STORAGE AND HANDLING OF PETROLEUM PRODUCTS AT DEPOTS AND TERMINALS INCLUDING STANDALONE CRUDE OIL STORAGE FACILITIES

Prepared by

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Preamble

Indian petroleum industry is the energy lifeline of the nation and its continuous performance is essential for sovereignty and prosperity of the country. As the industry essentially deals with inherently inflammable substances throughout its value chain — upstream, midstream and downstream — Safety is of paramount importance to this industry as only safe performance at all times can ensure optimum ROI of these national assets and resources including sustainability.

While statutory organizations were in place all along to oversee safety aspects of Indian petroleum industry Oil Industry Safety Directorate (OISD) was set up in 1986 Ministry of Petroleum and Natural Gas, Government of India as a knowledge centre for formulation of constantly updated world-scale standards for design, layout and operation of various equipment, facility and activities involved in this industry. Moreover, OISD was also given responsibility of monitoring implementation status of these standards through safety audits. In more than 25 years of its existence, OISD has developed a rigorous, multi-layer, iterative and participative process of development of standards — starting with research by in-house experts and iterating through seeking & validating inputs from all stakeholders — operators, designers, national level knowledge authorities and public at large — with a feedback loop of constant updation based on ground level experience obtained through audits, incident analysis and environment scanning.

The participative process followed in standard formulation has resulted in excellent level of compliance by the industry culminating in a safer environment in the industry. OISD — except in the Upstream Petroleum Sector — is still a regulatory (and not a statutory) body but that has not affected implementation of the OISD standards. It also goes to prove the old adage that self-regulation is the best regulation. The quality and relevance of OISD standards had been further endorsed by their adoption in various statutory rules of the land.

Petroleum industry in India is significantly globalized at present in terms of technology content requiring its operation to keep pace with the relevant world scale standards & practices. This matches the OISD philosophy of continuous improvement keeping pace with the global developments in its target environment. To this end, OISD keeps track of changes through participation as member in large number of international and national level Knowledge Organizations — both in the field of standard development and implementation & monitoring in addition to updation of internal knowledge base through continuous research and application surveillance, thereby ensuring that this OISD Standard, along with all other extant ones, remains relevant, updated and effective on a real time basis in the applicable areas.

Together we strive to achieve NIL incidents in the entire Hydrocarbon Value Chain. This, besides other issues, calls for total engagement from all levels of the stake holder organizations, which we, at OISD, fervently look forward to.

Jai Hind!!!

Executive Director
Oil Industry Safety Directorate
NOTE

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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, 113 OISD standards, recommended practices and guidelines are applicable to the Oil and Gas installations of both Private and Public Sector Oil & Gas Companies in India. 11 of these standards are mandatory for the entire Oil & Gas sector by dint of their being included in the Petroleum Rules 2002, Gas cylinder Rules 2004 and SMPV(U) Rules 1981.

Few serious incidents that had occurred in the recent past in India and abroad including vapour cloud explosion, major fires, loss of containment etc. triggered the need to review the existing provisions of various guidelines and statutory requirements.

With the above in view, Government of India advised Oil Industry Safety Directorate to develop a comprehensive standard covering all the facets of Marketing Operations namely Safety in Design, Operations, Maintenance & Inspection etc. with the objective to strengthen the existing safety management system.

This document on “storage and handling of petroleum products at depots and terminals including standalone crude oil storage facilities” has been prepared based on existing standards, guidelines & recommended practices of OISD, the learning’s from the recent major incidents, the accumulated knowledge and experience of industry members in India and up-dation of National and International codes and practices.

The provisions of this comprehensive standard, upon its implementation in true spirit, would go a long way in enhancing overall safety standard and reduce incidents in the respective Installations of the Operators.

The document, as per the extant practice, will be reviewed periodically for improvements based on the acquired new experiences and better understanding. Suggestions are invited from the users after it is put into practice to refine the document further.

We deeply appreciate the role played by the Industry Members, experts in the field, and team members of OISD who were actively associated with the development of this standard including the advice & guidance of Committee of Chairmen in further enriching the same. The standard has been approved for execution in the 31st Safety Council Meeting.

Suggestions may be addressed to:

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This standard in no way supersedes the statutory requirements.
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On  
“Storage and handling of Petroleum products at depots and terminals  
including standalone crude oil storage facilities”

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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, there after 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, Terminals and standalone Crude oil storage Terminals.

2.2 This standard does not cover:-

a) Tank farms, loading / unloading (Tank Truck / Rail) and allied facilities located inside the Refineries and/or Oil/Gas Processing Plants under the same management & within the same boundary, for which, OISD-STD-118 and OISD-STD-116 shall be referred for layout and fire protection facilities respectively.

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

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

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

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

f) Aviation Fueling Stations

2.3 Provisions of this standard shall be applicable to all petroleum depots and terminals. However, certain exceptions have been defined for certain clauses (6.1.e, 6.1.f, 6.3.d, 6.3.i, 6.4.5.f & 6.4.6 (note)) in this standard which are not applicable for existing facilities, equipment, structures or installations that are already in place, that are in the process of construction, or that are installed before the date of publication of this standard.

However, any additional facility put up within the battery area of such locations, where the above exceptions or part of the above exceptions are sought for / exists, must meet the provisions of the standard.
2.4 Wherever specified in the standard, the use of equivalent or superior performance systems/methods to those already prescribed in the standard, should be considered, provided these equivalent systems/methods are duly approved by a technical committee constituted by OISD, based upon technical documentation, performance record and field demonstration by the user industry.

2.5 The salient features of fire protection facilities for petroleum depots and terminals are listed in this STD, however, for details, OISD STD 117 shall be referred.

2.6 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 extinguishing medium 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 oxidation reaction liberating more energy than is dissipated through conduction and convection.

- Lower explosive Limit (LEL)

Is the minimum concentration of a vapour 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 vapour in air. This is also referred as Lower Explosive Limit (LEL).

- Upper Explosive Limit (UEL)

Is the maximum concentration of a vapour 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 vapours 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/IEC:60079-1)

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 Flammarion 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/IEC: 60079-11 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 do 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

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 facilities/mimic panel.

Fire Water pump house

A building/shed housing fire water pumps (electrical / diesel driven) including 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 for storing retention samples, packed additives, flammable materials etc.

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

ELECTRICAL SUB STATION
Electrical 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.
- Diesel Generating Set
- Apparatus for distribution viz MCC etc.
- 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.

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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 Hazards 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 Kerb 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 as per PESO / statutory requirements.

  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)**
  
  Pump-able 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 RULES / REGULATIONS

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:

- Central Electricity Authority (CEA) Regulations, 2010 made under Indian Electricity Act.
- 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, handled or stored at or 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-

Zone-0:

An area in which a flammable atmosphere is present continuously or is likely to be present for long periods. Examples are vapour space above closed process vessels, storage tanks or closed containers, areas containing open tanks of volatile, flammable liquids etc.

Zone-1:

Area in which an explosive gas/mixture is likely to occur in normal operation. Zone-1 locations may be distinguished when any of the following conditions exist:

- Flammable gas or vapour concentration is likely to exist in the air under normal operating conditions.

- Flammable atmospheric concentration is likely to occur frequently because of maintenance, repairs or leakage.

- Failure of process, storage or other equipment is likely to cause an electrical system failure simultaneously with the release of flammable gas or liquid.

- Flammable liquid or vapour piping system containing valves, meters, screwed or flanged fittings are in an inadequately ventilated area.

- The area below the surrounding elevation or grade is such that flammable liquids or vapours may accumulate therein.

The zone-1 classification typically includes:

i) Imperfectly fitted peripheral seals of floating roof tanks.

ii) Inadequately ventilated pump rooms for volatile, flammable liquids.

iii) Interiors of Sample Retention Room/ Cabinet as part of quality control laboratories, refrigerators and freezers in which volatile flammable materials are stored in lightly stoppered or easily breakable containers.

iv) API Separators / OWS

v) Oily waste water sewer/basins

vi) Areas in the immediate vicinity of vents and filling hatches.
Zone-2:

Areas in which an explosive gas/air mixture is not likely to occur in normal operation and if it occurs it will exist only for a short time.

Zone-2 locations may be distinguished when any one of the following conditions exists:

- The system handling flammable liquid or vapour is in an adequately ventilated area and is so designed and operated that the explosive or ignitable liquids, vapours or gases will normally be confined within closed containers or closed systems from which they can escape only during abnormal conditions such as accidental failure of a gasket or packing.

- The flammable vapours can be conducted to the location as through trenches, pipes or ducts.

- Locations adjacent to Zone-1 areas.

- In case positive mechanical ventilation is used, the failure or abnormal operation of ventilating equipment can permit atmospheric vapour mixtures to build up to flammable concentrations.
6.0 INSTALLATION LAYOUT DESIGN

6.1 LAYOUT PHILOSOPHY

Following philosophy should be adopted in layout of an installation:

a) Presence of ignition source shall always be contemplated beyond the boundary wall of installation.

b) 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.

c) 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. Minimum road width of 3.5 mtrs should be provided for one way movement.

d) 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.

e) 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. For existing locations, wherever it is difficult or not practicable to implement due to severe space constraint, QRA shall be conducted and mitigation measures shall be implemented.

f) Road widths, gradient and turning radii at road junctions shall be designed to facilitate movement of the fire-fighting vehicle envisaged in the event of emergency. Minimum road width of 3.5 M should be maintained. For existing locations, wherever it is difficult or not practicable to implement due to severe space constraint, QRA shall be conducted and mitigation measures shall be implemented.

g) Rail spur should be located close to the boundary of the installation to minimise road/pipe crossings and blockage of roads during shunting.

h) Layout should consider the space requirements for

- Maintenance and inspection of each equipment / facility.
- Dedicated area for construction activities.
- Future expansion for addition of facilities.

i) 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 Petroleum and Explosives Safety Organization (PESO) approved spark arrestor fitted on the vehicle.

j) 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 all applicable affecting aspects and not limiting to following:

- Storage tanks, utility requirements.
- Product receipt / dispatch and mode of transport (Rail, Road, Pipeline and Tanker/Barge).
- Warehouses, storage areas for 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, slope, 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 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. There shall be no structure in close vicinity that would fall on the control room in case of a blast.

c) For control room inter-distances, refer table no 1. In case it is unavoidable to comply with these requirements, the control room shall be made blast resistant and construction shall be 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 clause 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 Central Electricity Authority (Latest Regulations -2010/as amended).

g) High Tension (HT) line and HT sub-station(s) shall be terminated / located outside the hazardous area (For Distance refers 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 / unloading facilities should be located along the boundary of the installation. In case Tank wagon (TW) unloading facilities are located outside of installation boundary that shall also have a boundary wall as per MOHA / Government Guidelines.

This clause shall be applicable only to the locations conceived after the publication of this standard. However, at existing locations, wherever implementation of this clause is feasible, the same must be complied.

Standalone unloading siding at existing locations wherever implementation of this clause is infeasible due to space constraint, at least suitable fencing to be provided in order to have access control. Alternately, Quantitative Risk Assessment (QRA) shall be carried out and suggested control / mitigation measures shall be implemented.

j) Drain shall be provided around the TT gantry loading platform area to collect product due to accidental spill over / leakage and shall be routed to OWS/ETP. The drains shall always be maintained clean.

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 Oil storage Terminals / Depots.

n) Firewater storage & firewater pump house should 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 fire water 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 should be located at upwind of hydrocarbon storage & handling facilities. These shall be located 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.

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q) Room for hydrocarbon 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 explosive meters / 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 shall 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 KL for a group of fixed roof tanks.
- 120,000 KL 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 breaks 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.

However, construction of dyke exceeding 2 M may be considered where there is severe constraint on space availability subject to approval from PESO case to case basis. In such case, additionally following conditions must be fulfilled:

a. Total dyke capacity shall be based on containment of largest tank capacity.
b. Monitors on raised platforms, if required, shall be provided so that throw of the monitors are not restricted.
c. All the tanks inside such dyke shall be provided with sprinkler system, irrespective of the tank dia.
d. Tank farm area shall be covered through CCTV surveillance system and same shall be continuously monitored.

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

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

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

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 through 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 300 mm 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 M from electrical 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- corrotable 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.

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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.

- Grouping of petroleum products for storage shall be based on the product classification. Class-A and Class-B petroleum may be stored in the same dyked enclosure. When Class–A and Class–B are stored in common dyke, the fixed water spray system shall be provided on all tanks except for small installations as mentioned in clause 9.2.2.g and the Rim seal fire detection and extinguishing system shall be applicable only to floating roof tanks on Class – A service.

- Class-C petroleum should preferably be stored in separate enclosure.

- However, where Class-C petroleum is stored in a common dyke along with Class-A and/or Class-B petroleum, the fixed water spray system shall be provided on all Class C tanks irrespective of diameter except for small installations as mentioned in clause 9.2.2.g.

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 KL capacities 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.

To meet the objective, all installations shall be provided with boundary wall with gates and sluice gates on drain. Pipe line openings etc shall be sealed. 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 KL 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 KL 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 layout design inside tank dyke area should ensure easy accessibility for any operations in the tank farm. Elevated Catwalks above the height of the dyke wall shall be provided for safe access and exit in case of normal / emergency situations. The catwalks shall run at the same level and terminate directly outside the dyke.

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

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

e) Properly laid out road shall be provided for easy access on all four sides of each dyke.

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 3 M height from either side of boundary wall 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 (viz. Tank farm, TT/TW operating area, product pump house, fire water pump house etc) which shall be monitored continuously.

The CCTV monitoring station shall be provided in control room, Security cabin and in-charge room. The CCTV data shall be stored for a minimum period of 60 days or in line with prevailing IB norms.

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 through chain link fence/boundary wall
   • Separate entry and exit gate with access control.
   • Parking lane demarcation / slotting to ensure independent & quick evacuation in emergency.

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For existing locations, wherever the parking area is inadequate due to space constraint, proper monitoring of vehicle parking / movement shall be ensured in liaison with local administration.

g) Hydrocarbon (HC) detectors shall be installed near all potential leak sources of class “A” petroleum products i.e tank dykes, tank manifolds and 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 KL 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 KL 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.

Note: Separation distances as given in the enclosed tables in this Std. shall be applicable for all new and upcoming locations. For existing locations which do not meet the stipulated safety distances, following provisions & measures shall be in place:

1. Provision of sprinkler & fixed or semi fixed foam system for storage tanks -(Refer clause- 9.2.2.k).

2. For other facilities where inter distance is not meeting in existing locations, necessary Quantitative Risk Assessment (QRA) carried out and suggested control / mitigation measures shall be implemented.

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<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control Room (Note –1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control Room</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></td>
<td>Note-2</td>
<td>Note-4</td>
<td>Note-4</td>
<td>30</td>
<td>60</td>
<td>60</td>
<td>T2</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>60</td>
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<tr>
<td>3</td>
<td>Storage Tank Class-B</td>
<td></td>
<td>Note-3</td>
<td>Note-4</td>
<td>Note-4</td>
<td>30</td>
<td>60</td>
<td>60</td>
<td>T2</td>
<td>30</td>
<td>50</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Storage Tank Class-C</td>
<td></td>
<td>30</td>
<td>Note-4</td>
<td>Note-4</td>
<td>Note-4</td>
<td>30</td>
<td>60</td>
<td>30</td>
<td>T2</td>
<td>30</td>
<td>50</td>
<td>15</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>60</td>
<td>Note-6</td>
<td>T2</td>
<td>30</td>
<td>30/50*</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Fire water storage and pump house</td>
<td>12</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>X</td>
<td>30</td>
<td>X</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></td>
<td>X</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>Note-6</td>
<td>30</td>
<td>X</td>
<td>20</td>
<td>6</td>
<td>50</td>
<td>6</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>X</td>
<td>20</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 / effluent Treatment Plant / Oil sludge pit</td>
<td>30</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>30/50*</td>
<td>50</td>
<td>50</td>
<td>15</td>
<td>50</td>
<td>X</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>11</td>
<td>Electrical Sub Station</td>
<td></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>
</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>

* OWS to bulk loading / unloading POL (Rail) = 30 Mtrs and OWS to bulk loading / unloading POL (Road) = 50 Mtrs
Distance of product pump house (loading/unloading) from utilities and electrical substation shall be 30 mtrs. Respectively.
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
e) For facilities not listed in table -1 of OISD STD 244 like fire station, OISD STD 118 shall be referred.

Specific notes to Table-1:

Note-1: These distance norms are applicable to the locations where product receipt is through cross country pipelines. At all other locations, the building / room housing the automation equipments /system shall be treated as utility building for the purpose of separation distance. 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 trucks 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 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 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 Min 20 m</td>
<td>0.5 D Min 20 m</td>
<td>20</td>
<td>10</td>
<td>X</td>
<td>X</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;A) or (A&amp;B) or (B&amp;B)</th>
<th>Between fixed Roof Tanks Class –(A&amp;A) or (A&amp;B) or (B&amp;B)</th>
<th>Between fixed and Floating roof Tanks Class- (A&amp;A) or (A&amp;B) or (B&amp;B)</th>
<th>Between Class C Petroleum Storage tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All tanks with Diameter up to 50 meters</td>
<td>(D+d) / 4 or Min 10 m</td>
<td>(D+d) / 4 or Min 10 m</td>
<td>(D+d) / 6 or Min 6 m</td>
</tr>
<tr>
<td>2</td>
<td>Tanks with Diameter exceeding 50 meters.</td>
<td>(D+d) / 4</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;
   - Floating roof tanks having protection for exposure
   - Tanks with weak roof-to-shell joint having approved foam or inert gas 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>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>
</tr>
<tr>
<td>2</td>
<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>
</tr>
<tr>
<td>3</td>
<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>
</tr>
<tr>
<td>4</td>
<td>Tank vehicle Loading / unloading Class – A</td>
<td>15</td>
<td>9</td>
<td>9</td>
<td>X</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Tank vehicle Loading / unloading Class – B</td>
<td>15</td>
<td>4.5</td>
<td>4.5</td>
<td>9</td>
<td>X</td>
<td>4.5</td>
<td>1.5</td>
<td>4.5</td>
<td>4.5</td>
</tr>
<tr>
<td>6</td>
<td>Tank vehicle Loading / unloading Class – C</td>
<td>15</td>
<td>4.5</td>
<td>X</td>
<td>9</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Flame proof Electric motors</td>
<td>3</td>
<td>3</td>
<td>X</td>
<td>3</td>
<td>1.5</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>Non Flame proof Electric motors</td>
<td>15</td>
<td>4.5</td>
<td>X</td>
<td>9</td>
<td>4.5</td>
<td>X</td>
<td>3</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>Office building, stores, amenities</td>
<td>15</td>
<td>D Min 4.5</td>
<td>0.5 D Min 3.0</td>
<td>9</td>
<td>4.5</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>Boundary wall</td>
<td>15</td>
<td>D Min 4.5</td>
<td>0.5D Min 3.0</td>
<td>9</td>
<td>4.5</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
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 / IS 803 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 shall be 1.3 cm and maximum gap area shall 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 APPURTEANCES

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).

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iv. **Walkway on the Roof**

Walkway with handrail on the roof of the tank should be provided to facilitate inspection/checking of vents/ flame arrester 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 in the event of opening the valve. Refer 9.3.B for details.

#### 7.6.2 Tank Manifold

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

Tank body valves on process lines (inlet, outlet & recirculation) of all storage tanks storing class – A & B products 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.

Tank body valves including remote operated shut off valves (ROSOVs) should remain shut after closure of day operations.

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 actuator shall be fail-safe. The cables leading to the control room shall be fire resistant.

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.

MOV shall have open & close remote operation from control room and at field outside of dyke.

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 rise of temperature.

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TSV outlet line or expansion line shall be connected back to tank shell / tank inlet / outlet line before ROSOV with suitably positioned isolation valve(s). One isolation valve on TSV outlet line or expansion line shall be installed close to the tank shell / inlet / outlet line to the maximum extent possible.

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 through vapour space with provision of siphon breaker on top.

Termination of expansion line on tank roof top shall not be allowed as free fall through vapour space is unsafe.

However, at existing locations where ever the above provision does not exist, the same shall be provided on all tanks during scheduled tank maintenance / cleaning.

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/HC detectors/ PESO approved ex-proof water flow switch /ex-proof pressure transmitter 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.

iv) Crude tanks may be provided with side entry swivel angle type mixers.
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. Number 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. Ends of each drain point should have provision of blind flange / capping arrangement.

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 of roof drain(s) 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 spill 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

The breather valves for the blanketed tanks and low pressure tanks shall be provided as per API STD 650 and API STD 620 respectively. 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 floating roof 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 safety instrumented function for the tank including overfill protection shall be meeting the requirement of Part 1 of IEC 61511. All instrumentation equipment shall have required SIL certification based on the above study.

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

ii) Level controls on Tanks

Level controls on the tank shall be provided as under:

High Level (H), High High Level (HH) alarms: The tanks shall have provision of level instruments for sending audio visual alarms to the control rooms. All the alarms shall be of different type so that the “H” level alarm, “HH” alarms can be distinctively identified.

Level for “H” and “HH” alarms shall be decided based on site specific operating parameter i.e diameter of tank, flow rate and operators response time for corrective measures to stop product level
reaching curb angle/maximum floating position. However these levels shall be lower than the level corresponding to PESO approved safe filling capacity.

Independent level switch shall be provided at the “HHH” which in any case shall not be above the level corresponding to PESO approved safe filling capacity of the tank.

The level switch shall enable initiation of action for closure of the respective ROSOVs, MOVs and product pumps so that the entire receipt operation closes on safe mode and the product does not over flow.

Instruments to be provided:

“H” Level and “HH” level:

Two nos independent level instruments shall be provided out of which one instrument shall be of radar gauge type and other one shall be either Servo type or radar type. Each of the instruments shall have provision both for “H” and “HH” alarms. Provision shall be made in the system configuration for transmitting only two signals (one for “H” and one for “HH”). The signals i.e “H” & “HH” from each level instrument shall be available parallel in the control room using OR gate PLC logic.

Over spill Level switch: An independent hardwired level switch like Vibrating Fork etc. shall be provided for actuating ROSOV. Over spill level switch should be connected to ROSOV through safety PLC for SIL loop compliance.

The above clauses are applicable for all storage tanks storing Class A/B products.

For tanks storing class –C products two nos independent level instruments shall be provided out of which one instrument shall be of radar gauge type and other one shall be either servo type or radar type. Each of the level instruments shall have provision for both “H” and “HH” alarms. Signal transmitting shall be as explained above.

This clause as above shall be applicable to all new locations and the storage tanks constructed after publication of this standard. In respect of the existing locations, provision shall be made for installing additional level instruments whenever the tanks are taken out of service for cleaning / maintenance schedule at the earliest opportunity.

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) Tank farm management system integration:

TAS (terminal automation system) including TFMS (tank farm management system) shall be integrated with software for back up at remote location (DRC) with provision for recording of all critical events in the system. Back up data shall be retained for a minimum period of 30 days. In the event, the backup data is proposed to be stored within the same installation; the room for storing the backup data shall be blast resistant at a secured place.

iv) 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.

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Insulation shall be provided for heat conservation. The tanks having higher surface temperature shall have insulation up to 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 API 5L or equivalent as applicable.

Pipe joints should be welded as far as practicable with full penetration weld. Number of flanged or threaded joints should be kept to a minimum.

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

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

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

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

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

Valves:

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

Fittings:

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

Slip on or weld neck flanges should be used.

Screwed flanges for sizes 50 mm or smaller may be used.

Steel flanges should conform to the applicable provisions of ASME B 16.5 or equivalent.

Steel screwed fittings and couplings shall conform to ASME B 16.11 or equivalent.

Steel unions shall have ground metal to metal seats. Gasket type unions shall not be used.

Plugs shall be of steel. Cast iron or brass plugs shall not be used.

Electrical continuity across flange joints shall be maintained by providing metallic gaskets or jumpers.

7.13 BULK LOADING / UNLOADING OPERATIONS

i) Loading / unloading Pumps

- Pumps conforming to relevant API standards shall be used.
- Product pumps shall be provided with suitable sized strainers on suction and NRVs on discharge lines. All drain points of strainers shall be provided with double isolation valve and ends having provision for blind flange / screw capped

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Pumps shall be located in an exclusive paved area with drainage facilities routed to OWS / ETP.

Tank lorry loading / unloading pump house shall be positioned at an elevated level 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 through 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.

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

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 / auto recirculation valve / 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 Gantry.

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

The provision for Kerosene and MS / Naptha loading in TT (Tank truck) 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 raling 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.

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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.

Sampling points shall be provided at the farthest end of the gantry as per requirement of Industry Quality Control Manual (IQCM)

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. Alternately, the existing headers may be utilized for immediate decantation of product from sick wagons by providing suitable arrangements in the manifold.

- A portable pump with flame proof / explosion proof motors and other electrical fittings to be used with suitable flexible hose connection for quick withdrawal of products into sump tanks. Such drained products to be handled further as per IQCM (Industry Quality Control Manual)

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/zones 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.

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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, the outer PVC sheath of all cables used inside the dyke shall be fire retardant type conforming to category AF as per IS: 10810. 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 / XLPE 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. Earth resistance also can be measured through Direct Earth Clamp Tester (DECT)

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.

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

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

Earth resistance can be directly read through an earth test Megger which has associated Test, auxiliary Current and Potential electrodes. This instrument which is a combination of ohmmeter and generator works on ‘fall of potential’ principle. Test voltage is derived from the generator of the Megger.

B. INSTALLATION EARTHING

Installation earthing design shall be carried out in accordance with the requirements of Central Electricity Authority Regulations -2010 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:

i) System neutral earthing.
ii) Protective Equipment Earthing for personnel safety.
iii) Protection against Static discharges.
iv) Lightening Protection
v) 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 Arrestor (LA) of the Two Pole/ Four Pole structure shall be connected to two distinct earth pits. The strips shall run on insulators / isolators so as not to come in contact with the Pole structure. Connections shall be made to the pit directly and then pits will be connected to each other to form a grid. The Grid of LA shall be distinct and shall not be connected to any other earth Grid.

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

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

The Neutral of the Transformer shall be earthed with two distinct earth pits separately. Connections will be made to the pit directly and then pits will be connected to each other to form a grid. This Grid 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.

Product 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 up-to 60 meter perimeter 2 Nos earth pits shall be provided for above 60 meter perimeter and up-to 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 corrodible metal crocodile clips are to be used, the crocodile clips being attached to the tank-truck under loading or discharging. (For External Bonding of Loading unloading arms hose with the Tank Truck).

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

D. STATIC EARTHING

Static Earthing (earthing for static charge dissipation) shall be provided at Tank Lorry / Wagon Filling / Decantation Gantry, to prevent building up of Static Charges.

Earthing connections for static charge dissipation, electrical system, structure and instrumentation system shall be separate from each other. However, these separate leading strips can be connected with main grid below the ground.

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 (having min thickness 4.8 mm) 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. (Refer OISD Std 173).

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 (Radio frequency interference) suppression filters fitted to the data processing equipment may produce high earth leakage current. In such cases failure of protective earth connection may lead to high touch voltages.

Wherever 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 on 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>50 mm x 6 mm GI strip</td>
</tr>
<tr>
<td>Lightening Arrester of the 2/4 Pole Structure</td>
<td>40 mm x 6 mm GI strip</td>
</tr>
<tr>
<td>2/4 Pole structure / Sub-Station equipments / VCB etc</td>
<td>40 mm x 5 mm GI strip</td>
</tr>
<tr>
<td>Fence of the 2/4 pole structure / transformer yard</td>
<td>25 mm x 3 mm GI strip</td>
</tr>
<tr>
<td>Power Transformer Neutral</td>
<td>50 mm x 6 mm GI strip</td>
</tr>
<tr>
<td>Power Transformer Body</td>
<td>40 mm x 6 mm GI strip</td>
</tr>
<tr>
<td>Fire Water Pump House</td>
<td>25 mm x 6 mm GI strip</td>
</tr>
<tr>
<td>Building / Structure Columns</td>
<td>40 mm x 5 mm GI Strip</td>
</tr>
<tr>
<td>Storage Tanks</td>
<td>40 mm x 5 mm 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>40 mm x 6 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>Neutral of the transformer</td>
<td>2 Nos independent</td>
</tr>
<tr>
<td>Neutral of the D G Set</td>
<td>2 Nos independent</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</td>
<td>2 Nos for each structures</td>
</tr>
<tr>
<td>unloading Gantry / Air Compressor / Engg Store etc.</td>
<td></td>
</tr>
<tr>
<td>Static Earth for Loading / unloading Gantry (Tank Truck)</td>
<td>2 Nos earth pits for 8 bay gantry.</td>
</tr>
<tr>
<td>operations.</td>
<td></td>
</tr>
<tr>
<td>Static Earth for Loading unloading Gantry (Tank Wagon) operations.</td>
<td>Min. 4 nos. earth pits for each (single/two spur) gantry. For rail track as per railway norms.</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>

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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, Bore well, Gate Barrier, safety instrumentation and interlocks such as CCTV, Hydro Carbon detector, Dyke drain valve system, UPS of automation, supply to essential fire fighting equipment.

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 level</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 loading, unloading and storage of bulk Petroleum Products at installations. There should be strict compliance w.r.t selection, deployment of proper skilled manpower for effective operation and maintenance.

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 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

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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 10/9 kg DCP and 1 no. 1 kg CO2 /DCP /equivalent approved fire extinguisher).
   - Spark arrestors should 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 through manual dipping
   - Filling through 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 realizing the trucks ensure that valves are closed/ends are capped.

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

Checklist for bulk petroleum products tank Trucks at loading / unloading locations is given at Annexure-(2)

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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

- Petroleum Class A - 4%
- Petroleum Class B & C - 2.5%.

iii) Loading and unloading facilities are similar to the facilities of a tank truck. Product quantity should be ascertained by taking physical dip and quantity taken from CTCC charts.

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 it shall be ensured to apply brakes before detaching the loco.

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.

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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 through 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.

viii) 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.

ix) Open the manhole cover of the wagon.

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

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

xii) Increase the filling rate; however, filling speed shall not exceed 6 m/sec. Product shall be filled up to safe filling height as per CTCC chart.

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

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

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

xvi) Remove earthing connections from wagons.

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

xviii) 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 pipeline / jetty pipeline to marketing terminals within the same company or between the oil companies.

Where ever pipe line transfer is envisaged between various companies, a mass flow meter with integrator shall be installed on receipt line at both ends i.e despatch and receipt ends. Signal shall be provided in the control rooms of both despatching and receiving companies / locations for monitoring.

The following safe practices to be followed:

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

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

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

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

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

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

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

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

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

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

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

xii) In case product is required to be taken into more than one tank, tank should be switched over after completion of operation in first tank, close all valves to the first tank, make line through for the second tank as per procedure.

8.11 SAFETY PRECAUTIONS IN TANK FARM AREA OPERATIONS

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

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

iii) Tanks must be periodically checked for leakages / sweating and repairs must be immediately carried out whenever scaling / pitting are observed. Ref OISD STD 129

iv) 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.

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

vi) 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

vii) 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.

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

ix) 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.

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

- The roof should be minimum half way to the top.
- Floating roof is levelled, 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 of platform.
- The tank is not under operation (receipt or delivery).

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

xii) 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 (KI / 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.

xiii) Safety shoe (Conductive type ) shall be worn while gauging, sampling or taking temperatures.

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

xv) 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.

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

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

xvii) 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.
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.

Earthing and bonding connections shall be ensured during the entire operating 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 of ethanol shall be 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 tank lorry filling (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.

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9.0 FIRE PROTECTION FACILITIES

Salient features of Fire Protection Facilities for Petroleum Depots and Terminals. For details refer, OISD-STD-117.

9.1. GENERAL CONSIDERATIONS

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

9.2. FIRE PROTECTION PHILOSOPHY

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

9.2.1 Fire protection

Depending on the nature of risk, following fire protection facilities shall be provided in the installation.

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

9.2.2 Design criteria for fire protection system

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

b) The fire water pumps shall be provided with auto start facility with pressure drop in fire water network.

c) The fire water system shall be based on single contingency for all locations where total storage capacity in the location is up to 30,000 KL (Including storage of Class C products if stored with Class A and / or Class B). Wherever water replenishment @ 50% or more is available, the storage capacity can be reduced to 3 hours aggregate rated capacity of main pumps.

d) The fire water system shall be provided based on two largest fire contingencies simultaneously for all locations where total storage capacity in the location is above 30,000 KL (Excluding Class-C products stored in a separate dyke conforming to prescribed separation distances).

Wherever water replenishment @ 50% or more is available, single fire contingency shall be considered for Fire water storage. This clause shall not be applicable for locations exclusively storing class C & / or excluded products.

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For location/dyke storing exclusively Class C or excluded or combination of Class-C & excluded products the water requirement shall be based on 1 monitor of 144 kl/hr and 4 hose streams of 36 kl/hr i.e. a total of 288 kl per hr for four hrs.

The hazardous areas shall be protected by a well laid combination of hydrants & monitors. The following installations are exempted from this provision:-

The installation having aggregate above ground storage capacity of less than 1000 KL (Class A+B+C) other than AFS.

The installations storing Class A petroleum in above ground tanks shall have fixed water spray system. However, installations above 1000 KL storage fulfilling the following both conditions are exempted from the provision of fixed water spray system

i. Aggregate above ground storage of Class A & B petroleum's up to 5000 KL.
ii. Floating roof tank storing Class A petroleum having diameter up to 9 M.

Class 'B' above ground Petroleum storage tanks (fixed roof or floating roof) of diameter larger than 30 m shall be provided with fixed water spray system.

Fixed foam system or Semi-fixed foam system shall be provided on all tanks (floating roof or fixed roof) exceeding 18 m diameter storing Class A or Class B petroleum.

When Class A & B above ground storage tanks are placed in a common dyke, the fixed water spray system shall be provided on all tanks except for small installations as mentioned in (g) above.

Installations where inter distances between tanks in a dyke and / or within dykes are not conforming to the extant provisions of OISD-STD-118 / 244, the following additional facilities shall be provided to enhance safety.

i. The fixed water sprays system on all tanks, irrespective of diameter in the installations.
ii. The fixed or semi fixed foam system on all tanks, irrespective of diameter in the installation.

Tank Truck (TT) / Tank Wagon (TW) loading/unloading gantries/facilities, Manifold area of product pump house & Exchange pit shall be fully covered with alternate hydrant and UL/FM listed/approved variable flow (pattern) water cum foam monitors having multipurpose combination nozzles for jet, spray & fog arrangement and located at a spacing of 30 M on both sides of gantry ensuring min foam application rate of 6.5 lpm/sq.m (in line with NFPA-11 for spill fire more than 1 inch deep) to the target zone (3 adjacent segments of 15 mtrs each for TW gantry and 08 bays for TT gantry) of the relevant facility.

The hydrants & monitors shall be located at a minimum distance of 15 m from the hazard (e.g TW&TT loading / unloading facilities) to be protected.

Tank wagon loading gantries shall be provided with manually operated fixed water spray/sprinkler system.

The gantry shall be divided into suitable number of segments (each segment having min. length of 15 m length & width of 12 m) and three largest segments operating at a time shall be considered as single risk for calculating the water requirement.

Accordingly, a provision shall be made to actuate the water spray system from a safe approachable central location i.e. affected zone and adjoining zones.

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n) Portable monitors/foam hose streams shall be provided for fighting fires in dyke area and spills.

o) **Medium expansion foam generators** shall be provided for dyke area to arrest vapour cloud formation from spilled volatile hydrocarbons.

   Installation of medium expansion foam generator shall be as per following criteria:

   - **Class A tanks**: Two Nos. Fixed type foam generators (minimum) for each tank dyke.
   - **Class B tanks**: Two Nos. Portable foam generator (minimum) for each location.

p) **The high volume long range (HVL) water cum foam monitors (Manual / Remote)**

   For marketing terminals & Petroleum Depots, the remote operated high volume long range water cum foam monitors (Capacity 500/750/1000 GPM and above) to fight tank fires shall be provided which shall be of variable flow (with flow adjustable manually in the field).

   The foam tank and other accessories for induction of foam to the HVL monitor shall be positioned at a suitably convenient location for easy access and replenishment of foam in emergency. However, remote control panel for HVL monitor shall be min. 60 M away from the tank / hazard to be protected and the projectile of the foam & target object must be visible to the operator.

   Numbers & Capacity of monitor shall be provided in such a way that the foam delivery rate from the monitors meets requirement of foam application rate (8.1 LPM/m²) for full surface tank fire.

   Manual type HVL shall be considered only in case of Pipeline Terminals and Central Crude Tank farms where sufficient distance (minimum 15 mtrs) is available from the point of hazards and in-company fire fighting infrastructure such as fire tender, dedicated fire fighting team round the clock with respect to the location is available.

   The location of HVLs to be planned in such a way that the very purpose of these monitors is served and throw of the monitors is safely delivered at the aimed object. These high volume long range monitors shall be located at a distance of 15m to 45 m from the hazardous equipment subject to:

   - Monitors shall be positioned in such a way that throw of monitors are safely directed to the target tank under full surface fire without damaging tank shell, tank pad and other objects.
   - The throw is directed on the inner upper surface of the tank and not in the middle of the tank to prevent splash over.
   - Care need to be taken for Depots & Terminals located in habitated areas or adjoining to other objects such as High tension line etc.

   Following criteria shall be followed for installation of variable flow water cum foam monitors:

   (i) Remote or / and manual operated variable flow monitors shall be installed in such a way that all the tanks in the installation are within the horizontal range of foam throw.

   (ii) Minimum two HVL monitors shall be provided for each tank farm containing storage tanks of Class A products having aggregate storage capacity up to 10,000 KL to meet the requirement as per S.No. (i) above. Monitors shall be placed in opposite direction.

   At locations having more than one dyke having storage tanks of Class A products in close proximity, the monitors should be positioned at suitably convenient location to provide protection to tanks.
located in different dykes. In such cases, the minimum stipulated requirement of two monitors dedicated for each dyke shall not be required.

(iii) In tank farm having aggregate storage capacity more than 10,000 KL of Class A product, additional monitor/s should be provided to meet foam application rate of 8.1 LPM/m² for the largest Floating Roof on Class A service in the dyke. Additional monitors shall be provided in such a way that each tank is in the coverage area of at least two monitors.

(iv) For tank farm(s) not meeting the safety distance norms as per OISD 118 / 244, HVLR monitors of fixed type shall be provided for the tank farm(s) storing Class B/C products also. In respect of installation storing exclusively Class-C product this provision shall not be applicable.

(v) For all locations not meeting the safety distance norms as per OISD 118 / 244, HVLR monitors of fixed type shall be provided for the tank farms storing Class B/C products also. Requirement of HVLR monitors shall be calculated for full surface fire scenario of the largest tank @ 8.1 lpm/m² (Cone roof / External floating roof tanks). In respect of installation storing exclusively Class-C product this provision shall not be applicable.

(vi) At small installations, where it is not possible to install the fixed type HVLR monitors at a safe distance from the tank because of non-availability of adequate space/distance, shall be allowed to provide trolley mounted monitor of suitable capacity for Class A tank also.

(vii) Locations where HVLR monitors of fixed type are provided to cover both floating roof and fixed roof tanks, portable type HVLR monitor need not be provided.

(viii) Provision for connecting / hooking the portable monitor shall be made in the hydrant system around the fixed roof tanks at various strategic points.

(ix) Well laid procedures and plans shall be made and put into use for use of HVLRs to combat emergencies without loss of much time.

(x) For determining the total foam solution requirement, potential foam loss from wind and other factors shall be considered while designing.

(xi) Adequate foam drum/tank or reliable replenishment for foam induction system shall be provided.

q) **Automatic actuated rim seal fire detection and extinguishing system**

Automatic actuated rim seal fire detection and extinguishing system shall be provided on all existing as well as new external floating roof tanks storing Class A petroleum. The detection and extinguishing system shall have following features:

i) The system must detect fire in Rim Seal area immediately but not later than 10 seconds and extinguish the fire in its incipient stage i.e within 40 seconds of its indication.

ii) The system must be robust viz., it should not be affected by environmental conditions like low/high ambient temperature, dust, external corrosion, hydrocarbon vapour, rain etc.

iii) The extinguishing foam must apply in the seal area @ 18 LPM per square meter in a uniform manner in maximum of 40 seconds.

iv) The detection and extinguishing system shall be coupled with fire control panel with audio-visual alarm for necessary fire alert.
v) The rim seal protection system shall be of linear hollow metallic tube type detectors with foam based extinguishing media or equivalent system*, for existing, new installation as well as for replacements of existing system when due. These detection systems shall be listed and/or approved by any of the international agencies like UL, FM, VdS or LPC to ensure that those systems are used which meet with highest standards of safety.

The minimum requirement for the design of the system shall be as per OISD STD 117.

This is in addition to fixed water spray system and fixed foam system or semi fixed foam system on all floating roof tanks storing class-A & B. (Rim seal shall be for external floating roof tanks in class –A service)

* Ref clause at Para 2.4 for equivalency.

In addition, the individual components shall have certification from competent authority recognised by PESO for suitability for applicable hazardous zone.

r) Fixed water spray system shall also be provided in lube oil drum areas if located in hazardous area.

s) Clean Agent (Halon substitute) based flooding system should be provided for control rooms, computer rooms/ repeater station and pressurized rooms in major locations having automated pipeline receipt/dispatch and/or TW/TT loading facilities.

Selection of clean agent and design of fire protection system for control rooms, computer rooms and pressurized rooms should follow the Standard on "Clean Agent Extinguishing systems NFPA Standard 2001 (2008 or Latest Edition) including its safety guidelines with respect to ‘Hazards to Personnel’, electrical clearance and environmental factors in line with environmental considerations of Kyoto and Montreal Protocol & latest MOEF regulations.

9.2.3 Combined POL and LPG facilities in the same premises

The common water storage facility for fire fighting purpose may be shared between POL Installation and LPG Plant under following conditions:

a) Each POL / LPG facility shall independently meet the design, layout & fire protection system requirements of corresponding OISD standards and have common boundary wall and ownership of both the facilities under same company.

b) The fire water requirement shall be based on two fire contingencies simultaneously in the combined facility and fire water storage capacity shall be fixed accordingly.

c) The fire water system shall ensure availability of pressure of 7 kg/cm2g at the farthest point.

d) The entire fire water system shall remain pressurized and kept in auto mode.

e) The responsibility of maintenance of these tanks and maintaining the water level in the storage tank at all the time shall rest with occupier of LPG facility.

f) The pump house may be common / separate. In case common pump house is provided the control of the pump house shall remain with LPG group.

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9.2.4 Fire water system design

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

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

a) A fire water ring main shall be provided all around perimeter of the location facilities with hydrants / monitors spaced at intervals not exceeding 30 M when measured aerially. Fire hydrants and monitors shall not be installed within 15 Meters from the facilities/ equipment to be protected.

b) The installation shall have facilities for receiving and diverting all the water coming to the installation to fire water storage tanks in case of an emergency.

9.2.5 Fire water design flow rate

a) Fire water flow rate for a tank farm shall be aggregate of the following :-

- For water flow calculations, all tanks farms having class A or B petroleum storage shall be considered irrespective of diameter of tanks and whether fixed water spray system is provided or not.
- Water flow calculated for cooling a tank on fire at a rate of 3 lpm / sqm of tank shell area.
- Water flow calculated for exposure protection for all other tanks falling within a radius of (R +30) m from centre of the tank on fire (R-Radius of tank on fire) and situated in the same dyke at a rate of 3 lpm / sq.m of tank shell area.
- Water flow calculated for exposure protection for all other tanks falling outside a radius of (R+30) m from centre of the tank on fire and situated in the same dyke at a rate of 1 lpm/m² of tank shell area.
- Water flow required for applying foam on a single largest tank by way of fixed foam system, where provided, or by use of water/foam monitors whichever is higher.
  (Foam solution applicable rate for cone roof tanks shall be taken as 5 lpm/sqm and for floating roof rim seal protection it shall be 12 lpm / sqm).
- Various combinations shall be considered in the tank farm for arriving at different fire water flow rate and the largest rate to be considered for design.

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

c) Fire water flow for product pump house shed for depot / terminal and cross country pipe line installations with / without tankage shall be at a rate of 10.2 lpm / sqm.

d) Pumps of volatile products located under pipe rack fire water flow rate shall be calculated at a rate of 20.4 lpm / sqm.

e) Fire water flow rate for TT&TW loading Gantry in a depot or terminal shall be calculated at a rate of @ 10.2 lpm / sq.m. The gantry shall be divided into suitable number of segments (each segment having min. length of 15 m length & width of 12 m) and three largest segments operating at a time shall be considered as single risk for calculating the water requirement.

Design flow rate shall be largest of 9.2.5a, 9.2.5b, 9.2.5.c, 9.2.5.d and 9.2.5.e for single contingency and largest two scenarios in respect of double contingency installations. Design flow rate for roof sinking case of largest tank shall be calculated. Where ever the design flow rate of
roof sinking case is higher than single or two contingencies, as the condition applicable, the same shall be considered for calculating water requirement.

f) Supplementary water: Fire water flow rate for supplementary streams shall be based on using 4 single hydrant outlets simultaneously. Capacity of each hydrant outlet as 36 kl/hr shall be considered at a pressure of 7 kg/cm². The supplementary water stream requirement shall be in addition to the design flow rates. (Refer OISD STD 117)

9.2.6 Fire water storage

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

b) The effective capacity of the reservoir/tank above the level of suction point shall be minimum 4 hours aggregate rated capacity of pumps. This clause shall be read with clause c & d of 9.2.2 (design criteria)

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

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

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

9.2.7 Fire water pumps

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

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

c) At least one standby fire water pump shall be provided up to 2 nos. of main pumps. For main pumps 3 nos. and above, minimum 2 nos. standby pumps of the same type, capacity & head as the main pumps shall be provided. Fire water pumps shall be of equal capacity and head.

d) The fire water pump(s) including the standby pump(s) shall be of diesel engine driven type. Where electric supply is reliable, 50% of the pumps can be electric driven. The diesel engines shall be quick starting type with the help of push buttons located on or near the pumps or located at a remote location. Each engine shall have an independent fuel tank adequately sized for 6 hours continuous running of the pump. Fuel tank should be installed outside of fire pump house and shall have provision for venting. If tanks are located inside the pump house, the vent shall have provision for venting outside the pump house.

e) Fire water pumps & storage shall be located far away from the potential leak sources / tankage area and shall be at least 30 M (minimum) away from equipment or where hydrocarbons are handled or stored.

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

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

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

i) Auto cut-in / cut-off facility should be provided for jockey pumps to maintain the line pressure.

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

9.2.8 Fire hydrant network

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

b) Fire hydrant ring main shall be laid above ground ensuring that:
   i) Pipe line shall be laid at a height of 300 mm to 400mm above finished ground level.
   ii) The pipe support shall have only point contact. The mains shall be supported at regular intervals:
       • For pipeline size less than 150 mm, support interval shall not exceed 3 mtrs..
       • Pipe line size 150mm and above not exceeding 6 meters or design approved.
   iii) The system for above ground portion shall be analysed for flexibility against thermal expansion and necessary expansion loops where called for shall be provided.

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

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

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

iv) The stand post for hydrants and monitors shall be sized to meet the respective design water flow rates.

f) General:

i) Fire water mains shall not pass through buildings or dyke areas. In case of underground mains the isolation valves shall be located in RCC/brick masonry chamber of suitable size to facilitate operation during emergency & maintenance.

ii) Associated Sprinkler/foam riser/branch connections meant for storage tanks if applicable shall be taken directly to the outside of tank dyke and shall not pass through fire wall of any adjacent tanks.

iii) The riser connections shall be taken directly from the mains and provided with separate isolation valve outside of dyke. Suitable strainer shall be provided on sprinkler branch connection and shall be located outside of dyke.

9.2.9 Hydrant / monitors

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

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

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

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

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

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

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

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

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

j) TW/TT loading & unloading facilities shall be provided with alternate hydrant / water cum foam monitor (Refer 9.2.2.L) of suitable capacity and size to ensure adequate coverage and located at a spacing of 30 M on both sides of the gantry.

The hydrants & monitors shall be located at a minimum distance of 15 M from the hazard (e.g.TW & TT loading/unloading facilities) to be protected.

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9.2.10 Material specifications

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

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

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

c) **Hydrants post**: Stand post - Carbon Steel
   Outlet valves – Gunmetal / Aluminium / Stainless / Steel/Al-Zn Alloy

d) **Monitors / High Volume Long Range Water Cum Foam Monitors (HVLR) / Rim seal**: Approved / listed by any of the international certifying agencies like UL, FM, VdS or LPC.

The electrical or hydraulic remote control mechanism shall be in line with Hazardous Area Classification.

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

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

9.2.11 Fixed water spray system

a) Fixed water spray system is a fixed pipe system connected to a reliable source of water supply and equipped with water spray nozzles for specific water discharge and distribution over the surface of area to be protected. The piping system is connected to the hydrant system water supply through an automatically or manually actuated valve which initiates the flow of water. In case the system is manually actuated, the isolation valve shall be located outside the dyke for ease of access & operation.

b) Spray nozzles shall be directed radially to the tank at a distance not exceeding 0.6 M from the tank surface.

c) While calculating the water rates for spray application for cases other than tanks such as pump house and tank wagon gantry, the area should be divided into suitable segments so that maximum water requirement can be optimized.

For TW loading gantry, sprinklers shall be provided to ensure full surface coverage. Three largest Segments shall be considered for water requirement.

For Tank Truck loading gantries specifically for those cases which have obstructions in water throw, sprinklers should be provided.

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9.2.12 Foam systems

Fire fighting foam is a homogeneous mass of tiny air or gas filled bubble of low specific Gravity, which when applied in correct manner and in sufficient quantity, forms a compact fluid and stable blanket which is capable of floating on the surface of flammable liquids and preventing atmospheric air from reaching the liquid.
Foams are classified by producing action of generation and expansion. Foam concentrate to be used shall conform to IS: 4989 2006/UL-162 or Equivalent Standard

Types of foam compound

Two Types of foams are used for fighting liquid fires:

A. Chemical foam

When two or more chemicals are added the foam generates due to chemical reaction. The most common ingredients used for chemical foam are sodium bicarbonate and aluminium sulphate with stabilizer. The chemical foam is generally used in fire extinguishers.

B. Mechanical foam

It is produced by mechanically mixing a gas or air to a solution of foam compound (concentrate) in water. Various types of foam concentrates are used for generating foam, depending on the requirement and suitability. Each concentrate has its own advantage and limitations. The brief description of foam concentrates is given below.

Types of mechanical foam

Mechanical foam compound is classified into 3 categories based on its expansion ratio.

a) Low expansion foam

- Foam expansion ratio can be up to 50 to 1, but usually between 5:1 to 15:1 as typically produced by self aspirating foam branch pipes.

- The low expansion foam contains more water and has better resistant to fire. It is suitable for hydrocarbon liquid fires and is widely used in oil refinery, oil platforms, petrochemical and other chemical industries.

b) Medium expansion foam

Foam expansion ratio vary from 51:1 to 500:1 as typically produced by self aspirating foam branch pipes with nets. This foam has limited use in controlling hydrocarbon liquid fire because of its limitations w. r. t. poor cooling, poor resistant to hot surface/radiant heat, etc.

c) High expansion foam

Foam expansion ratio vary from 501:1 to 1500:1, usually between 750:1 to 1000:1 as typically produced by foam generators with air fans. This foam also has very limited use in controlling hydrocarbon liquid fire because of its limitations w. r. t. poor cooling, resistant to hot surface/radiant heat, etc. It is used for protection of hydrocarbon gases stored under cryogenic conditions and for warehouse protection.
Types of low expansion foam

i) Protein foam

The foam concentrate is prepared from hydrolyzed protein either from animal or vegetable source. The suitable stabilizer and preservatives are also added. The concentrate forms a thick foam blanket and is suitable for hydrocarbon liquid fires, but not on water miscible liquids. The effectiveness of foam is not very good on deep pools or low flash point fuels which have had lengthy pre-burn time unless applied very gently to the surface. The concentrate is available for induction rate of 3 to 6%. The shelf life of concentrate is 2 years.

ii) Fluoro protein foam

This is similar to protein base foam with fluro-chemical which makes it more effective than protein base foam. The concentrate forms a thick foam blanket and is suitable for hydrocarbon liquid fires, but not on water miscible liquids. The foam is very effective on deep pools of low flash point fuels which have had lengthy pre burn time. The concentrate is available for induction rate of 3 to 6% and the shelf life is similar to that of protein base foam.

iii) Aqueous film forming foam (AFFF)

The foam concentrate mainly consists of fluoro-carbon surfactants, foaming agent and stabilizer. This can be used with fresh water as well as with sea water.

It produces very fluid foam, which flows freely on liquid surface. The aqueous film produced suppresses the liquid vapour quickly. The foam has quick fire knock down property and is suitable for liquid hydrocarbon fires. As the foam has poor drainage rate, the effectiveness is limited on deep pool fires of low flash point fuels which have lengthy pre burn time.

The concentrate is available for induction rate of 1 to 6% and the shelf life is more than 10 years. This can also be used with non aspirating type nozzles.

iv) Multiple purpose AFFF

Multipurpose AFFF concentrate is synthetic, foaming liquid designed specially for fire protection of water soluble solvents and water insoluble hydrocarbon liquids. This can be used either with fresh water or sea water.

When applied it forms foam with a cohesive polymeric layer on liquid surface, which suppresses the vapour and extinguishes the fire. The foam is also suitable for deep pool fires because of superior drainage rate and more resistive to hot fuels/radiant heat. The 3% induction rate is suitable for liquid hydrocarbon fires and 5% for water miscible solvents. The shelf life of concentrate is not less than 10 years. This can also be used with non aspirating type nozzles.

v) Film forming flouro protein foam (FFFPF)

FFFPF combines the rapid fire knock down quality of conventional film forming AFFF with the high level of post fire security and burn back resistance of flouro-protein foam. The concentrate can either be used with fresh water or sea water. The foam is suitable for hydrocarbon liquid fires including deep pool fires of low flash point fuels which have had lengthy pre burn time.

The concentrate is available for induction rate of 3 to 6% and the shelf life is 5 years. This can also be used with non aspirating type nozzles.
Types of medium and high expansion foam

Synthetic foam concentrate is used with suitable devices to produce medium and high expansion foams. This can be used on hydrocarbon fuels with low boiling point. The foam is very light in weight and gives poor cooling effect in comparison to low expansion foams. The foam is susceptible to easy break down by hot fuel layers and radiant heat.

The induction rate in water should vary from 1.5 to 3%. Many of the low expansion foam concentrate can also be used with suitable devices to produce medium / high expansion foam.

Advantage of low expansion foam

For combating large hydrocarbon fires particularly in a contained area like storage tank, foam has proved useful for its inherent blanketing ability, heat resistance and security against burn back. Aqueous Film Forming Foam (AFFF) compound is technically superior and compatible with other fire fighting agents.

9.2.13 Conveying system of foam

Efficient and effective foam delivery system is a vital tool for its usefulness in controlling the fire. The process of adding or injecting the foam concentrate to water is called proportioning. The mixture of water and foam compound (foam solution) is then mixed with air in a foam maker for onward transmission to burning surface. The system consists of an adequate water supply, supply of foam concentrate, suitable proportioning equipment, a proper piping system, foam makers and discharge devices designed to adequately distribute the foam over the hazard.

Conventional systems are of the open outlet type, in which foam discharges from all foam outlets at the same time, covering the entire hazard within the confines of the system. There are three types of systems:-

- Fixed
- Semi-Fixed
- Mobile

i) Fixed Foam System

Fixed foam conveying system comprises of fixed piping for water supply at adequate pressure, foam concentrate tank, eductor, suitable proportioning equipment for drawing foam concentrate and making foam solution, fixed piping system for onward conveying to foam makers for making foam, vapour seal box and foam pourer.

ii) Semi-Fixed Foam System

Semi-fixed foam system gets supply of foam solution through the mobile foam tender. A fixed piping system connected to foam makers cum vapour seal box in case of cone roof tanks and foam maker and foam pourers in the case of floating roof tanks conveys foam to the surface of tank.

iii) Mobile System

Mobile system includes foam producing unit mounted on wheels which should be self propelled or towed by a vehicle. These units supply foam through monitors/foam towers to the burning surface.
9.2.14 Foam protection

A. Floating roof tank protection

B. Fixed roof tank protection

C. Floating cum fixed roof tank protection

D. Protection for dyke area / spill fire

**Storage tank protection**

A. Floating roof tank protection

For floating roof tank, foam shall be poured at the foam dam to blanket the roof seal. Features of foam system for floating roof tank protection shall be as follows:

a) System shall be designed to create foam blanket on the burning surface in a reasonably short period.

b) Foam shall be applied to the burning hazard continuously at a rate high enough to overcome the destructive effects of radiant heat.

c) Foam makers/foam pourers shall be located not more than 24 M apart on the shell perimeter based on 600 mm foam dam height. The height of foam dam shall be at least 51 mm above the top of metallic secondary seal.

B. Fixed roof tank protection

Foam conveying system shall have same features as of floating roof tank excepting that a vapour seal chamber is required before the foam discharge outlet. Features of the foam system for fixed roof protection shall be as follows:

i) The vapour seal chamber shall be provided with an effective and durable seal, fragile under low pressure, to prevent entrance of vapour into the foam conveying piping system.

ii) Where two or more pourers are required these shall be equally spaced at the periphery of the tank and each discharge outlet shall be sized to deliver foam at approximately the same rate. Tanks should be provided with foam discharge outlets/pourers as indicated below :-

**Tank diameter and requirement of Foam Pourer**

<table>
<thead>
<tr>
<th>(In M)</th>
<th>(Min. Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 18 &amp; up to 20</td>
<td>2</td>
</tr>
<tr>
<td>Above 20 &amp; up to 25</td>
<td>3</td>
</tr>
<tr>
<td>Above 25 &amp; up to 30</td>
<td>4</td>
</tr>
<tr>
<td>Above 30 &amp; up to 35</td>
<td>5</td>
</tr>
<tr>
<td>Above 35 &amp; up to 40</td>
<td>6</td>
</tr>
<tr>
<td>Above 40 &amp; up to 45</td>
<td>8</td>
</tr>
<tr>
<td>Above 45 &amp; up to 50</td>
<td>10</td>
</tr>
</tbody>
</table>

In case foam pourers are provided on tanks having diameter up to 18 m, minimum 2 nos. foam pourers shall be provided.

The estimation of number of foam discharge outlet is based on pourer capacity of 1000 lpm at a pressure of 7 kg/sq.cm (g) upstream of eductor. This can be suitably adjusted for different pourer capacity in accordance with section 9.2.12.a.iii).

C. Floating cum fixed roof tank protection

Protection facilities shall be provided as required for fixed roof tank.

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D. Protection for dyke area /spill fire

Portable monitors/foam hose streams shall be provided for fighting fires in dyked area and spills. Additionally, Medium expansion foam generators shall be provided to arrest vapour cloud formation from spilled volatile hydrocarbons. Installation of medium expansion foam generator shall be as per following criteria:

Class A tanks:
2 nos. Fixed type foam generators (minimum) for each tank dyke.

Class B tanks:
Two nos. portable foam generators (minimum) for each location.

9.2.15 Foam application

A. Application rate

The minimum delivery rate for primary protection based on the assumption that all the foam reaches the area being protected shall be as indicated below :-
For cone roof tanks containing liquid hydrocarbons, the foam solution delivery rate shall be at least 5 lpm/ sqm of liquid surface area of the tank to be protected.
For floating roof tanks containing liquid hydrocarbons foam solution delivery rate shall be at least 12 lpm/ sqm of seal area with foam dam height of 600 mm of the tank to be protected.
The height of foam dam shall be at least 51 mm above the top of metallic secondary seal. In the case of Floating roof tank roof sinking, the application rate shall be considered as 8.1 lpm/ sqm.

In determining total solution flow requirements, potential foam losses from wind and other factors shall be considered.

B. Duration of foam discharge

The equipment shall be capable of providing primary protection at the specified delivery rates for the following minimum duration:

i) Tanks (fixed roof/floating roof) containing Class 'A' & 'B' - 65 minutes.

ii) Where the system's primary purpose is for spill fire protection such as dyked area and non dyked area (TT/TW etc) - 30 minutes.

C. Water for foam making

Water quantity required for making foam solution depends on the percent concentration of foam Compound. Foams in normal use have a 1 to 6% proportioning ratio. However, foam supplier data shall be used for determining water requirement.

D. Foam quantity requirement

1. For locations aggregate capacity upto 30,000 kl (Single contingency):

i) Foam solution application at the rate of 5 lpm/ sqm for the liquid surface of the single largest cone roof tank.

ii) Foam solution applicable at the rate of 12 lpm/ sqm of seal area of the single largest floating roof tank.

iii) Floating roof sinking case also shall be considered for foam compound requirement and storage. Application by required Nos. HVLR of installed capacity.

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Min. aggregate foam storage shall be largest of i), ii) & iii) above

2. For locations aggregate capacity more than 30,000 kl (Double contingency) (Assume, both cone roof tank farm and floating roof tank farms are the two largest simultaneous fire risk in a double contingency Installation for the purpose of foam requirement).

i) Foam solution application at the rate of 5 lpm/ sqm for the liquid surface of the single largest cone roof tank.

ii) Foam solution application rate of 12 lpm/ sqm of seal area of the single largest floating roof tank.

iii) Floating roof sinking case also shall be considered for foam compound requirement and storage. Application @ 8.1 lpm/sq.m by required Nos. HVLR of installed capacity.

Min. aggregate foam storage shall be total of (i +ii) or iii) whichever is higher.

iv) In case of Aviation Fuelling Stations where aggregate product storage capacity is less than 1000 KL, foam quantity for spill fire protection of 30 minutes shall be made.

E. Foam compound storage

Foam compound should be stored as explained in IS-4989:2006/UL-162. Type of foam compound to be used can be protein, fluro-protein or AFFF. Alcohol Resistant Foam shall be used for handling methanol/ ethanol or furfural fires. Minimum 1000 litres of Alcohol Resistant Foam compound shall be maintained at the installation to handle methanol/ethanol or furfural fire.

Shelf life of foam compound shall be taken from manufacturer’s data. Foam compound shall be tested periodically as per OEM guidelines to ensure its quality and the deteriorated quantity replaced. The deteriorated foam compound can be used for fire training purposes.

Care shall be taken to avoid mixture of two/more different grades / batches of foam in a foam storage tank. In such cases foam shall be tested on yearly basis to check its efficacy and record maintained. For details of type of tests & their periodicity, refer IS 4989: 2006/UL-162 or Equivalent Standard. Quantity of foam compound equal to 100% of requirement as calculated in 9.2.14.d.1 or d2, should be stored in the Installation.

Foam may be stored either in storage tanks of fixed type or mounted on mobile trolleys.

9.2.16 Control room and computer room protection

- Control room and computer room should be protected by Clean Agent Fire Extinguishing System.

- It is considered good practice to avoid unnecessary exposure to Clean Agent Fire Extinguishing System. In order to minimize the exposure, persons should be evacuated from the areas before the system comes into operation.

- Clean agent fire extinguishing system as per NFPA-2001 (Latest edition) shall be provided for such protection system. Each hazard area to be protected by the protection system shall have an independent system. The time needed to obtain the gas for replacement to restore the systems shall be considered as a governing factor in determining the reserve supply needed. 100% standby containers shall be considered for each protected hazard. Storage containers shall be located as near as possible to hazard area but shall not be exposed to fire. Storage containers shall be carefully located so that they are not subjected to mechanical, chemical or other damage. All the components of the system shall be capable of withstanding heat of fire and severe weather conditions.
9.2.17 First aid fire fighting equipment

**Portable Fire Extinguishers**

i) All fire extinguishers shall conform to respective IS/UL or Equivalent codes, viz. 10/9 Kg DCP Type (IS: 15683 /UL 299), 4.5/6, 8 Kg CO2 Type (IS: 2878/UL 154) & 25/50/75 Kg DCP Type (IS: 10658/UL 299) and bear ISI/UL mark. BIS/UL or Equivalent certificates of all extinguishers shall be maintained at the location.

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

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

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

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

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

vii) Portable fire extinguishers shall be located at convenient locations and are readily accessible and clearly visible at all times. The no. of extinguishers at various locations shall be provided as per OISD STD-117.

viii) The sand buckets shall have round bottom with bottom handle having 9 liter water capacity conforming to IS: 2546. The sand stored in bucket shall be fine and free from oil, water or rubbish.

ix) Rain protection of suitable design should be provided for all extinguishers & sand buckets.

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

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

9.2.18 Emergency trolley and emergency kit

i) A trolley containing Fire Proximity Suit, B. A. Set, Water Jel Blanket, Resuscitator, First Aid Box, Stretcher with blanket, Spare fire hoses, Special purpose nozzles, Foam branch pipes, Explosive meter, P. A. System shall be readily available at the location and positioned to have easy access to it during emergency situation.

ii) An emergency kit shall be provided consisting of safety items (Refer OISD STD-117 for details) and shall be readily available at the terminals. All the items of the kit shall be kept on a trolley specifically designed for the purpose.

9.2.19 Mobile fire fighting equipment

Mobile fire fighting equipment include Foam trolleys, Portable water-cum-foam monitors etc.
9.3. 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

a. Hydrocarbon (HC) detectors shall be installed near all potential leak sources of Class-A Petroleum products e.g tank dykes, tank manifolds and 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.

b. 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 uninterruptible 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. 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. Calibration of the detectors shall be done as per OEM recommendation or once in six month whichever is earlier.

2. 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.

3. Standard calibration kit must be available in the location for periodic performance test of hydrocarbon detectors.

**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 alarm and visual indication shall come at 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 Central Institute of Mining and Fuel Research (CIMFR) /Petroleum and Explosive Safety Organization (PESO) / Authorized lab by the country of the origin.
iii) Annunciation System

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

iv) Control system:

The system shall be available at all times.

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

v) Inspection and Testing:

1. The system shall be checked by the safety officer on a daily basis.
2. The system shall be thoroughly inspected every month by opening and closing the valves and verifying that the Audio Video alarms are generated at local and remote panel and records maintained.

C. Emergency shut Down (ESD) 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
   - All ROSOVs and MOVs to close.
   - Tank lorry filling (TLF) / tank wagon filling (TWF) operations through the batch controllers to stop.
   - Fire siren to blow.

ii) Power Shutdown shall initiate the following:

1. Trip all the panels other than Emergency panel. The Emergency panel should host fire siren, bore wells, jockey pumps, critical High Mast tower lights outside the licensed area, security cabin, fire pump house, 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.

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iii) Inspection and Testing:

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

9.4. FIRE SAFETY ORGANISATION / TRAINING

a) Organisation

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

b) Training

i) Training on safety, fire fighting and rescue operation shall be compulsory for all officers, operators, security, T/T drivers & contract workmen, clericals who are likely to be present/working in the installation& record maintained. The above training shall be imparted before induction.

Each employee shall undergo a refresher course once in every three years after initial training.

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

iii) All operating personnel shall be given training on Live Fire training at any of the reputed institutes having facilities for simulations representing fire scenarios likely to occur at POL installations.

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

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

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

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

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

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

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

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

c) Mutual Aid:

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

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

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

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

9.6. FIRE PROTECTION SYSTEM, INSPECTION AND TESTING

i) The fire protection equipment shall be kept in good working condition all the time.

ii) The fire protection system shall be periodically tested for proper functioning and logged for record and corrective actions.

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

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

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

a) Fire water pumps

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

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

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

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

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

b) Fire water ring mains

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

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

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

c) Fire water spray system

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

ii) Spray nozzles shall be inspected for proper orientation, corrosion and cleaned, if necessary at least once a year.
iii) The strainers provided in the water spray system shall be cleaned once in a quarter and records maintained.

d) **Fixed / semi fixed foam system**

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

e) **Clean agent system**

Clean agent fire extinguishing system should be checked as under:-

i) Agent quantity and pressure of refillable containers shall be checked once every six month.

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

f) **Hoses**

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

g) **Communication system**

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

h) **fire water tank/reservoir**

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

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

i) **fire extinguishers**

Inspection, testing frequency and procedure should be in line with OISDSTD- 142.
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. 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.

B. Pipes, valves and fittings

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

This standard covers minimum inspection requirements for plant piping 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 inspection & Ultrasonic thickness survey

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 the pipes. 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 Ultrasonic testing (UT), 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 through a competent agency.

Hydro-testing

Hydro-testing 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 referred.

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-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:

**TYPE / LOCATION**  **FREQUENCY**
Upstream of Pump Suction: Quarterly
Upstream of PD meter quarterly
Sprinkler strainer quarterly

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.
- Provisions of OISD-STD-132 on "Inspection of Pressure Relieving Devices" shall be followed.

G. Rotary equipment:

i) Compressors:

   Periodic maintenance checks, as detailed in Annexure-(3) to be followed.

ii) Pumps:

   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.

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v) Flow measuring devices:

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

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 has been fully restored.

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

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

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

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

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

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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 address 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.


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

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 annualized 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 & updating 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, works 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 is required to be discussed and suggestions / acceptance of the Committee are to be recorded in the MOC application. Competent authorities shall ensure that the proposed changes in design / process are completely safe through appropriate checks / evaluations, which may include process hazard analysis and HAZOP (Hazard & Operability study).

B. Execution of Change

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

C. Commissioning, Training & Updating 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.

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12.0 EMERGENCY PREPAREDNESS PLAN 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, published by Petroleum & Natural Regulatory Board shall be referred for further details.

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

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

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

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

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

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

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

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

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

j) 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.

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

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

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

Appropriate reward and recognition scheme may be introduced encouraging employees to identify and reporting near miss events.
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 operator’s job is essential and this should be ensured. For terminal managers, safety training should include areas like:

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

For training needs of various operating personnel refer Annexure-(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;

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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. Persons are more open to learning if they feel respected and not being talked down to, embarrassed or ridiculed.

ii. Participation in group exercises where trainees see themselves as mutual helpers rather than rivals.

iii. Mutual trust and friendliness between trainees & faculty.

iv. Care of human needs such as peaceful environment, comfortable seats, adequate breaks between training sessions, proper lighting and ventilation.

D) Course Design:

The course design should include following factors:

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 GUIDELINES FOR FACULTY

I) Essential Factors:

The faculty should take in to consideration following factors while preparing and presenting a topic:

a. Course objective

b. Target group

c. Time available

d. Feedback from earlier 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 is 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. 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.

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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, Guidelines and Recommended Practices.

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

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

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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

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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 safeway 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 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 aspect (Process, Mechanical, Electrical, etc.), 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 Offices.
External safety audits will be carried out by outside teams consisting of technical experts from other organizations in Oil Industry, professional bodies and statutory authorities under the overall coordination of OISD.

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.

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

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

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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.

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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.
**VARIOUS AUDITS AND FREQUENCY OF AUDITS.**

<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>Accredited electrical</td>
<td>Once in 3 years or as per statutory requirement whichever is earlier?</td>
<td>Annexure-8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineers/Authorised Class A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical engineer</td>
<td></td>
<td></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/General Manager/Dy. General Manager of respective oil company</td>
<td>At least one major installation per year</td>
<td>Random Checks</td>
</tr>
</tbody>
</table>

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REFERENCES:

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2. OISD STD-108: Recommended practices on Oil storage and handling.
3. OISD STD-110: Recommended practices on static electricity
4. OISD STD-113: Classification of areas for electrical installations at hydrocarbon processing and handling facilities.
5. OISD STD-117: Fire protection facilities for petroleum depots, terminals, pipeline installations and lube oil installations.
6. OISD STD-118: Layout for Oil and Gas installations.
7. OISD STD-129: Inspection of storage tanks.
8. OISD STD-130: Inspection of piping systems
9. OISD STD-135: Inspection of loading and unloading hoses for petroleum products
10. OISD STD-137: Inspection of electrical equipment.
11. OISD STD-140: Inspection of jetty pipelines
12. OISD STD-142: Inspection of fire fighting equipment and systems
13. OISD STD-145: Guide lines on internal safety audits (procedures and checks)
14. OISD STD-154: Safety aspects in functional training
15. OISD STD-155: Personnel protective equipment (Part -I: Non respiratory equipment and part-II: Respiratory Equipment)
16. OISD STD-156: Fire protection facilities for ports handling hydrocarbons
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21. API STD 620: Design and construction of large, welded, low pressure storage tanks.
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26. IS 10987: Code of practice for design, fabrication, testing and installation underground /above ground horizontal cylindrical storage tanks for petroleum products.
27. IS 4308: Dry Chemical Powder for Fighting B and C Class Fires— Specification
28. IS 10658: Specification for Higher Capacity Dry Powder Fire Extinguisher (Trolley Mounted)
29. IS 11006: Flashback arrester (Flame arrester)-Specification.
30. IS 10810: Method of test for cables, part 43-Insulation resistance.
32. IS 15683: Portable fire extinguishers —performance and construction spec.

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33. IS 2190: Selection, installation and maintenance of first -aid fire extinguishers- code of practice.
34. IS 2546: Specification for Galvanised mild steel fire bucket.
35. IS 3043: Code of practice for earthing
36. IS 5571: Guide for selection of electrical equipment for hazardous areas
37. IS 5572: Classification of hazardous areas (other than mines) having flammable gases and vapours for electrical installations.
39. IS 12709: Specification for glass fibre reinforced plastics (GRP) pipes for use for water supply and sewerage.
41. IS 803: Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tanks.
42. NFPA 11: Standard for Low-, Medium-, and High-Expansion Foam
43. NFPA 13: Standard for the Installation of Sprinkler Systems
44. NFPA 15: Standard for Water Spray Fixed Systems for Fire Protection
45. NFPA 30: Flammable and Combustible Liquids Code
46. NFPA 72: National Fire Alarm and Signalling Code
47. UL162: Foam equipment and liquid concentrate.
ANNEXURE-1: CRITICAL ALARM LEVELS 'LOGIC' IN Tank

- Corresponding to PESO approved Safe Fill Level (independent level switch)

- High High Level (HH)

- High Level (H)

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 / UNLOADING 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>
## ANNEXURE-3

### MAINTENANCE SCHEDULE OF CRITICAL EQUIPMENTS

#### COMPRESSOR

<table>
<thead>
<tr>
<th>Sln.</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Check Lube Oil Level of plunger pump unit &amp; top up if necessary.</td>
<td>Daily Weekly Monthly Quarterly</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>10.</td>
<td>Flush jacket water cooling system.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Check alignment of compressor &amp; motor pullies.</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>Sln.</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Check lub &amp; top up level if necessary. Check cooling water flow (where provided).</td>
<td>Daily Weekly Monthly Quarterly</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>

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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” Daily Checklist

<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. 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>3</td>
<td>Check engine oil level and top up if necessary</td>
<td>Use clean engine oil</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, up to 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>Discard paper type element, if clogged.</td>
</tr>
<tr>
<td></td>
<td>Clean crankcase breather</td>
<td>Check for leaks, use specified engine oil for topping up.</td>
</tr>
<tr>
<td></td>
<td>Check oil level in hydraulic governor, if provided.</td>
<td>If there is a change in oil pressure from that recorded in the log 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>11</td>
<td>Start the engine and note the oil pressure both at idling and maximum speed</td>
<td>Refer O&amp;M Manual for Lub. Oil pressure limits.</td>
</tr>
<tr>
<td></td>
<td>Record oil pressure</td>
<td>Use clean fuel and a strainer. Also clean the cap and surrounding area before opening the filler cap.</td>
</tr>
<tr>
<td></td>
<td>Fill fuel tank at the end of the shift.</td>
<td></td>
</tr>
</tbody>
</table>

Note: In addition, Diesel Engine “B”, “C”, “D” and “E” checks shall be carried out as per manufacturers guide lines
ANNEXURE-4

FORMAT FOR REQUEST FOR MANAGEMENT OF CHANGE

Location: ____________________________  Request No.: __________

Request Date: __________

1. Description of Proposed change :
2. Technical Reason for the proposed change :
3. Potential benefit after effecting the change :
4. Impact of the proposed change on :
   a) Safety [HAZOP findings, if applicable]
   b) Health
   c) Work Environment
   d) Product Quality
   e) Any other aspect
5. Compliance status to OISD & Statutory Regulations :
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 :

Name & Designation of Initiator ____________________________
Signature of the Initiator ____________________________

Comments of the Reviewer

Name & Designation of Reviewer ____________________________
Signature of the Reviewer ____________________________

Comments of the Approver

Name & Designation of Approver ____________________________
Signature of the Approver ____________________________

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## ANNEXURE-5

### Limits of Authority (LOA) for MOC : POL Depots & Terminals

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Category of change</th>
<th>Details of change</th>
<th>Addl. Requirements/ Remarks</th>
<th>Initiator of MOC request</th>
<th>Reviewer *</th>
<th>Approver *</th>
<th>Post execution Inspection for confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Facility</td>
<td>Augmentation of Storage Tanks of product, additives</td>
<td>Risk Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Facility</td>
<td>Modification in Piping system – sizing / routing / Pressure Relief ratings / type &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>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Facility</td>
<td>Changes in Electrical Systems – reduction in contracted 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 through 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 Organization Chart, Mutual</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<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 / Ops Manual</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>
</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 Asses. if reqd by Safety Officer</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>
</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>
</tr>
<tr>
<td>16</td>
<td>Operating Procedure</td>
<td>Change in working hours / Addition/Deletion of shifts</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>
</tr>
</tbody>
</table>

*Note:

Designations of requisite authority for the initiator, reviewer and approving authorities shall be assigned by the respective oil marketing company (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>Not required if you have had ASA (Advanced Safety Auditing) training.</td>
</tr>
<tr>
<td>First Aid</td>
<td>All Supervisory personnel and emergency crews.</td>
<td>Within 6 months of assignment</td>
<td>Refresher may vary based upon certificates held.</td>
</tr>
<tr>
<td>HSE Orientation for New Hires and transferees</td>
<td>All personnel newly hired or transferred</td>
<td>Within 1 week</td>
<td>HSE Orientation for New Hires and transferees</td>
</tr>
<tr>
<td>Orientation Program for Personnel arriving at site/facility for the First Time</td>
<td>All Personnel arriving at site/facility.</td>
<td>Prior to entering site/facility</td>
<td>Specific for facility/site and locally determined.</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>This training is required for full knowledge of system and is critical for supervisors.</td>
</tr>
<tr>
<td>Defensive Driving</td>
<td>All employees who are required to drive a company vehicle or who drive their own vehicle on company business 3 or more times a year.</td>
<td>Within 3 months of assignment</td>
<td>Only with company approved instructors</td>
</tr>
<tr>
<td>Hazard Identification/Risk Assessment training</td>
<td>All employees</td>
<td>Within 6 months of assignment</td>
<td>Subjects can be included in ASA/Behavioural Safety Auditing (BSA) or STOP or Near Miss Program</td>
</tr>
<tr>
<td>Legislative Requirements</td>
<td>All Extended Leadership Team and designated environmental coordinators.</td>
<td>Within 1 year of assignment</td>
<td>Every 3 years</td>
</tr>
<tr>
<td>General Environmental/ Waste Management</td>
<td>All Staff other than Leadership team</td>
<td>Within 1 year of assignment</td>
<td>Every 2 years</td>
</tr>
<tr>
<td>Work permit system</td>
<td>Personnel that will be assigned to issue or receive work permits</td>
<td>Prior to performing task</td>
<td>2 Years</td>
</tr>
<tr>
<td>Personal Protective Equipment (PPE)</td>
<td>Personnel required to use PPE.</td>
<td>Prior to using PPE</td>
<td>As Required Based upon Changes in PPE Requirements.</td>
</tr>
<tr>
<td>Fire Training - Hose Line (Fire Brigade)</td>
<td>Personnel assigned to field locations. The level of training will be based upon the facility location and/or the assigned responsibilities of the individual.</td>
<td>Upon assignment to a job that requires fire fighting</td>
<td>3 Years</td>
</tr>
</tbody>
</table>
ANNEXURE-7

CHECK LISTS

DAILY/WEEKLY/FORTNIGHTLY/MONTHLY SAFETY AUDIT CHECK LIST – DEPOT/Terminal

Location

Audit/Inspection by

A. Fire Protection System & Security check

<table>
<thead>
<tr>
<th>Sln</th>
<th>Item</th>
<th>Frequency</th>
<th>Observations</th>
<th>Action taken in brief (if any) with date.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check water level in static water tanks and record in the log book.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ensure pump suction &amp; discharge valves are full open.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Check functioning of water tank level gauges</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Check &amp; record hydrant line pressure in the log book</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Periodical health checkup of batteries and maintain record</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Check fuel level in the fire engine fuel tanks &amp; record.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check functioning of fuel level indicators.</td>
<td>weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check condition of engine exhaust insulation lading.</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Run one pump &amp; ensure all the pumps are run at least twice in a week</td>
<td>Daily/weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and record pressure developed &amp; operating parameters in the log book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Whether engine trip mechanism is in working condition.</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Simulation testing of fire engine auto start with pressure drop in hydrant and Engines starts in sequential order as per displayed philosophy.</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Check functioning of exhaust fans in a covered pump house to Check effectiveness of ventilation.</td>
<td>weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Check Fire siren range (3 km) and hand sirens are in strategic place.</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether emergency / DC supply continuously available for fire siren?</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Check functioning of HC detectors by through calibration.</td>
<td>Quarterly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Surprise check if frisking of crew members /visitors/contract</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Frequency</td>
<td></td>
<td></td>
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<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>15</td>
<td>Check proper functioning of DFMD/HH metal detectors at gate are.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Check functioning of CCTV system &amp; record deficiencies, if any?</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Security check for integrity of boundary wall/fence? Safety officer to review</td>
<td>Daily, Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Random Check if any vehicle with Spark ignition engine is allowed in the hazardous area and vehicles of IC engines are fitted with proper exhaust.</td>
<td>Daily</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 firefighting system. Deviations to be recorded &amp; report to location IC</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Check effectiveness of communication between various operating areas functioning &amp; record deficiency.</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Random Check of emergency gate for any obstruction.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Check for Caution signs &amp; speed limit display at appropriate places.</td>
<td>Quarterly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Whether control room is manned continuously / during operations?</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Random check if persons entering /working at hazardous areas are using PPEs?</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Check for any accumulation of oil in the drains connected to OWS</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Randomly check if OWS outlet drain valve is closed</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Whether OWS functioning is effective and final discharge free of Oil?</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Check TT parking area for any unsafe practice/activity.</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Check illumination level at all operating areas after sun set &amp; record the lux level.</td>
<td>Quarterly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Check if Portable fire extinguishers are placed as per OISD 117?</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Check proper functioning of hydrant/monitors in the location.</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Check / test of sprinkler system and records performance.</td>
<td>Half yearly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Check/test of foam pourer system</td>
<td>Half yearly</td>
<td></td>
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</tbody>
</table>
and record performance.

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>33</td>
<td>Whether foam quantity is adequate and meets requirement. Check deployment of foam drums at field and stored as per OEM recommendation.</td>
<td>Monthly</td>
</tr>
<tr>
<td>34</td>
<td>Check functioning of bore well pumps. Record yield</td>
<td>Weekly Once each in summer and winter</td>
</tr>
<tr>
<td>35</td>
<td>Comments on housing keeping</td>
<td>Weekly</td>
</tr>
<tr>
<td>36</td>
<td>Any other observations?</td>
<td>---</td>
</tr>
</tbody>
</table>

B. Bulk storage area – Tank Farm

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check if product tank water drain line ends are blanked off when not in use.</td>
<td>Weekly</td>
</tr>
<tr>
<td>2</td>
<td>Check if dyke drain valve kept in closed position?</td>
<td>Daily</td>
</tr>
<tr>
<td>3</td>
<td>Check functioning of dyke drain valve position indication in C/room for effectiveness of it's working.</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Check for rigidity of earthing terminal connections.</td>
<td>Monthly</td>
</tr>
<tr>
<td>6</td>
<td>Whether tank level instruments are in working condition?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>7</td>
<td>Visual inspection of product storage tanks for any sign of leakage / sweating /valve gland leakage etc. Check the floating roof deck for any excessive vapour accumulation/leakage/abnormality etc.</td>
<td>Monthly Weekly</td>
</tr>
<tr>
<td>8</td>
<td>Whether any settlement of tank, cracks on pad observed?</td>
<td>Monthly</td>
</tr>
<tr>
<td>9</td>
<td>Whether ROsov on tank delivery line on remote mode?</td>
<td>Weekly</td>
</tr>
<tr>
<td>10</td>
<td>Whether dyke area &amp; underneath of manifold are free from any oil leakage / accumulation.</td>
<td>Monthly</td>
</tr>
<tr>
<td>11</td>
<td>Whether isolation valve for TSV / expansion line kept open to facilitate taking care of expansion</td>
<td>Monthly</td>
</tr>
<tr>
<td>12</td>
<td>Whether Bonding across flange joints and floating roof deck are rigid.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>13</td>
<td>Check floating roof ladder rails for proper alignment.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>14</td>
<td>Whether escape pathway from tank farm is free from obstruction?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>15</td>
<td>Whether road round the dyke is free from any obstruction?</td>
<td>Daily</td>
</tr>
<tr>
<td>16</td>
<td>Whether Housekeeping in order?</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
| 17 | Any other observations? | ---

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C. Truck loading / unloading gantry

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity Description</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Random check for TT speed limit (10 KMPH) inside the premises</td>
<td>Daily</td>
</tr>
<tr>
<td>2</td>
<td>Whether crew members are carrying proper l-cards? (Random check)</td>
<td>Daily</td>
</tr>
<tr>
<td>3</td>
<td>Whether spark arrestors are of make and design approved by PESO? (Random check)</td>
<td>All TTs in each Quarterly</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>Daily</td>
</tr>
<tr>
<td>5</td>
<td>Random check for TT earthing on clt of TT body and not on mud / guard / valve / cabin.</td>
<td>Weekly</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>Monthly</td>
</tr>
<tr>
<td>7</td>
<td>Random check for product leakage from valve / flanges / swivel joints etc. Check TT manifold valves for any leakage during loading</td>
<td>Weekly</td>
</tr>
<tr>
<td>8</td>
<td>Whether removal of excess filled product from TT compartment is safely handled? Check if any loose product is stored in the gantry in drums / buckets etc.</td>
<td>Weekly</td>
</tr>
<tr>
<td>9</td>
<td>Whether gantry area is free from oil spillage and housekeeping is good?</td>
<td>Daily</td>
</tr>
<tr>
<td>10</td>
<td>Whether operating personnel are carrying walkie talky?</td>
<td>Daily</td>
</tr>
<tr>
<td>11</td>
<td>Whether the emergency shut off switch for pumps is functional?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>12</td>
<td>Whether approach to gantry isolation valve is free from any obstruction?</td>
<td>Monthly</td>
</tr>
<tr>
<td>13</td>
<td>Whether approach to hydrant / monitors around gantry are free from any obstruction?</td>
<td>Monthly</td>
</tr>
<tr>
<td>14</td>
<td>Random Check if portable FE are placed at designated area &amp; easy accessible area before loading of TT</td>
<td>Daily</td>
</tr>
<tr>
<td>15</td>
<td>If hoses are used, visual check of hose condition</td>
<td>Monthly</td>
</tr>
<tr>
<td>16</td>
<td>Check whether periodical testing (hydro test &amp; electrical continuity test) of hoses are due.</td>
<td>At defined frequency.</td>
</tr>
<tr>
<td>17</td>
<td>Whether loading arms / hoses are</td>
<td>Daily</td>
</tr>
</tbody>
</table>
secured properly in the gantry after loading operations and do not obstruct TT movement in the gantry?  

18 Whether emergency escape is marked with signage / display and approach is free from obstruction?  

19 Any other observations?  

<table>
<thead>
<tr>
<th>D. Wagon loading/unloading gantry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Random check for Railway locomotive, whether stops at least 15 mtrs. Short from 1st loading / unloading point during placement/withdrawal</td>
</tr>
<tr>
<td>2 Random check for physical stopper, whether ensure apart from hand / pneumatic brakes to prevent movement during operations?</td>
</tr>
<tr>
<td>3 Whether No shunting device / caution boards positioned before start of operations?</td>
</tr>
<tr>
<td>4 Whether swing ladders are safe for operations and neoprene pad provided to avoid metal to metal contact?</td>
</tr>
<tr>
<td>5 Whether only fit wagons having fill pipe are considered for white oil loading?</td>
</tr>
<tr>
<td>6 Whether splash loading is avoided? (random check)</td>
</tr>
<tr>
<td>7 Whether product leakage from valve / flanges /swivel joints observed?</td>
</tr>
<tr>
<td>8 Whether removal of excess filled product is safety handled?</td>
</tr>
<tr>
<td>9 Check if collection of product in open drums and buckets are safely handled.</td>
</tr>
<tr>
<td>10 Check if gantry area is free from oil spillage and housekeeping is good?</td>
</tr>
<tr>
<td>11 Check if Oil accumulation in drains is observed?</td>
</tr>
<tr>
<td>12 Whether covers on open drain in place?</td>
</tr>
<tr>
<td>13 Whether walkie talky provided to the persons working at gantry area?</td>
</tr>
<tr>
<td>14 Whether the ESD for automation location or explosion proof remote shut off switch for pumps exist &amp; functional? When the same was last checked.</td>
</tr>
<tr>
<td>15 Whether approach to isolation</td>
</tr>
</tbody>
</table>
### E. Product Pump House (loading / unloading)

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether electrical termination in the JBs is apparently sound?</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Whether earthing / bonding connections are apparently sound?</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Whether pressure gauges on pumps / compressors are in working condition?</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Whether pump motor coupling guards are in position?</td>
<td>Monthly</td>
</tr>
<tr>
<td>5</td>
<td>Whether connected drain line valves on strainer / line are closed &amp; caps in position?</td>
<td>Monthly</td>
</tr>
<tr>
<td>6</td>
<td>Whether valves for product circulation are cracked open for loading operations?</td>
<td>Daily</td>
</tr>
<tr>
<td>7</td>
<td>Whether any abnormal vibration excessive noise from pumps motors noticed?</td>
<td>Daily</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>Daily</td>
</tr>
<tr>
<td>9</td>
<td>Whether strainers are periodically cleaned and written?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>10</td>
<td>Whether valve operating platforms are kept free for easy movement?</td>
<td>Monthly</td>
</tr>
<tr>
<td>11</td>
<td>Whether Housekeeping in order?</td>
<td>Monthly</td>
</tr>
<tr>
<td>12</td>
<td>Any other observations?</td>
<td>----</td>
</tr>
</tbody>
</table>

### F. Laboratory

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether earthing connection terminals are apparently rigid</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Whether laboratory electrical fittings are Industrial type closed / tight metal clad fittings for plug and</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>
## G. Transformer yard

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Check if gate of transformer yard kept closed. And entry of persons other than authorized person is under supervision.</td>
<td>Daily</td>
</tr>
<tr>
<td>2</td>
<td>Check if entry of persons other than authorized person is under supervision only.</td>
<td>Daily</td>
</tr>
<tr>
<td>3</td>
<td>Transformer Grounding OK</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Any visible oil leak observed.</td>
<td>Daily</td>
</tr>
<tr>
<td>5</td>
<td>Silica gel condition ok</td>
<td>Monthly</td>
</tr>
<tr>
<td>6</td>
<td>Transformer Oil level ok</td>
<td>Monthly</td>
</tr>
<tr>
<td>7</td>
<td>Oil / winding temp ok</td>
<td>Monthly</td>
</tr>
<tr>
<td>8</td>
<td>Whether earthing &amp; bonding of yard fencing is ok.</td>
<td>Monthly</td>
</tr>
<tr>
<td>9</td>
<td>Whether danger board is displayed?</td>
<td>Monthly</td>
</tr>
<tr>
<td>10</td>
<td>Whether proper rated hand gloves available and periodical testing is not due.</td>
<td>Monthly</td>
</tr>
<tr>
<td>11</td>
<td>Whether Housekeeping in order?</td>
<td>Daily</td>
</tr>
<tr>
<td>12</td>
<td>Any other observations?</td>
<td>---</td>
</tr>
</tbody>
</table>

## H. Electrical Sub Station/ Switch room

<table>
<thead>
<tr>
<th>Sin</th>
<th>Item</th>
<th>Observatio n</th>
<th></th>
<th>Item</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check if any unauthorized electrician/person handles the</td>
<td>Daily</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Whether earthing / bonding connections are apparently sound?</td>
<td>Monthly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Whether updated single line diagram is available?</td>
<td>Half yearly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Whether proper rating insulating mats are provided?</td>
<td>Half yearly</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Check functioning of sub Stn/MCC room Exhaust fans for effective ventilation.</td>
<td>Weekly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Check if any temporary electrical connection exists.</td>
<td>Daily</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Check presence of Dust / soot / cobwebs in the panel</td>
<td>Quarterly</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Check availability of proper rated hand gloves, validity and its use.</td>
<td>Monthly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Whether Housekeeping in order?</td>
<td>Daily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Any other observations?</td>
<td>----</td>
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**TT Checks required to be carried out on random basis by Officer (Total no of TTs plying in location shall cover in a quarter):**

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether driver undergone training on “safe driving practices” &amp; “transportation of hazardous goods”?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>2</td>
<td>Comments on assimilation of above training / knowledge.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>3</td>
<td>Whether crew members possess TREM card / detailing instructions on handling emergencies en route and understand the contents?</td>
<td>Quarterly</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>Quarterly</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>Quarterly</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>Quarterly</td>
</tr>
<tr>
<td>7</td>
<td>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>Quarterly</td>
</tr>
<tr>
<td>8</td>
<td>Check that all electrical wiring through conduit pipe and there is no loose connection. All junction</td>
<td>Quarterly</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Whether TT is carrying a fully equipped first aid box and FLP emergency light?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>11</td>
<td>Whether proper safety fittings (PV vent, Master valve, fusible link etc.) are in place? Check the testing certificate of PV vents.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>12</td>
<td>Whether TT is having any visible dent on the body?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>13</td>
<td>Whether any visible leak observed from valves / flange joints?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>14</td>
<td>Check for ladder at rear end and catwalk are intact and in position.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>15</td>
<td>Check that width of tank body is less than cabin width.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>16</td>
<td>Whether fire extinguishers are ISI approved and periodical testing / refill are carried out?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>17</td>
<td>Demonstration by crew members on operation of fire extinguishers.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>18</td>
<td>Check for valid PESO license and authenticated copy of tank truck drawing.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>19</td>
<td>Check adaptation of roll over design for protection of manhole fittings in case of TT overturning.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>20</td>
<td>Check for Calibration certificate, physical verification of dip rod for correctness of dip marking, condition W &amp; M seals on manholes.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>21</td>
<td>HAZCHEM sign, name of contractor with address and telephone No. displayed prominently.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>22</td>
<td>Random check, during TT calibration, the compartments are fittings are fabricated in line with OISD STD 167. Any deviation shall be recorded and rectified immediately.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>23</td>
<td>Any other observation?</td>
<td>-----</td>
</tr>
</tbody>
</table>
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 fuses 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 proofing 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 up-to date.
F-05  Work permit system is effective and records are maintained.