displayed?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Whether Manual call point/hand siren provided and in place? Random check for effectiveness</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Whether Portable fire extinguishers are in place as per OISD 117?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Whether proper communication system exist and working?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Whether illumination is adequate in line with OISD 149?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Whether SOP is displayed?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Whether Housekeeping in order?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Any other observations?</td>
<td>Yes/No</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### G. Transformer yard

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item</th>
<th>Observation</th>
<th>Action Plan</th>
<th>Target date</th>
<th>Review date (status)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Whether transformer yard is segregated &amp; gate are locked and only authorised person is allowed for entry?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Condition of transformer:</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Grounding OK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>No oil leak</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Silica gel condition ok</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Transformer Oil level ok</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Terminal box earthing ok</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Oil /winding temp ok</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Periodical oil condition testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Whether transformer neutral has been provided with two separate &amp; distinct earthing connection and earthing strips are insulated by HT tape?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Whether the lightning arrestors are Provided to take care surge current.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Whether yard fencing is earthed and bonding provided between gate and fencing?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Whether danger board is displayed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Whether Portable fire extinguishers are in place as per OISD 117?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Whether illumination is adequate in line with OISD 149 after sunset operations.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Whether proper rated hand gloves available and periodical testing is not due.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Whether SOP is displayed?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Whether Housekeeping in order?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Any other observations?</td>
<td>Yes/No</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### H. Electrical Sub Station/switch room

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item</th>
<th>Observation</th>
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<th>Target date</th>
<th>Review date (status)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Whether substation operations are handled by authorised electrician?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Whether earthing/Bonding connections are apparently sound?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Whether updated single line diagram is available?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Whether proper rating insulating mats are provided?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Whether sub Stn/MCC room well ventilated/Exhaust fan provided? | Yes/No
6. Check if any temporary electrical connection existing? |
7. MCC panel condition: |
8. Doors ok and closed |
9. Dust /soot/cobwebs not existing |
10. Whether Portable fire extinguishers are in place as per OISD 117? | Yes/No
11. Whether illumination is adequate in line with OISD 149? | Yes/No
12. Whether proper rated hand gloves available and periodical testing is not due. |
13. Whether SOP is displayed? | Yes/No
14. Whether Housekeeping in order? | Yes/No
15. Any other observations? | Yes/No

**TT Checks required to be carried out on random basis by Officer (Total no of TTs plying in the location shall cover in a quarter):**

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item</th>
<th>Observation</th>
<th>Action Plan</th>
<th>Target date</th>
<th>Review date (status)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether driver undergone training on &quot;safe driving practices&quot; &amp;&quot;transportation of hazardous goods&quot;?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Comments on assimilation of above training/knowledge.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether crew members posses TREM card/detailing instructions on handling emergencies en route and understand the contents?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether master switch control is easily accessible to enable electrical circuits to be isolated and fitted close to Battery?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Whether batteries are effectively protected against contact with any spillage of flammable liquid and be fitted with an insulator cover to protect against inadvertent contact by objects which could cause a spark?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Electrical wiring is insulated and provided with suitable over current protection in the form of fuses/automatic circuit breaker etc have been provided.</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>and Exhaust is wholly in front of the TT? Whether spark arrester of make and design approved by PESO is properly fitted and Exhaust is wholly in front of the TT?</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Check that all electrical wiring through</td>
<td>Yes/No</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10. Whether TT is carrying a fully equipped first aid box and FLP emergency light?  Yes/No  
11. Whether Proper Safety Fittings (PV vent, Master valve, fusible link etc.,) are in place? Check the testing certificate of PV vents.  Yes/No  
12. Whether TT is having any visible dent on the body?  Yes/No  
13. Whether any visible leak observed from valves/flange joints?  Yes/No  
14. Check for ladder at rear end and catwalk are intact and in position.  Yes/No  
15. Check that width of tank body is less than cabin width.  Yes/No  
16. Whether fire extinguishers are ISI approved and periodical testing/refill are carried out?  Yes/No  
17. Demonstration by crew members on operation of fire extinguishers.  Yes/No  
18. Check for valid PESO licence and authenticated copy of tank truck drawing.  Yes/No  
19. Check adaptation of roll over design for protection of manhole fittings in case of TT overturning.  Yes/No  
20. Check for Calibration certificate, physical verification of dip rod for correctness of dip marking, condition W & M seals on manholes.  Yes/No  
21. HAZCHEM sign, name of contractor with address and telephone No. displayed prominently  Yes/No  
22. Random check, during TT calibration, the compartments and fittings are fabricated in line with OISD STD 167. Any deviation shall be recorded and rectified immediately.  Yes/No  
23. Any other observations?  Yes/No
Annexure-8

ELECTRICAL AUDIT OF INSTALLATION

LOCATION _____________                     Dated ____________

AUDIT/ INSPECTION BY ______________________

<table>
<thead>
<tr>
<th>S.No.</th>
<th>ITEM DESCRIPTION</th>
<th>AUDITORS REMARKS</th>
</tr>
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A. ELECTRICAL SUBSTATION/ SWITCH ROOM

A-01 Is painted line diagram of power/ lighting distribution provided.
A-02 Is the equipment easily accessible for operation, inspection & maintenance.
A-03 MCC Panel condition :
   a) Doors okay and closed
   b) Dust/soot/ cobwebs not existed
   c) Lugs existing at each cable, termination not loose.
   d) Visual condition of switch contact fuse etc. O.K.
   e) Control wiring condition satisfactory.
   f) Jumper condition between bus and distribution okay.
   g) Grounding OK
   h) Alarm/ trip circuit working.
A-04 Live parts of equipment made inaccessible by barriers/ shrouds.
A-05 No temporary electrical connection existing.
A-06 Condition of cable duct
   a) Cables are on rack
   b) Cable deck clear
   c) Sealing of duct
   d) Cable identification tags.
A-07 Insulation mats (with ISI mark) existing are enough in number.
A-08 Protective relays set at recommended values.
A-09 All fuses are of proper type and rating as specified in single line diagram.
A-10 Fire extinguishers are of proper type and are in working condition.
A-11 Lighting condition OK (fixtures/ tubes/ switches etc.)
A-12 Emergency lighting system in order.
A-13 All energized equipment provided with caution boards.
A-14 Condition of transformer :
   a) Grounding OK
   b) No oil leak
   c) Silica gel OK
   d) Oil level OK
   e) Terminal box earthing OK
   f) Oil/winding temp. OK
   g) Periodic oil quality test conducted.
A-15 Whether location/type of transformer in conformity with area classification drawings.
A-16 Housekeeping is good.

B. MOTORS IN PUMP HOUSE/ COMPRESSOR ROOM
B-01 Is double independent earthing connection for all motors provided.
B-02 Is grounding wire OK (not loose).
B-03 a) Is terminal box and gland OK Flame-proofness maintained and not tampered.
   b) Existing cable termination are proper
B-04 a) Is push button earthed properly and flame proof condition not tampered.
   b) General condition of push button good.
B-05 Ground resistance at motor/ push button measured and found okay.
B-06 No motor abnormality Vibration/ bearing condition, faulty guard, fan condition, excessive noise, high body temperature.
B-07 Existing preventive maintenance schedule OK.
B-08 a) Earthing resistance test schedules/ records satisfactory.
   b) Earthing pit condition OK
B-09 First-aid chart for treating electrical shocks displayed prominently in MCC room.

C. UNIT LIGHTING

C-01 All lighting fixture flame proof as per area classification.
C-02 Whether flame proof condition of fixtures ensured ?
C-03 Whether proper earthing of fixture provided ?
C-04 Condition of wiring good.
C-05 Does water enter and accumulate in fixture distribution boxes etc ?
C-06 Whether lighting DB, switches, MCB well maintained ?
C-07 Any other unsafe point observed.

D. MAST LIGHTS (AREA LIGHTING)

D-01 Whether grounding of mast OK ?
D-02 Condition of junction boxes, switch board, fuses etc. OK
D-03 Approach to electrical installation and ladder good and safe.
D-04 Condition of flood lights :
   a) Is gasket present ?
   b) Is glass cover in good condition ?
   c) Is control gear condition OK
D-05 Is earthing electrode of mast OK and its connection with mast proper ?

E. TANFARM AREA, PIPELINES, LOADING/UNLOADING GANTRY

E-01 Are pipelines provided with flange earth jumper connection for electrical continuity?
E-02 Are earthing provision on storage tanks well maintained ?
E-03 Condition of grounding electrode OK
E-04 Continuity of location, hoses maintained.
E-05 Grounding resistance at inlet of grounding connection checked/ date
E-06 Connection of earth-bonding of railway track OK.

F. GENERAL

F-01 a) Area classification drawings duly approved by PESO?
   b) Conditions if any, specified by PESO for electrical substation, switch room etc. and their compliance.
F-02 Certificate in respect of FLP for each electrical equipment- records maintained.
F-03 Earthing network diagram available and site checks done from time to time.
F-04 Records for electrical testing/ checks maintained upto date.
F-05 Work permit system is effective and records are maintained.