STORAGE, HANDLING, REFUELLING AND FIRE FIGHTING AT AVIATION FUELLING STATIONS

Prepared by

FUNCTIONAL COMMITTEE

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

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

At the time of development of this document, 113 Codes and Standards, Recommended Practices and guidelines of OISD are applicable to the oil and gas installations of Public sector oil companies in India. 11 of these standards have been adopted by Petroleum and Explosives Safety Organisation (PESO) in various rules administered by them and thus the provisions of these standards are mandatory for entire Oil & Gas sector to that extent.

During 48th Steering committee meeting of Oil Industry Safety directorate (OISD), industry members decided to develop a comprehensive new standard covering all the facets of Safety in STORAGE, HANDLING, REFUELLING AND FIRE FIGHTING at Aviation Fuelling Stations.

This document on “STORAGE, HANDLING , REFUELLING AND FIRE FIGHTING AT AVIATION FUELLING STATIONS ” has been prepared by the functional committee based on existing national standards, guidelines and recommended practices of OISD, the recommendations arising out of accumulated knowledge and experience of industry members and international codes & practices.

This document will be reviewed periodically for improvements based on the new experiences and updation in national & international standards and practices. Suggestions may be addressed to:

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1.0 INTRODUCTION

The Aviation Fuelling Stations (AFS) / Aviation Service Facilities (ASF) are generally located at the airports or near to the airport for both defence and civil categories.

In view of high growth in aviation sector in India, a need was felt to consolidate and develop a comprehensive standard covering all aspects including design, operation, maintenance and safety in receipt, storage, handling, refuelling and firefighting of aviation fuels at AFS. The requirement of a safety system is to prevent emergencies from developing into major threat to the AFS and surroundings including the airport.

2.0 SCOPE

2.1 This standard lays down the minimum safety requirements in design, layout, fire protection, storage, loading and unloading operation, refuelling operation, mobile refuelling equipment, hydrant refuelling system, handling, storage and supply of Aviation products in barrels/packed conditions, inspection & maintenance, training, emergency plan & response, and safety audit systems of AFS.

2.2 This standard does not cover:-

a) The intermediate depot, terminals and refineries handling aviation fuels for which relevant OISD standards to be referred (OISD-STD-118, OISD-STD-117, OISD-STD-116 etc.) for layout and fire protection facilities.

b) Firefighting facilities of ports handling hydrocarbons including aviation fuels for which OISD-STD-156 shall be referred.

c) The facilities on cross-country pipelines (including aviation fuels) 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) Quality control aspects of aviation fuels.

2.3 Keeping in view paucity of land for AFS and availability of a reliable fire fighting support from the airport operator, the provisions of this standard shall be applicable to all new upcoming AFSs. Inter distance norms as defined in this standard will not be mandatory for existing facilities, equipment, structures that are already in place ie. are installed before the date of publication of this Standard. The requisite inter-distance norms will also not be mandatory for augmented facility in existing AFS, which is necessitated due to increased demand at the airport.

2.4 The portable fire protection facilities given in this standard shall be applicable to existing and new upcoming AFS, including augmentation of existing facilities of AFS. Fixed fire protection facilities shall be provided in this standard for new facilities only. For existing AFSs and its augmentation, the same should be provided to the extent possible.

2.5 Requirement of green belt /buffer zone beyond the AFS boundary is outside the scope of this standard.

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3.0 DEFINITIONS:

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

II. AFS SCADA/Server room
The room is an enclosure, equipped with control, monitoring and communication systems used for handling and operation of aviation fuels with automated hydrant refuelling system. This room can be located inside an administrative building.

III. 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.

IV. 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).

V. 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)

VI. Flammable Liquid
It is a liquid capable of producing a flammable vapour or mist under any foreseeable operating conditions.

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

VIII. 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.

IX. 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.

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

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

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XII. Facility

This refers to any building, structure, equipment, pipeline or any other physical feature used in AFS for handling of aviation fuels at various stages of operations, fire protection, testing, maintenance, security, utilities services, mobile equipment and communication etc.

XIII. Flameproof (Ex-d)-(Ref:IS: 2148)

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

XIV. Intrinsically Safe

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

XV. 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).

XVI. General Classification of Petroleum Products

Petroleum products are classified according to their closed cup Flash Point as given below:

Class-A Petroleum: Liquids which have flash point below 23 degree C.

Class-B Petroleum: Liquids which have flash point of 23 degree C and above but below 65 degree C.

Class-C Petroleum: Liquids which have flash point of 65 degree C and above but below 93 degree C.

Excluded Petroleum: Liquids which have flash point of 93 degree 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.

XVII. Aviation Turbine Fuel (ATF)

There are basically two types of aviation fuels viz. Jet A1 (K-50) as per IS-1571, RT fuel (K-60) and JP5 are all Class B POL products. These kerosene type aviation fuels have minimum flash point of 38 degrees C (for Jet A1),28 degrees C (for K-60) and 80 degree C for JP5. At ambient temperatures they must be treated as flammable liquids and additional precautions should always be taken in handling them at these temperatures.

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XVIII. Aviation Gasoline 100 Low Lead (Avgas100LL): Avgas 100LL (IS 1604) is a Class A product and is dyed blue. The product is used for small aircrafts with piston type engines.

XIX. 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.

XX. Fire Station
Building/ housing facilities for parking fire tenders and keeping in readiness other fire-fighting equipment for meeting plant emergencies, fire control room with required communication facilities/mimic panel.

XXI. Fire Water pump house
A structure housing fire engines, fire water pumps, fire water jockey pumps, communication, alarm system, instrumentation and other supporting equipment.

XXII. Aircraft refuelling
Delivery of aviation fuel to the aircrafts from the refuelling equipment. The refuelling equipment is designed to ensure that fuel is delivered in a safe manner to the aircraft at the required pressure and flow rate.

Depending on the scale of operation at an airport, the fuelling methods used are - mobile refuellers, fuel hydrant systems, fuelling cabinet or barrel refuelling. Mobile Refuelling equipment are either refuellers or hydrant dispensers.

a. Refuellers / Bowsers: Mechanically propelled vehicles with storage tank (rigid, semi-trailer or full trailer) for aviation fuel, filtration, pressure control system, metering device and associated safety and quality control system for transferring fuel into or from the aircraft.

b. Hydrant Dispensers: Self-propelled or towed trailer equipped with filters, meters, hoses and controls that is used to transfer aviation fuel between a fuel hydrant and an aircraft.

c. Fuelling cabinet: A fixed above ground structure with hose, meters and auxiliary equipment from which aviation fuel can be dispensed into an aircraft without any additional equipment.

XXIII. Aircraft defuelling:
Transfer of aviation fuel from the aircraft to the refuelling equipment

XXIV. 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.

XXV. 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.

XXVI. 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.

XXVII. Near-miss

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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.

XXVIII. GPM

Denotes US gallons (1GPM=3.785 lpm)

XXIX. 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.

XXX. Aviation Fuel Station (AFS)

The facilities for receipt of aviation fuel through tank trucks or/and pipelines, storage tanks in bulk, pumps, piping and associated equipment like filters, fuel hydrants etc, and refuelling of aircrafts through refuellers, hydrant dispensers and fuelling cabinets. It also include facilities for storage of methanol & Avgas 100LL in barrels, aviation lubricants, HSD (for own consumption) and other additives in packed condition.

XXXI. Sample Room / Additive storage/ DP shed:

Building for storing retention samples, packed additives, Power boost Methanol, Aviation gasoline 100 LL, flammable materials etc.

XXXII. Service Building

Building/structure housing facilities for inspection/maintenance/other supporting services which are directly required for operation of the AFS.

XXXIII. Hydrant Refuelling System

A type of fixed refuelling system that includes an underground system of pipes and valves used to transfer aviation fuel directly from fuel storage facility to one or more designated aircraft parking positions. This also includes pumps, filters and controls which are usually located at the AFS.

a. Hydrant pit valves: Mechanism connected to the termination point of the each lateral or riser of underground fuel hydrant pipe to allow fuel to flow from the hydrant refuelling pipeline system to the aircraft by connecting a coupler to a hose installed on hydrant dispenser. These valves shall conform to EI 1584.

b. Hydrant pit: A chamber embedded in the apron that contains hydrant pit valve and conforming to EI 1584.

XXXIV. ELECTRICAL SUB STATION

Electrical substation 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:

a. Apparatus for transforming or converting energy to or from a voltage.

b. Diesel Generating Set

c. Apparatus for distribution viz. MCC etc.

d. Any other apparatus for switching, controlling or otherwise regulating the energy.

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

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

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

XXXVIII. Slop
Off-specification/downgraded Aviation Turbine Fuel or Avgas, during operations and draining etc. from various equipment / tanks / pumps / filters containing oil-water mixture are called slops.

XXXIX. 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 AFS.

XL. 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.

XL. 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 problems that may pose risk to personnel or equipment, or prevent efficient operation.

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

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

XLIII. Tanks
Storage tanks are defined as "ATMOSPHERIC PRESSURE STORAGE TANK".

Atmospheric pressure storage tank

Vertical Tanks are designed as per API STD 650 or equivalents IS standards, and horizontal storage tanks (buried or semi-buried) as per IS 10987 or equivalent industry standards are called ATMOSPHERIC PRESSURE STORAGE TANKS. These tanks are designed to operate in its gas and vapour spaces at internal pressure approximately equal to atmospheric pressure.

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These tanks are fitted with open vent to atmosphere.

XLIV. Tank height

Tank height is the height from tank bottom to top of the kerb angle for cone roof above ground tanks. For horizontal buried, semi-buried and above ground tanks, it is equivalent to the outer diameter of the tank.

XLV. Tank capacity

a. 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 above ground vertical tanks, and is equal to the geometric volume for horizontal tanks.

b. 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 to the tank structure or appurtenances.

c. 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.

d. 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.

e. Aggregate capacity

Combined safe capacity of storage tanks in an AFS.

f. Pumbable Capacity (Net Capacity)

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

XLVI. Tank Trucks / Refuellers loading / unloading:

Facility for loading / unloading of ATF to / from tank truck/refuellers.

XLVII. Utilities:

Utilities consisting of administrative building, QC laboratory, canteen, parking shed, air compressor, maintenance shed, security cabin, store etc. shall be away from other AFS facilities located as per the inter-distance specified in this standard.
XLVIII. Shall
Indicates provisions that are mandatory.

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

4.0 STATUTORY ACTS AND RULES

The Aviation Fuelling Station's various facilities are covered under various regulations and require specific approval / licence from concerned statutory authorities. The list of statutory acts, rules, regulations inter-alia the following:

i. The Factories Rules made under The Factories Act, 1948.


iv. Civil Aviation Requirements (CAR) Series E&H issued by DGCA.


x. The Water (Prevention & Control of Pollution) Act, 1974 and the Rules made there under.


5.0 HAZARDOUS AREA CLASSIFICATION

The hazardous area is mainly defined for the purpose of selection and installation of electrical equipment, however definition shall be applied, as specified hereinafter, for other purposes also.

An area will be deemed to be hazardous where;

i. 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.

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ii. 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 equipment): A hazardous area shall be deemed to be-

i. 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.

ii. 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:

1. Flammable gas or vapour concentration is likely to exist in the air under normal operating conditions.
2. Flammable atmospheric concentration is likely to occur frequently because of maintenance, repairs or leakage.
3. Failure of process, storage or other equipment is likely to cause an electrical system failure simultaneously with the release of flammable gas or liquid.
4. Flammable liquid or vapour piping system containing valves, meters, screwed or flanged fittings are in an inadequately ventilated area.
5. The area below the surrounding elevation or grade is such that flammable liquids or vapours may accumulate therein.

The zone-1 classification typically includes:

a. Inadequately ventilated ATF pump houses.
b. Interiors of Sample Retention Room/ DP shed
c. API Separators / QWS
d. Oily waste water sewer, basins, sampling/drain points/pits and hydrant pits.
e. Areas in the immediate vicinity of vents, floating suction inspection and manual gauging hatch and filling hatches.
f. Unloading/loading points, proving measure.

g. 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 like fast flushing system, sampling points

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

a. 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.

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

c. Locations adjacent to Zone-1 areas.

d. 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.

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6.0 LAYOUT DESIGN

6.1 Design philosophy

Following philosophy should be adopted in layout of an AFS:

1) Identify and size the facilities needed for receipt, storage and delivery of Class B (ATF) in bulk, based on the business & process requirements and with a provision for future expansion. Facilities for receipt, storage and dispensing of Class A (Av gas) shall be designed and segregated from ATF.

2) Physical segregation/demarcation 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 BIS 5572:2009 & OISD -113.

3) These facilities will be located in the allotted plot of land based on the following:
   i. De-licensed area consisting of admin building, security cabin, utilities will be nearer to the entry/exit gates to minimise movement of personnel in licensed premise.
   ii. TT unloading/refuellers loading area and refuellers parking to be located in such a way that vehicular movement is minimised.
   iii. Facilities should be laid such that length of drain leading to OWS is minimal.

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

   The outcome of risk assessment 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 five years whichever is earlier.

5) Minimum two approaches from the major road should be provided, one for normal movement and another for emergency exit. Both these approaches should be available for receipt of assistance in emergency.

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

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

8) Layout should consider the space requirements for:
   i. Maintenance and inspection of each equipment / facility.
   ii. Dedicated area for construction activities.
   iii. Future expansion for addition of facilities.
   iv. Parking of refuellers/hydrant dispensers and other vehicles.

9) Vehicles with spark ignition engine shall not be allowed inside hazardous area. Vehicles with internal combustion engine (compression ignition) such as refuellers and tank truck required to
be permitted for business shall have Petroleum and Explosives Safety Organization (PESO) approved spark arrester fitted on the vehicle in line with PESO requirement.

10) The maximum height of structure at the AFS shall not exceed the maximum permissible height specified by the local airport authority/operator.

6.2 Layout of facilities

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

a. Storage tanks, utility requirements

b. Product receipt / dispatch and mode of transport (by Road & Pipeline)

c. Warehouses, DP Shed (for storing Avgas 100ll or Methanol) and other open storage areas like scrap yards

d. Chemical storage, hazardous waste storage / disposal facilities etc.

e. Service buildings and allied facilities

f. Site topography including elevation, slope and drainage

g. Seismic data and probability of tsunami in coastal areas

h. Highest flood level in the area, water table, natural streams/ canals

i. Approach roads for functional areas

j. Aviation considerations like height restrictions and distance from flight path

k. Environmental considerations

l. Statutory requirements, airport operator’s requirements, local bye-laws etc.

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, OWS (wherever required) and approach roads should be suitably constructed to prevent flooding.

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

c) The control room for Pipeline receipt (if applicable) can be co-located with the SCADA/server room for the AFS.

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

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

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

g) Tank truck/refuellers movement inside the AFS shall be kept to minimum and for this purpose the truck/refuellers 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/refuellers in the gantry shall be in drive out position for easy escape in case of emergency.

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h) For AFSs with storage capacity more than 1000 KL above ground tanks, drain shall be provided around the Tank farm, TT/Refuellers loading/unloading area to collect product due to accidental spill over / leakage and shall be routed to OWS/pits. The drains shall always be maintained clean.

i) Roads should be provided in a symmetric manner to the extent possible to serve all areas requiring access for the operation, maintenance and firefighting.

j) Smoking booths shall not be provided inside an Aviation Fuel Station.

k) Firewater storage & firewater pump house, wherever applicable, 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 should be made to receive the water from other sources including mutual aid / sharing of water into fire water storage tanks.

l) All buildings which are not related to AFS 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.

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

Electrical equipment / fittings of type suitable for respective area classification (Zone-0,1,2) to be ensured. Electrical fittings as well as electrical equipment in hazardous areas should be flame-proof. Adequate number of portable fire extinguishers should be placed as per details provided in this standard.

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

o) Unlicensed area to be suitably demarcated by fencing.

6.4 Layout of storage tanks

6.4.1 Dyked Enclosures:

a) Above ground ATF storage tanks shall be located in dyked enclosures. Each dyke shall have roads all around for aggregate tankage more than 5000 KL, for access during 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 60,000 KL for a group of fixed roof tanks.

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 minimum 200 mm above the calculated liquid level shall be provided for fixing the height and capacity of the dyke.

c) Enclosure capacity shall be calculated after deducting the following volumes:

i. Volume of the tanks other than largest tank up to enclosure height without free board.
ii. Volume of all tank pads/supports/RCC rings as applicable.
iii. Volumes of fire break walls.
iv. Volume of pipes/supports/steps etc.

d) 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 of PESO. In such case, following conditions must be fulfilled:

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i. Total dyke capacity shall be based on containment of largest tank capacity.

ii. Monitors on raised platforms shall be provided so that throw of the monitors are not restricted.

iii. All tanks in such a dyke shall be provided with sprinkler system for AFSs storing more than 1000 KL in above ground tanks.

iv) 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.

v) Suitable railing for fall protection to be provided.

e) 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.

f) Piping through dyke wall, if any, shall be properly sealed to make dyke impervious.

g) The dyke area shall have proper slope outward of tank pad towards the inner periphery of the dyke enclosure to prevent reverse flow.

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

i) Pump stations and piping manifold should be located outside dyke areas.

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

k) Inter distance between dyke wall and tank shell shall be minimum half the height of the tank.

l) In case of buried tanks - Under Ground (UG/buried) & Semi-buried (SB) tanks:

i. Kerb wall of minimum 300 mm height should be provided in the UG/SB tank Farm Area to contain accidental overflow.

ii. A minimum of 1.5M clear distance from the tank shell shall be maintained from structures / boundary.

iii. Vents shall be located / terminated at a distance of 4 M from hazards and shall be at minimum 4 M height from the ground level.

iv. The open end of free vent pipe shall be covered with non-corrodible metal wire gauze having 60 meshes and shall be further protected from rain by hood or by suitably bending it downward.

v. Aviation fuels shall enter a tank through closed piping system/coupled electrically continuous and sound hose.

vi. The manholes, dip hatch, floating suction inspection hatch and pipelines should be minimum 300mm above the grade level of the tank farm.

m) Corrosion control measures like provision of Cathodic protection for hydrant pipelines, wrapping-coating for buried pipelines and tanks, epoxy lining of tanks & hydrant pipelines, etc. shall be undertaken.

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6.4.2 Grouping of Tanks:

a) Tanks shall be arranged in maximum two rows so that each tank is approachable from the road surrounding the enclosure.
b) Tanks having 50,000 KL capacity and above shall be laid in single row.

6.4.3 Fire walls inside dyke enclosure for above ground tanks;

a) In a dyked enclosure where more than one tank is located, firewalls of minimum height 600mm shall be provided to prevent spills from one tank endangering any other tank in the same enclosure.
b) A group of small tanks each not exceeding 9 meters in diameter and in all not exceeding 5,000 cum in capacity shall be treated as one tank for the provision of firewall.

6.4.4 General

a) The tank height shall not exceed one and half times the diameter of the tank or 20 m for above ground vertical tanks, subject to height restrictions at the airport, whichever is less.
b) All Piping from / to any tank including connected sprinkler / foam line shall comply with the following:
   i) Shall not pass through any other dyked enclosure.
   ii) Shall run directly to outside of dyke to minimise piping within the enclosures.
   iii) Shall not pass through other tank areas / fire walls.

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

c) No part of the dyked enclosure shall be below the level of surrounding ground 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 should be provided for easy access on all four sides of each dyke, wherever feasible.

6.4.5 Protection of facilities:

a) Properly laid out roads around various facilities should be provided within the AFS for smooth access of fire tenders etc. in case of emergency, for AFSs storing more than 1000 KL in above ground tanks.
b) For AFSs located outside airport/defence premises, the boundary wall should be constructed as per the directives of the Ministry of Home Affairs or any other Government directive. In any case the boundary wall shall be of minimum 3m height with V/Y shaped barbed wire fencing on the wall with 600 mm diameter concertina coil on top.

c) 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.
d) CCTV shall be installed in AFSs, other than defence, with aggregate storage more than 5,000 KL, covering entry/exit gate, periphery of installation and all critical operating areas like tank farm, loading/unloading area, etc. which should be monitored continuously. The CCTV monitoring station should be provided in SCADA/SHIFT room, security cabin and in-charge room.

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6.4.6 Separation distances:

a) Minimum separation distances between various facilities described above shall be as per Table-1, 2 & 3. The table shall be read in conjunction with the notes specified with the table.

b) The layout shall also take into account findings/recommendations of HAZOP/ Quantitative Risk Assessment study, which shall be carried out at all the stages of facility development process. For existing AFSs, the same has to be carried out in line with requirement of Factory’s Act is irrespective of tankage capacity.

c) For large AFSs, minimum separation distances are specified in Table- 1. The table is applicable where total storage capacity for ATF in above ground tanks is more than 5000 KL.

d) For medium sized AFSs, minimum separation distances shall be as specified in Table-2. This table is applicable where total above ground storage capacity for ATF is equal to or less than 500 KL but more than 1000 KL.

e) For “other” category AFSs, minimum separation distances shall be as specified in Table-3. This table is applicable where total above ground storage capacity ATF is equal to or less than 1000 KL or where AFSs are having only buried /semi-buried tanks irrespective of storage capacity.

f) Existing AFSs with capacity more than 1000 KL above ground tanks where inter distances between tanks in a dyke and / or within dykes and other facilities are not conforming to the Table 1 and 2 following additional facilities shall be provided to enhance safety:

   i. The fixed water spray system on all tanks, irrespective of tank diameter at locations where required water is available from local resources. ii. Either fixed or semi fixed foam system on all tanks or minimum 2 nos. Trolley-mounted HVLR (variable discharge type).irrespective of tank diameter.

   iii. Additional 75 kg DCP fire extinguishers shall be positioned at other facilities not meeting safety distances.

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**TABLE – 1**

**Separation distances between facilities for LARGE AFSs with ABOVE GROUND tankage > 5000 KL**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>From / To</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Storage Tank- Class B</td>
<td>(D+d)/4 or 10 min</td>
<td>15</td>
<td>30</td>
<td>0.5D or 20 min</td>
<td>30</td>
<td>30</td>
<td>8</td>
<td>30</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tank vehicle loading/unloading for petroleum Class B</td>
<td>15</td>
<td>x</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>8</td>
<td>30</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Fire water tanks &amp; Pump House</td>
<td>30</td>
<td>30</td>
<td>x</td>
<td>X</td>
<td>12</td>
<td>30</td>
<td>6</td>
<td>30</td>
<td>12</td>
<td>30</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Boundary wall around AFS</td>
<td>0.5 D or 20 min</td>
<td>20</td>
<td>X</td>
<td>x</td>
<td>X</td>
<td>1.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>15</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Service/office buildings/workshop</td>
<td>30</td>
<td>30</td>
<td>12</td>
<td>X</td>
<td>X</td>
<td>30</td>
<td>X</td>
<td>8</td>
<td>X</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>OWS</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>1.5</td>
<td>30</td>
<td>X</td>
<td>30</td>
<td>X</td>
<td>30</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Electrical Panel Room (PMCC/DG room)/Electrical Sub station</td>
<td>30</td>
<td>30</td>
<td>6</td>
<td>X</td>
<td>X</td>
<td>30</td>
<td>X</td>
<td>8</td>
<td>X</td>
<td>15</td>
<td>X</td>
</tr>
<tr>
<td>8</td>
<td>FLP Electric Motors</td>
<td>8</td>
<td>8</td>
<td>30</td>
<td>X</td>
<td>8</td>
<td>X</td>
<td>8</td>
<td>X</td>
<td>8</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>SCADA/Server Room</td>
<td>30</td>
<td>30</td>
<td>12</td>
<td>X</td>
<td>X</td>
<td>30</td>
<td>X</td>
<td>8</td>
<td>X</td>
<td>30</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>DP shed (Class A in packed condition)</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>30</td>
<td>15</td>
<td>8</td>
<td>30</td>
<td>X</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>Non-FLP Motors</td>
<td>15</td>
<td>15</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>15</td>
<td>X</td>
<td>15</td>
<td>X</td>
<td>15</td>
<td>X</td>
</tr>
</tbody>
</table>

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General Notes to Table-1:

a) All distances are in meters and the table specified the minimum requirement.

b) "D" indicates the diameter of the larger tank.

c) 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.

d) Service building shall have minimal manning and normally no hot work would be done there.

e) " X " means any distance suitable for constructional or operational convenience

f) Safety distances between tanks are not applicable (other than boundary wall) for double walled above ground storage tanks. No dykes are required for such tanks.

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

Specific notes to Table-1:

1. OWS shall be minimum 1.5 m from boundary wall. However, OWS in this case shall have permanent covers with venting arrangement located at minimum 4 m from boundary wall and other hazard.

2. Refuellers parking space should be demarcated and a minimum distance of 4m distance to be maintained from the centre line of the nearest refuellers to the boundary wall.

3. Fixed type Proving Measure should be at a minimum distance of 4 m from hazard.

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## TABLE - 2

SEPARATION DISTANCES BETWEEN TANK / OFFSITE FACILITIES for AFSs with Above Ground Tankage >1000 &≤5000KL

<table>
<thead>
<tr>
<th>S.No.</th>
<th>From / To</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Storage - Class B</td>
<td>0.5D</td>
<td>4.5</td>
<td>D or 4.5</td>
<td>D or 4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>3</td>
<td>9</td>
<td>30</td>
<td>4.5</td>
<td>D min</td>
</tr>
<tr>
<td>2</td>
<td>Tank vehicle decantation / Topping-up</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>1.5</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Boundary wall around AFS</td>
<td>D or 4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>1.5</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Service/office buildings/workshop</td>
<td>D or 4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
<td>12</td>
<td>9</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Non-FLP motors</td>
<td>4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>9</td>
<td>x</td>
<td>9</td>
<td>x</td>
</tr>
<tr>
<td>6</td>
<td>Electrical Panel Room (PMCC/DG room)/Electrical sub statin</td>
<td>4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>9</td>
<td>x</td>
<td>9</td>
<td>x</td>
</tr>
<tr>
<td>7</td>
<td>FLP Electric Motors</td>
<td>3</td>
<td>1.5</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>3</td>
<td>30</td>
<td>x</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>DP shed (Class A in packed condition)</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>30</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Fire water tanks &amp; Pump House</td>
<td>30</td>
<td>30</td>
<td>X</td>
<td>12</td>
<td>X</td>
<td>X</td>
<td>30</td>
<td>30</td>
<td>x</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>OWS</td>
<td>4.5</td>
<td>9</td>
<td>1.5</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>X</td>
<td>9</td>
<td>30</td>
<td>x</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>SCADA/Server Room</td>
<td>D min</td>
<td>9</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>9</td>
<td>12</td>
<td>9</td>
<td>x</td>
</tr>
</tbody>
</table>

Notes:
Safety distances between tanks are not applicable (other than boundary) for double walled above ground storage tanks. No dykes are required for such tanks. Notes given under Table 1 are applicable for Table 2.

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### TABLE - 3

**SEPARATION DISTANCES BETWEEN TANK for AFS with Above Ground tankage <=1000 KL or Buried/Semi Buried tanks irrespective of capacity.**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>From / To</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Storage - Class B</td>
<td>0.5D (note b)</td>
<td>4.5</td>
<td>D or 4.5min (note b)</td>
<td>4.5</td>
<td>D or 4.5min</td>
<td>4.5</td>
<td>3</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>2</td>
<td>Tank vehicle decantation / Topping-up</td>
<td>4.5</td>
<td>X</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>1.5</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>3</td>
<td>Boundary around AFS</td>
<td>D or 4.5min</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Service/office buildings/workshop</td>
<td>D or 4.5min</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Electrical Panel Room (PMCC/DG room)</td>
<td>4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>9</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>FLP Electric Motors</td>
<td>3</td>
<td>1.5</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>DP shed (Class A in packed condition)</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>X</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>Non-FLP motors</td>
<td>4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>SCADA/Server Room</td>
<td>4.5</td>
<td>4.5</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>3</td>
<td>9</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**General notes to Table –3:**

a) All distances are in meter and the table specifies the minimum requirement.

b) Distance norms between buried / semi buried tanks will not be applicable. The distance between buried/semi buried tanks & boundary shall be minimum 1.5 m.

c) “X” indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements

d) “D” indicates the diameter of the larger tank.

e) Distances given for the tanks are shell to shell in the same dyke.

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

g) 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.

h) Pig launcher/receiver should be located at least 5 m from boundary.

i) Safety distances between tanks & other facilities (other than boundary are not applicable for double walled above ground storage tanks. No dykes are required for such tanks.

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For Aviation Fuel Stations:
1. For underground & semi buried tanks the separation distance between Tank Vents and hazard should be minimum 4 m. The vertical separation should be minimum 4 m from the grade level.
2. Separation distance of 1.5 m to be maintained from underground and semi buried tanks to nearby structures and boundary wall. For above ground tanks Table 3 to be followed.
3. Refuellers parking space should be demarcated and a minimum distance of 4m distance to be maintained from the centre line of the nearest refuellers to the boundary wall.
4. Fixed type Proving Measure should be at a minimum distance of 4 m from hazard.

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7. DESIGN CONSIDERATIONS

7.1 Types of storage tanks

i) Horizontal tanks: Above ground, Underground and semi-buried Tanks

All horizontal tanks—above ground, underground and semi buried, shall be as per BIS 10987 or any equivalent industry standard.

ii) Fixed Roof Tank

Fixed roof may be of cone type. For designing atmospheric pressure tanks, API STD 650 or IS 803 or any other equivalent shall be followed.

7.2 Selection of type of storage tanks

Selection of type of tank generally depends on ambient conditions, site requirement and the volume of product to be handled.

7.3 Special Considerations

Tank bottoms should be cone down with a continuous slope towards centre sump for vertical tanks as per industry standard and horizontal tank should be installed with a continuous slope of 1:60 minimum.

7.4 Tank appurtenances

i. Ladders and Handrails:

Individual above ground vertical and horizontal tanks shall be provided with access to the roof or tank top. A platform with railing should be provided from the top of the stairway to gauge well, vents and floating suction check point.

ii. Stairs:

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

iii. Manholes:

Minimum two number of roof manholes and 2nos. of shell manholes to be provided in all vertical tanks. For horizontal tanks minimum two numbers of manholes shall be provided.

iv. Walkway on the Roof:

Walkway with hand rail on the roof of the tank should be provided to facilitate inspection/checking of vents etc. so that movement of personnel on roof is safer. Anti-slippery path on the roof should be provided for this purpose.

v. Floating suction: All Aviation tanks shall be provided with floating suction of size depending on the tank capacity and discharge flow rate, with an inspection hatch at the top of the tank.

vi Sampling sump: to be provided in all types of Aviation tanks.

vii sampling draw off line and water draw off line: For vertical tanks minimum one no. sampling draw off line and / or one water draw off line should be provided.

Viii Vents: Adequately sized free vents to be provided for ATF tanks as per API 2000. Vents should be fitted with a protective screen of 60 mesh size.

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7.5 Tank farms/manifolds

7.5.1 Tank Farm Drains for AFS with storage capacity > 1000 KL

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 divert to the OWS or to main storm water drain.

AFS with total tankage of more than 5000 KL in above ground tanks, the dyke drain valves shall be provided with position indication and alarm system.

7.5.2 Tank Manifold

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

Tank body valve of above ground tanks shall be manually operated valve.

The second valve on above ground tanks should be motor operated valve (MOV) on inlet and outlet lines for locations having hydrant refuelling system. For other AFSs, in place of MOV, manual operated valve may be provided. This second valve can be located outside the dyke area.

All AFSs with above ground storage capacity more than 5000 KL shall have over-fill protection system

ii) Hammer blind valves of any type shall not be used in AFSs.

iii) MOV should have open & close remote operation from SCADA/shift room and at field outside of dyke.

In addition, open, close & stop feature should be available for local operations, close to the valve.

iv) Tank manifold(s), if provided, should 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 OWS.

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

TSV outlet line or expansion line should be connected back to above ground tank / tank inlet/outlet line before manually operated body valve with suitably positioned isolation valve(s). One isolation valve shall be installed close to the tank body/inlet/outlet line to the maximum extent possible.

In case the expansion line is connected at tank top, the line shall be extended inside up to the Tank bottom to avoid free fall thru vapour space. However, at existing locations where ever the above provision does not exist in above ground tanks, the same shall be provided on all tanks during scheduled tank maintenance / cleaning.

vi) 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 MOVs should be above the dyke height.

7.5.3 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.

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7.6 Drain/sampling point

7.6.2 Drain/sampling point in Above Ground tanks

Arrangement should be provided in all above ground tanks for product sampling and water draw off from tanks. 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 tank 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.

7.6.3 Drain/sampling point in Buried / Semi Buried tanks

Arrangement should be provided in all buried and semi buried tanks for product sampling and water from tank sump.

7.7 Vents

Open Vents
For sizing the vents API STD 2000 is to be referred. However, following are the basic guidelines need to be considered:

a. Maximum and minimum ambient temperatures.
b. Vapour pressure of the product at operating/design temperature.
c. 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).

7.8 Dip Hatch/Sampling

a) Dip hatch or gauge hatch is used for gauging the height of the liquid in an above ground tank as well as to take out samples for testing. In underground and semi buried tanks, separate sampling hatch is provided in addition to dip hatch for gauging purpose.

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

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

7.9 Instrumentation

i) Safety Integrity Level (SIL)

The SIL classification study should be carried out for AFS having hydrant refuelling system and pipeline receipt with storage capacity more than 1000 KL above ground, 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 EN 61511. All instrumentation equipment shall have required SIL certification based on the above study.

ii) Level controls on Tanks

Position of level alarms:

High Level (H): Between normal fill level and safe fill level

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High Level (HH): At safe fill level (PESO approved stored volume)

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

The above alarms shall be provided as given below:

| AFS with total storage less than or equal to 1000 KL above ground. | NIL requirement. |
| AFS with total storage 5000 KL and more (above ground tanks) | Hi, Hi-Hi and shut down system |
| AFSSs with above ground storage capacity more than 1000 KL & less than 5000 KL. | Hi level alarm. |

The above shall be applicable to all locations.

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 MOV 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 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.

7.10 Piping/valves/flanges

Piping: should 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 AFS) 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.

The product hydrant pipelines should be provided with low point and high point drains to facilitate emptying /sampling/hydro-testing etc. Ends of each drain point should have provision of blind flange/capping arrangement.

Valves for handling aviation product:

Steel valves for handling aviation products should conform to relevant API or equivalent standards. Cast iron valves shall not be used for handling aviation products.

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Fittings for handling aviation product:

Steel flanges and flanged fittings shall conform to relevant ASME / ASTM/ANSI or equivalent. Slip on or weld neck flanges should be used.

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

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

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

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

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

All flanges shall be connected for bonding for electrical continuity.

7.11 Bulk Loading /unloading operations

i) Loading / unloading Pumps
   a) Pumps conforming to relevant API standards may be used.
   b) Product pumps may be provided with suitable sized strainers on suction and NRVs on discharge lines. All drain points of strainers shall be provided with isolation valves and ends having provision for blind flange / screw capped
   c) Pumps shall be located in an exclusive paved area with drainage facilities routed to OWS for AFSs with more than 1000 KL above ground tanks.
   d) Pump house shall be positioned at an elevated platform and shall be well ventilated on all four sides.
   e) Pump-motors are to be provided with suitable IP protection
   f) 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.
   g) Unloading/loading pumps shall also be provided with additional flame proof switch located at the strategic location in the gantry/loading-unloading bays to switch off the pump in case of emergency such as over flow, fire or any other abnormal situation.
   h) In addition to above, locations having automation shall be provided ESD (Emergency Shutdown) feature through automation system.
   i) Suction and discharge lines at AFSs with above ground tanks 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. When connected to tank, it (TSV) shall be provided with isolation valves, which shall be locked open. One isolation valve shall be installed close to the tank body to the maximum extent possible.

ii) Tank truck and Refuellers Loading Bays.
   a) Tank Truck and refuellers should be bottom loaded.
   b) Loading unloading points shall have quick shut-off valves e.g. Cast steel Plug or Ball Valves.
   c) Automated locations may be provide suitable overfill protection system to prevent any overflow and hazards arising out of that.

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d) Loading hoses for Tank Trucks and refuellers shall be as per relevant API/EI/EN/BIS specifications.

e) Flameproof lighting or portable flame proof torches shall be provided for night time checking of bottom leaks of trucks and also for proper sealing and inspection wherever loading/unloading during night is required to be done.

f) Operating personnel of large size AFSs (storage more than 5000 KL) shall be provided with intrinsically safe walkie-talkie sets.

g) AFSs with Tank Truck unloading/loading gantries and refuellers loading gantries shall be provided with safety harness to protect the operating crew against fall from height.

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

i) Proper handrail arrangement should be provided on platforms and stairs for safe movement of personnel.

j) 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 should be considered as per the site conditions and overall automation system in the AFS.

k) Loading and unloading bay area shall be paved for smooth draining and collection of spillages into drains.

l) Open drains shall be covered with gratings so as not to endanger movement of personnel.

m) All tank trucks/refuellers, if not exempted by PESO, entering licenced area shall be provided with PESO approved spark/flame arrestor at the exhaust.

n) Oil and water collected from loading/unloading areas shall be routed to Oil water separator system for AFSs with storage capacity more than 1000 KL above ground. A slop tank should be earmarked for storing separated oil.

o) The loading and unloading bays shall be designed such that movement of vehicle is smooth without criss-crossing.

7.12 HANDLING OF SLOP

Collection and Drainage for AFSs with above ground storage capacity more than 1000 KL.

A network of drainage system shall be provided to collect oil drains from various equipment, loading/unloading 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.

OWS

The receiving sump of the OWS shall have suitable arrangement for skimming off upper layer of accumulated oil.

7.13 ELECTRICAL EQUIPMENT

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

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

**Protection:** The protection 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 including XLPE insulated cables used inside the dyke shall be flame retardant type conforming to category AF as per IS: 10810. The cable shall have a low smoke property.

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

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

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

**A. MEASUREMENT OF EARTH RESISTANCE**
The testing of the earth pits shall be done six monthly one in dry and once in wet weather and records maintained. An earth resistance tester to be used for this purpose.

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:

-- 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.

**B. AFS EARNING**
AFS earthing design shall be carried out in accordance with the requirements of Central Electricity Authority (CEA) safety Regulation 2010 or equivalent system recognised by statutory authorities under the petroleum act / electricity act. All earth connections should be visible for inspection to the extent possible. The earthing system shall have an earthing network with required number of earth electrodes connected to it.

Earthing system shall be designed for the following:

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

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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) to be provided for Di Pole/ Four Pole structures and shall be connected to two distinct earth pits. The strips shall run on insulators / isolators so as not to come in contact with the Pole structure. Connections shall be made to the pit directly and then pits will be connected to each other to form a grid. The Grid of LA shall be distinct and shall not be connected to any other earth Grid.

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

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

The Neutral of the Transformer shall be earthed with two distinct earth pits separately. Connections will be made to the pit directly and then pits will be connected to each other to form a grid. This Grid shall be distinct and shall not be connected to any other earth Grid.

The Neutral of the Diesel Generator shall be connected to two distinct earth pits separately. Connections shall be made to the pit directly and then pits will be connected to each other to form a grid. This Grid shall be distinct and shall not be connected to any other earth Grid.

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

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

All the electrical equipment operating above 250 volts shall have two separate connections to the earth. (Sub Station Panels, Motors, FLP JBs etc.).

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

Storage Tanks shall have minimum 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. All earth pits shall be located outside dyke area. 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 Truck/Refuellers Loading and Unloading bays: For the bays minimum 6 mm Sq. braided copper wire with one end firmly bolted to the Loading Unloading Arm / hoses and the other end provided with G.1 / Copper / Non corrotable metal crocodile clips are to be used, the crocodile clips being attached to the tank-truck/refuellers under loading or discharging. (For External Bonding of Loading unloading arms/hose with the Tank Truck).

SAMPLING /GAUGING: For sampling devices to be inserted into product tanks, use SS chain.

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D. **STATIC EARTHING:**

Static Earthing shall be provided at **Tank Lorry / Refuellers loading/ Decantation Gantries**, to prevent building up of Static Charges. The Static Earthing shall be segregated from electrical earthing to prevent it from getting energized to the same voltage level as it would exist on electrical fittings in case of fault. This earthing shall be independent of earthing system for automation.

E. **LIGHTNING PROTECTIVE SYSTEM:**

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

Self-conducting structures do not require lightning protection with aerial rod and down conductors. They shall be connected to the earthing system at two points of the base.

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

F. **EARTHING FOR DATA PROCESSING SYSTEM:**

Low noise Earthing are required for critical data processing equipment. These are to be independent of any other Earthing of the Building.

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>50mmx6 mm GI strip</td>
</tr>
<tr>
<td>Lightening Arrester of the 2/4 Pole Structure</td>
<td>40mmx6 mm GI strip</td>
</tr>
<tr>
<td>2/4 Pole structure / Sub-Station equipment / VCB etc.</td>
<td>40mmx6 mm GI strip</td>
</tr>
<tr>
<td>Fence of the 2/4 pole structure / transformer yard</td>
<td>25mmx3 mm GI strip</td>
</tr>
<tr>
<td>Power Transformer Neutral</td>
<td>50mmx6 mm GI strip</td>
</tr>
<tr>
<td>Power Transformer Body</td>
<td>40mmx6 mm GI strip</td>
</tr>
<tr>
<td>Fire Water Pump House</td>
<td>25mmx6 mm GI strip</td>
</tr>
<tr>
<td>Building / Structure Columns</td>
<td>40mm X 5mm GI Strip</td>
</tr>
<tr>
<td>Storage Tanks</td>
<td>40mm X 5mm GI Strip</td>
</tr>
<tr>
<td>Push Button Stations</td>
<td>No. 8 SWG Solid GI Wire</td>
</tr>
<tr>
<td>Street Light Poles</td>
<td>10 mm (3/8&quot;) GI Wire Rope</td>
</tr>
<tr>
<td>Small Equipment &amp; Instruments</td>
<td>No. 8 SWG Solid GI Wire</td>
</tr>
<tr>
<td>Bonding of Pipes</td>
<td>25 mm square copper strip / braided flexible cable.</td>
</tr>
<tr>
<td>Motors up to 3.7 Kw</td>
<td>No. 8 SWG Solid GI Wire</td>
</tr>
<tr>
<td>Motors above 3.7 Kw up to 30Kw</td>
<td>10 mm (3/8&quot;) GI Wire Rope</td>
</tr>
<tr>
<td>Static Earth at Tanker / Wagon loading/ Unloading gantry</td>
<td>40mmx6 mm GI strip.</td>
</tr>
<tr>
<td>Flexible cable for Static Earth</td>
<td>10 Sq. mm Copper flexible cables with lugs at one end and crocodile clip at other end.</td>
</tr>
</tbody>
</table>

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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 for each DG Set</td>
</tr>
<tr>
<td>Body of DG Set / control panel for DG Set</td>
<td>2 Nos</td>
</tr>
<tr>
<td>Sub-station -PMCC Room</td>
<td>4 Nos</td>
</tr>
<tr>
<td>Fire Pump House</td>
<td>2 Nos</td>
</tr>
<tr>
<td>Air Comp House</td>
<td>2 Nos</td>
</tr>
<tr>
<td>All structures Shed of Pump House / Fire Engine / Loading unloading Gantry / Air Compressor / Eng. Store etc.</td>
<td>2 Nos for each structures</td>
</tr>
<tr>
<td>Static Earth for Loading unloading Gantry (Tank Truck)</td>
<td>1 Nos independent for each bay.</td>
</tr>
<tr>
<td>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 equipment 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 Clause B above.</td>
</tr>
</tbody>
</table>

I. General

a) Fail safe Interlock / change over switch shall be provided between the Grid Power and the DG power to ensure that the equipment gets supply from one source only.

b) Insulation mats as per IS-15652 standard shall be provided in the Sub Station, control panels etc.

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

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

J. Emergency Feeder, for AFSs with more than 1000 KL above ground storage:

Emergency Feeder shall host the following equipment:
Fire water jockey Pump, Critical lighting, Fire Siren, Bore well, Gate Barrier, safety instrumentation and interlocks, CCTV, , UPS of automation, supply to essential firefighting equipment.

7.14 AFS lighting

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

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

Under normal operation, both emergency and normal lighting shall be fed by normal power source. On failure of normal supply, critical emergency lighting, wherever available may be transferred to emergency source, until the start of D.G. set.
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 AFS. 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,

a) Facilitate carrying out of specified operations, for safe shutdown.

b) Gain access and permit ready identification of fire-fighting facilities such as fire water pumps, fire alarm stations etc.

c) 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 in line with OISD-RP-149:

<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 Area &amp; Access Stairs (TT/Refuellers/dispenser parking area and TW gantry, Tank manifold)</td>
<td>60</td>
</tr>
<tr>
<td>Maintenance shed</td>
<td>100</td>
</tr>
<tr>
<td>OWS 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>SCADA Room bldg./laboratory</td>
<td>400</td>
</tr>
<tr>
<td>DP shed (for storing Class A product in barrels)</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>
</tbody>
</table>

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

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

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

8.0 Safe Operating Practices in Storage and handling of bulk aviation fuels

8.1 GENERAL

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

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8.2 SAFE OPERATING PRACTICES.

i) AFS SCADA 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. 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) VHF handsets provided to operating personnel shall be of intrinsically safe type.

v) 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.

vi) 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 trained & experienced staff.

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

viii) For locations with above ground storage tanks having aggregate capacity more than 5000 KL, the tank farm management system should be integrated with SAP/ERP. Provision of recording of TFMS inventory levels shall be made on SAP / ERP.

ix) For locations with above ground storage tanks having aggregate capacity more than 5000 KL, suitable interlocks shall be provided for tripping / alarm / MOV operation based on the events high level, high high level etc.

x) 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) for safe disposal.

xi) Personnel protective equipment such as safety shoe, hand gloves, apron, safety goggles, safety belt, helmet, ear muffs, bump caps, self-contained breathing apparatus (SCBA), resuscitator etc. as applicable shall be worn while carrying out operations in normal and emergency situations. Personnel protective equipment (PPE) are equipment designed to offer protection against potential hazards, fire, toxicity, accidental fall etc. during normal and emergency operations.

8.3 BULK HANDLING FOR MOVEMENT BY ROAD


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

iii) For movement of refuellers, sampling/pit cleaning vehicles and hydrant dispensers, inside airport premises, the relevant Motor vehicle Rules, local airport operator’s requirement and Civil Aviation Requirements to be followed.

8.4 SAFETY PRECAUTIONS DURING TT/REFUELLERS LOADING / UNLOADING

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

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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 and refuellers in respect of Class A&B petroleum products.

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

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

v) The first operation after positioning the truck/refuellers shall be to provide proper earthing/bonding. Earthing/bonding shall be disconnected just before the release of the truck.

vi) All Refuelling Hoses shall conform to EI-1529/ISO 1825 standard and shall be handled with care and hydrostatically tested once in 6 months.

vii) No repairs shall be made on the truck/refuellers 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 -
   a) Uncontrolled leakage occurring
   b) A fire occurring in the vicinity
   c) Lightning and thunderstorm

8.5 PROCEDURES FOR OPERATION

A. LOADING/TOPPING UP OPERATIONS:

I. Check for following in a tank truck/Refuellers as per statutory regulations before accepting it for filling:
   a) Provision of PV vent, emergency vent valve (for refuellers), master valve, spark arrester and other safety fittings.
   b) Fire screen between cabin and tank is provided. For this purpose, cabins with metallic back over without any opening will be considered as fire screen.
   c) Each tank truck shall be provided with 2 nos. of Fire Extinguishers of ISI mark (1 no.10/9 kg DCP and 1 no. 1 kg CO2/equivalent approved fire extinguisher in driver’s cabin).
   d) Each refuellers shall be provided with 3 nos. of Fire Extinguishers of ISI mark (2 no.10/9 kg DCP and 1 no. 1 kg CO2/equivalent approved fire extinguisher in driver’s cabin).
   e) Spark arrestors, unless exempted by PESO, shall be welded on the exhaust.
   f) No leakage in exhaust silencer pipe.
   g) Valid Explosive License with PESO approved drawing and RTO certificate is available.
   h) Availability of brazed copper strip for earthing / bonding connection.

II. Move vehicle to the loading/topping up bay.

III. Place the truck/refuellers on loading/topping up bay and place wheel chokes at front and rear wheels. Keep the truck/refuellers in neutral mode with hand brakes “ON”.

IV. Stop the engine and switch off all electrical equipment.

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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. Ensure tank vent valve is open and fire extinguisher is readily available near loading point

VIII. Start the loading/topping up operations.
IX. The quantity loaded into the truck/refuellers can be assessed by liquid recorded through manual dipping/dial gauge reading.

B. UNLOADING OPERATIONS

i) Necessary steps described under clause 8.5(a) should be carried out.

ii) Test the connections for leaks

iii) Start the Unloading operations

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

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

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

8.6 PIPELINE TRANSFER OPERATIONS

Pipeline transfer of ATF is carried out through dedicated pipeline for receipt of ATF at the AFS from refineries / cross country pipeline/ marketing terminal/other AFSs within the same company or between oil companies.

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

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 DGCA approved Quality Control Manual.

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

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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.

8.7 TANKFARM OPERATIONS: SAFETY PRECAUTIONS IN TANK FARM AREA

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

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

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

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

v) Proper earthing and bonding shall be maintained and ensured at all times for the tank body,

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

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

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

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

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 Rate (KL/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>246</td>
</tr>
<tr>
<td>250</td>
<td>168</td>
</tr>
<tr>
<td>200</td>
<td>109</td>
</tr>
<tr>
<td>150</td>
<td>59</td>
</tr>
<tr>
<td>100</td>
<td>27</td>
</tr>
<tr>
<td>80</td>
<td>25.5</td>
</tr>
</tbody>
</table>

x) Safety shoes/PPEs shall be worn by the operating staff in the operational area.

xi) 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.

xii) Synthetic fibre cord shall not be used for sampling, gauging etc. If the sampling, gauging, etc., equipment is a conductor, the cord must be conductive, e.g. a metal wire/chain. Proper bonding to be provided in this case.

xiii) 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.

8.8 METHANOL HANDLING AT AFS

“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
i. For piston engines methanol/water mixtures (MWM) are used and these may have 1% of anti-corrosion oil added. The injection system may be used to compensate the power lost when operating under high temperature and/or high altitude conditions where air densities are very low or to obtain increased take off power under normal atmospheric conditions by permitting high boost pressure for a short period.

ii. In the case of turbine engines, water alone or Methanol/Water mixtures are used, to restore the take-off power or thrust lost when operating under low air density conditions. Use of a corrosion inhibitor in thrust augmentation fluids used for these engines, is not permitted.

iii. The principal grades of Methanol Water Mixtures in use is MWM (45/55/0). In this grade 45 parts of PBM (Power Boost Methanol) is mixed with 55 parts of de-ionized water and there is no corrosion inhibitor which is denoted by ‘0’. This grade is used in the turbine engines in Aircraft like Avro, Fokker Friendship, etc.

iv. Raw water has minerals in the form of metal salts. These minerals have to be removed from water. This removal of minerals from water is achieved by ion exchange process. The water thus produced is de-ionized water. It may be either purchased from outside source; stock transferred from another location or refinery or may be generated at the location itself.

v. Containers used for storage of De-ionized Water shall be of high density polythene (HDP) or stainless steel and will be flushed clean before use.

vi. High density Polythene (HDP) pipes shall be used for transferring De-ionized Water from one container to another.

vii. The HDP container shall be handled with care to avoid damage.

viii. The container shall always be kept closed and in a clean condition.

ix. DP Shed of required dimensions duly approved by PESO shall be provided for storage of PBM. An authenticated copy of the approved drawing from PESO, showing the DP shed shall be available at the location.

x. For transporting PBM barrels in trucks, a suitable road permit must be obtained by the consignee from local Excise authorities and sent to the consignor. The permit shall indicate the storage licence number of the consignee and total quantity of PBM being dispatched in barrels.

xi. De-Ionized Water used for blending of Methanol Water Mixture shall be as per the requirements laid down in the QC Manual.

xii. Blending of Methanol Water Mixture is carried out in a blending unit kept in a ventilated area.

xiii. The blending unit has two identical containers which are provided with level indicators.

xiv. De-Ionized Water and PBM shall be pumped into the blending unit through a hand pump in the required proportion. Only polythene pipes and stainless steel pipes shall be used for suction of PBM and De-Ionized Water.

xv. Both PBM and De-ionized Water are simultaneously allowed to mix in a blender, by adjusting the valves in the blending unit. The Methanol Water Mixture is drawn out of the unit and loaded into the MWM refuelling unit, through a funnel provided with 100 mesh strainer.

xvi. All the sampling procedures and tests required as per Quality Control Manual shall be carried out.

xvii. In case where blending units are not available, blending may be carried out in the refuelling unit itself. Refuelling of MWM is through a refuelling unit kept specifically for that purpose and is refuelling in special tanks in the aircrafts. All precautions taken in normal refuelling is done for MWM refuelling also.

8.9 REFUELLING OPERATIONS:

8.9.1 Aviation refuelling Equipment:

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Aircraft Refuellers or Bowser – It will be designed and constructed as per Petroleum Rules, Motor Vehicle Rules and other statutory requirements. Each refuellers shall comply with the requirements of PESO licence, local RTO, local Weights & Measure etc.

Salient features in a Refuellers / Hydrant dispenser:

a. Refuellers tank shall be either mild steel or aluminium alloy
b. Pressure control valves (PCV),
c. Hydrostatically tested pumping circuits for refuellers,
d. Externally mounted emergency stop buttons for engine and refuelling.
e. All refuellers shall carry only one grade of product and the grade identification shall be displayed prominently on the control panel.
f. Main pipe work shall be equipped with low point drain plugs located so as to enable complete draining of all product.
g. All pipe work and accessories shall be of aluminium alloy, stainless steel or mild steel protected internally by hot tinning or by lining with epoxy material, approved as being compatible with aviation fuels.
h. No copper alloys, cadmium plating, galvanised steel or plastic materials shall be permitted for main piping. The use of copper containing materials for other components in contact with ATF should be avoided and no zinc, magnesium or cadmium shall be used.
   i. Spill Containment kit: it is recommended that all fuelling equipment be equipped with a spill containment kit for use as first response to a spill on the apron. The contents of the kit should comply with local airport regulations and include fuel absorbent pads.
   ii. Sealing System: Suitable seals shall be provided on Fire extinguishers, nozzles, Meters. To be provided on Deadman override, Interlock override, wherever provided.
   iii. All refuelling Equipment shall have Flame arrester (Approved by Petroleum and Explosive Safety Organization) fitted on the outlet of the exhaust system of the vehicle.

i. New generation refuelling vehicles shall be fitted with a brake interlock system to prevent drive away, roll away and jet blast blow away during fuelling of aircraft. This system shall be activated whenever hose couplings (including hydrant inlet couplings), platforms, bonding reel, platform railing are removed from their normally stowed positions. The system will be so designed that no operator action (such as engaging the handbrake) is required to arm and/or activate the interlock mechanism. Emergency interlock overrides shall be safety wired and sealed in the interlock operating position. The sealing wire shall be easy to break in an emergency. Interlock status warning indicator light will indicate whenever an interlock protected component is removed from its stowed position. An emergency override status warning light which indicates whenever the override mechanism is moved from its normal operating position shall be fitted in a prominent position in the cab.

j. Overwing (trigger) fuelling nozzles shall not have hold-open ratchets. Overwing fuelling nozzles shall be grade marked and colour coded (black for Jet A-1). Nozzle spouts shall not be painted or coated. Brake interlock to be extended to the overwing nozzle.

k. All refuelling equipment (hydrant services and Refuellers) shall be fitted with pressure control systems to protect aircraft from excessive flow and shock pressures (surge) which can damage aircraft fuel systems. The pressure control equipment shall be of a type and design which has undergone a formal approved test procedure. The minimum requirements for pressure control equipment are as follows:
   i. Maximum achievable pump/hydrant pressure below 3.5 bar (50 lbf/in2): Not required.
   ii. Maximum achievable pump/hydrant pressure 3.5 to 5.5 bar (50 to 80 lbf/in2): Hose End Pressure Control Valve required. In-line Pressure Control Valve required for vehicles with maximum flow rates of 1000 litres/min or more per delivery hose.
   iii) Maximum achievable pump/hydrant pressure above 5.5 bar (80 lbf/in2): Hose End Pressure Control Valve and In-line Pressure Control Valve required.

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Other features:

I. **Hose End (Primary) Pressure Control Valves** are situated at the nozzle at the end of the delivery hose. In-line (Secondary) Pressure Control Valves are situated on the vehicle, in the inlet coupler (hydrant servicer). A second Hose End Pressure Control Valve is acceptable in place of an In-line Pressure Control Valve, provided that the maximum inlet pressure does not exceed 8 bar (115 lb/in²).

II. **Fire Extinguishers**
All fuelling vehicles and trailers shall carry at least 2 nos 9/10 kg (unless a different size is specified by local legislation) dry chemical type fire extinguishers in quick release housings consistent with local regulations and 1 no. 1 Kg CO₂ type fire extinguisher shall be provided in the driver’s cabin.

III. **Bonding Reel and Cable**
A bonding reel and cable with suitable clip shall be provided, electrically bonded to the vehicle chassis.

IV. **Emergency Engine and Fuel Stop Control**: Externally mounted emergency engine stop and fuel stop controls shall be provided and shall be clearly identified.

V. **Deadman Control System**
All pressure fuelling vehicles shall be fitted with a deadman control system. New generation deadman control system should be designed to require periodic action by the operator within a pre-determined time interval to prevent automatic close-down. In hydrant systems the deadman control shall, where possible, activate valve closure upstream of the hydrant servicer inlet hose. Deadpan systems include an override switch. This is for operation only in emergencies. It shall be sealed in the non-bypassed position.

VI. **Placards on vehicle:**
The following placards shall be available on any Refuelling Equipment.
   a. Hazchem sign (for refuellers)
   b. Product ID
   c. No smoking
   d. Interlock light
   e. Override light
   f. Emergency shut-off
   g. Clear Exit
   h. Mobile not allowed.

I. **Refuellers Tank**
   i) All Refuellers tanks shall be either constructed of mild steel internally coated with a light coloured epoxy material (approved as being compatible with aviation fuels) or of aluminium alloy or stainless steel. The tank shall be designed as a single compartment with baffles as per PESO.
   ii) The tank shall drain to a low point sump, provided with a drain line and valve. Single compartment tanks are preferred, but if multi compartment tanks are used, then each compartment shall have separate drain lines not manifolded together. All drain lines shall have a constant downward slope.
   iii) Tanks shall be provided with adequate venting to take care of rated loading/unloading flow rates.
   iv) All Refuellers shall be bottom loaded through a self-sealing (tight fit) connection.
   v) The main outlet from the tank shall be fitted with an internal foot/bottom valve capable of being shut quickly in an emergency.

m. **Elevating Platforms for Hydrant Dispensers, wherever provided for operational convenience:**
Elevating fuelling platforms shall be equipped at least with:
   i) Emergency Engine and Fuel stop controls
   ii) A safe exit route when the platform is in the fully raised position or an emergency lowering capability that can also be operated from ground level. In the space of a hydraulic system the

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depressurisation line should be dedicated to this function and be routed direct to the oil reservoir, not via filter.

iii) A suitable device to prevent contact with the aircraft during raising the platform should be provided.

n. Lanyards for Hydrant Dispensers
i) Lanyards for hydrant pit valve operation shall be manufactured from fire resistant material of adequate strength (for example, cord with steel heart strands).
ii) It is recommended that lanyards are of a highly visible colour such as red. The selected colour should be in line with any local regulations concerning the recommended colours for emergency systems and shall be different to that of the fuelling vehicle bonding cable. There should be no electrical connection between the fuelling vehicle and the hydrant pit. If lanyards are attached to vehicle-mounted reels, the reels should be electrically isolated from the vehicle.

8.9.2. Refuelling Operations:

8.9.2.1. Tarmac Safety:
i. When the aircraft parking position is known, the refuelling equipment and crew shall proceed to the fuelling area, for refuelling the aircraft, when it arrives. The vehicle brakes should be checked before approaching the aircraft. Strictly follow all the apron safety rules and regulations specified by the local airport authority.

ii. Fuelling of aircrafts shall only be done outdoors and not less than 15 meters away from any building.

iii. Refuelling equipment shall be operated carefully on the periphery roads and apron and speed shall not exceed the approved limits for the airport. If the speeds are not specified at any airport, the following speeds maybe taken into consideration:
   a. On the periphery roads : 30 kmph.
   b. On the Apron : 15 kmph.
   c. Approaching aircraft : 5 kmph.

iv. The use of a mobile phone whilst driving a fuelling vehicle is strictly prohibited. Calls shall not be made or received whilst driving.

v. Vehicles shall not approach aircraft until the aircraft anti-collision lights have been switched off.

vi. The approach to an aircraft shall be such that in the event of the vehicle’s brake failure, collision will be avoided.

vii. The order of arrival of support equipment is generally prescribed by the airline, with the stairs or aerobridge being positioned first. Refuelling equipment shall arrive strictly on time in order to avoid congestion and the possibility of fuelling delays. This is particularly important for large refuellers, which require a substantial area for manoeuvring.

viii. Wherever possible, refuelling equipment should be moved in a forward direction. If moving a refuelling equipment in reverse is necessary in an emergency, guides (crewman/supervisor or assistance from airline) shall be used.

ix. Vehicles shall be positioned safely, taking account of the following:
   a. Extreme care should be taken to avoid the possibility of collision with any part of the aircraft or ground servicing equipment whilst manoeuvring in to(and away from) the fuelling position.
   b. Fuelling staff shall ensure that clear path is maintained to permit rapid removal of fuelling equipment in case of emergency. While placing the Refuelling equipment oblique approach to the aircraft shall be followed. The refuelling equipment shall never be reversed towards the aircraft.
   c. Vehicle delivery hoses and hydrant servicer inlet hoses should be positioned to minimise the risk of baggage handling equipment or other aircraft servicing vehicles driving over them and causing damage.
   d. If underwing deck hoses are to be used, it must be possible to connect hoses to the aircraft fuelling point without exerting any sideways pressure which could damage the aircraft adapters. Once connected, hoses should hang freely and vertically from the fuelling point.

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e. Special precautions shall be taken to ensure that vehicles used for underwing fuelling have sufficiently low profile for this purpose.

x. If possible, avoid any part of vehicle being in line with aircraft engine exhaust ensuring that deck hoses can hang freely and vertically (without sideways pressure) from the aircraft adaptors.

xi. Due allowance should be made for settlement of the aircraft wing and other surfaces under increased fuel load in positioning the fuelling vehicle. If possible, the engine of the fuelling vehicle should not be positioned under the wing of the aircraft.

xii. Under normal circumstances the fuelling equipment shall be positioned to allow a clear forward drive out in an emergency and to permit ready movement to another aircraft when fuelling is complete.

xiii. When in position, the operator of the refuelling equipment shall not leave the cab until the parking brakes have been applied.

xiv. While raising the lift platform of a dispenser, care shall be taken to ensure that it does not touch any part of the aircraft.

xv. Operating staff shall be wearing PPE like safety shoes, bump cap/helmet, high visibility jacket, gloves and ear protection while refuelling.

xvi. Place the traffic cones in position for segregating the refuelling area

xvii. Carry soak mat (spill containment kit) with vehicle.

8.9.2.2. Underwing Refuelling with Hydrant Dispenser:

Promptly after the dispenser has been positioned for the refuelling as detailed above, the following operations shall be performed in sequence:

a) When the equipment has been positioned properly, the operator shall activate the handbrakes and place chokes under front and rear tyres. 

b) An earthing plate shall be securely placed under the vehicle tyre.

c) Fire extinguisher to be unclamped or kept at panel side of the Refuelling Equipment at an easily accessible position.

d) Unreel and securely connect the bonding reel wire to a designated point on the aircraft. If no point is designated, select a point (preferably with the assistance of the aircraft operator) which is bare metal but not to:
   i) Any part of a wheel assembly (there may be no continuity to the rest of the aircraft);
   ii) Any radio antenna;
   iii) Any polished, sliding or stressed components such as under carriage details, flap tracks or propellers. Suggested components suitable for bonding include the lip around many fuelling panel access doors or other similar apertures. This should however be done only after obtaining the clearance from the aircraft engineer.

e) Connect delivery hoses to aircraft. Ensure that the bonding of the nozzle to the aircraft is done before the nozzle is connected to aircraft adaptors. Open the nozzle valve. Ensure that the opening lever handle is in the over centre position. Check that the connection to the aircraft adaptor is secure by attempting to remove the nozzle with the nozzle handle in the locked position.

f) Remove the hydrant pit cover and remove any dirt or water on adapter surface.

g) Attach lanyard to hydrant pit valve and extend lanyard towards the operating position and clear of obstructions. Ensure that the pit valve is closed by activating the lanyard to close the pit valve.

h) Connect intake hydrant coupler to pit valve. Do not actuate hydrant pit valve until fuelling is to start. Place the traffic cones in position for segregating the area.

i) Note and record accurately all meter totalizer readings. Wait for airlines representative for opening manual fuelling valve on aircraft, if provided.

j) QC Check to be performed on the line sample drawn from the outlet of the filter monitor vessel or filter water sump. When an Airline representative advises that delivery can start, open hydrant pit valve and actuate deadman control to start flow;

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n) If so requested by the airline, after start of flow to aircraft; approximately 1000 litres will ensure most dispensers have been flushed of fuel from the previous delivery before taking the sample.

o) The showing of the sample and microdetector capsule check results to the airline representative is desirable to facilitate the acknowledgment of acceptance of a water and particulate free delivery in the Aircraft Delivery Receipt (ADR).

p) Hand hold open deadman control throughout fuelling and maintain a clear view of the dispenser control panel and aircraft fuelling points. Where deadman timers are installed, the deadman should be actuated in frequency with the setting to avoid interruption to the fuelling;

**Note:** All the Electrical deadman systems include a deadman override. This should be preferably of the spring loaded, push button type. In case no spring return deadman override switches are used the same need to be properly sealed in the inoperative position at all times other than for emergency use. Whenever used during refuelling, it should be continuously attended by a refuelling operator-supervisor. Preferably, all deadman override switches should be converted to push button type. Deadman override switch should be used only for completing the ongoing refuelling and the deadman should be repaired before it is taken for the next refuelling.

a) During fuelling, occasionally check the vehicle, inlet and all delivery hoses for leaks, aircraft fuel vents for overflow and monitor the dispenser gauges for operation within limits, particularly the differential and fuelling sense pressures. Record the Inlet pressure, Nozzle Pressure, differential pressure and the flow rate of the refuelling when the differential pressure is noted. Be alert to and respond to instructions from the airline representative, or to situations requiring emergency action; If the fuelling sense (venturi) pressure is greater than the maximum indicated on or adjacent to the aircraft gauge (limits for the same is 50 psi unless a lower limit is prescribed for the aircraft) while fuel is flowing; the fuelling should be stopped since the secondary pressure controller (the Pressure Control Valve) is apparently no longer able to limit steady flow pressure to a level which is safe for the aircraft.

b) On completion of fuelling and after confirmation from airline representative, close hydrant valve and accurately record meter totalizer readings and delivered quantity.

c) Disconnect nozzles and attach dust covers; retrieve hoses and securely stow nozzles in holders. Do not remove ladder or lower lift platforms until airline representative has completed his check of the adapters, etc. and has completed panel work.

d) Before removing dispenser on the completion of the fuelling, perform a final check, including a complete “360 Degree” walk around the vehicle to ensure that the aircraft fuel caps have been refitted, that the fuelling vehicle is properly disconnected from the aircraft and that all equipment are stowed correctly. Ensure that all hoses are properly stowed and that lift platform and rails are fully retracted. Disconnect and retrieve bonding and grounding wires and ensure that no items are left behind.

e) Drive dispenser off moving in a forward direction. If reversing is necessary due to congestion, the concurrence of the airline staff should be taken. Equipment should be properly guided out of its position.

f) In case the brake interlock and Deadman override seal is broken in emergency situation or any other defect/abnormality is observed in equipment during refuelling, the information shall be recorded in Log Book.

### 8.9.2.3 Underwing Refuelling with Refuellers:

Promptly after the refuellers has been positioned for the refuelling as detailed earlier, the following operations shall be performed in sequence:

a) When the equipment has been positioned properly, the operator shall activate the handbrakes and place chokes under the tyres. Place the traffic cones in position for segregating the refuelling area

b) An earthing plate should be securely placed under the vehicle tyre.

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c) Fire Extinguisher to be unclamped or kept at panel side of the Refuelling Equipment at an easily accessible position.
d) Unreel and securely connect the bonding reel wire to a designated point on the aircraft. If no point is designated, select a point (preferably with the assistance of the aircraft operator) which is bare metal but not to:
   i) part of a wheel assembly (there may be no continuity to the rest of the aircraft);
   ii) any radio antenna;
   iii) any polished, sliding or stressed components such as undercarriage details, flap tracks or propellers.
e) Suggested components suitable for bonding include the lip around many fuelling panel access doors or other similar apertures. This should however be done only after obtaining the clearance from the aircraft engineer.
f) Connect delivery hoses to aircraft. Ensure that the bonding of the nozzle to the aircraft is done before the nozzle is connected to aircraft adaptors. Open the nozzle valve. Ensure that the opening lever handle is in the over center position. Check that the connection to the aircraft adaptor is secure by attempting to remove the nozzle with the nozzle handle in the locked position. Return all meter registers to zero, note and record accurately all meter totalizer readings. Do not use totalizer readings from previous delivery.
g) Wait for airlines representative for opening manual fuelling valve on aircraft, if provided.
h) QC check to be performed on the line sample drawn from the tank bottom and outlet of the filter monitor vessel or filter water sump. When airline representative advises that delivery can start, engage pump, open flow valves and actuate deadman control to start flow. Gradually advance engine speed control to the desired flow rate if this function is not automatic;
i) Perform quality control checks on line sample drawn downstream of the filter water separator or filter monitor before commencement of refuelling.
j) The showing of the sample and microdetector capsule check results to the airline representative is desirable to facilitate the acknowledgment of acceptance of a water and particulate free delivery in the Aircraft Delivery Receipt.
k) Hand hold open deadman control throughout fuelling and maintain a clear view of the refuellers, control panel and aircraft fuelling points. Where deadman timers are installed, the deadman should be actuated in frequency with the setting to avoid interruption to the fuelling;

**Note:** All the Electrical deadman systems include a deadman override. This should be preferably of the spring loaded, push button type. In case no spring return deadman override switches are used the same need to be properly sealed in the inoperative position at all times other than for emergency use. Whenever used during refuelling, it should be continuously attended by a refuelling operator/supervisor. Preferably, all deadman override switches should be converted to push button type. Deadman override switch should be used only for completing the ongoing refuelling and the deadman should be repaired before it is taken for the next refuelling.
l) During fuelling occasionally check the vehicle and delivery hoses for leaks, aircraft fuel vent for overflow and monitor the fueller gauges for proper operation within limits, particularly the differential and fuel sense (nozzle) pressures. Be alert and respond to instruction from the airline representative or to situations requiring emergency action; Adjust engine speed as required by delivery conditions;
m) On completion of fuelling and after confirmation from airline representative, disengage pump and accurately record meter totalizer readings;
n) Disconnect and retrieve bonding and grounding wires and ensure that all hoses are stowed and that no items are left behind. Before removing the refuellers at the completion of the fuelling, ensure, perform a final check, including a complete “360 degree” walk around the vehicle to ensure that aircraft fuel caps have been re-fitted, that the fuelling vehicle is properly disconnected from the aircraft and that all

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equipment is stowed correctly. Ensure that all hoses & ladder are properly stowed. Disconnect and retrieve bonding and grounding wires and ensure that no items are left behind.

p) Drive refuellers off moving in a forward direction; if reversing is necessary due to congestion, the assistance of guide shall be obtained.

u) In case the brake interlocks or Deadman Override seal is broken in emergency situation or any other defect/ abnormality is observed in equipment during refuelling the information of same shall be recorded in Log Book.

8.9.2.4. **Overwing Fuelling:**
The following special precautions shall be adhered to for overwing fuelling:

a) For refuelling attended by the flight crew or aircraft operator, ensure there is a fuel grade decal or other sign writing around or adjacent to the aircraft fill aperture to identify clearly the grade of fuel to be used in this aircraft. It shall be ensured that details are received in writing with due endorsement from the airline representative as per Refuelling Request Format.

b) If there is no grade marking on the aircraft or if it is a non-scheduled flight, refuelling shall not commence until a Refuelling Request Format, reconfirming the grade of the fuel required has been filled/completed, by the airline representative/operator.

c) If it is necessary to climb onto any part of the aircraft to gain access to fill points, do not wear footwear with protruding nails or studs since these may cause damage to the wing surface of the aircraft.

d) Do not carry loose items such as pens, pencils or loose change in the pockets of shirts or jackets since these may fall into the aircraft tanks;

e) Ensure the grade of fuel is correct for the aircraft. Nozzle spouts used for fuelling jet aircraft must be of the flattened type with a major axis dimension of at least 67mm to prevent misfiling of aircraft requiring Avgas. However, a few jet aircraft have apertures too small to accept a 67mm dimension and some AVGAS aircraft have apertures large enough to accept 67mm nozzles. It is therefore essential to have the Refuelling Request Format duly filled before the commencement of the refuelling.

f) Ascend, if applicable, to the wing top area from the wing leading edge. Take care not to step or walk on prohibited wing areas, particularly the trailing edge or flaps;

g) Use ladders with padded ends and use mats to protect wing leading edges;

h) Do not route hoses over trailing edges;

i) Position hose on the ladder, not alongside. Ensure that mats protect wing edge from hoses;

j) On all aircraft fuelled with overwing nozzles, it is necessary to avoid:

1) Mechanical damage to the floor of the aircraft tank from:
   i) Having a nozzle spout of excessive length or
   ii) Having an excessively powerful jet of product from the nozzle;

2) Static electricity build up from splash filling, this shall be prevented by ensuring that the end of the nozzle used for a particular aircraft reaches within a few inches of the floor of the aircraft tank or the surface of product already in the tank or filling takes place at reduced flow until the end of the nozzle is covered by product;

k) Check that overwing nozzles do not include ratchet lugs or other mechanical devices to hold nozzle open. Overwing nozzles shall not be wedged open under any circumstance;

m) Bond the overwing nozzle to the aircraft if this is possible before removing the fill cap. Maintain bonding until the cap is replaced;

n) Adjust the fuelling rate to meet the aircraft operator’s specified conditions provided the operator’s requirements do not conflict with the procedure in this manual;

o) Have available a clean waterproof tarpaulin to cover nozzle and fill opening during rains or thunder storms. Do not use a chamois leather or any other type of strainer at the aircraft fill opening when fuelling jet aircraft. In wet or dusty conditions, it may be necessary to block the gap between the nozzle and filler orifice with a clean, lint-free cloth made from natural fibres;

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8.10. SAFETY IN DESIGN OF HYDRANT REFUELING SYSTEM:

a) No electrical connection between the fuelling vehicle and the hydrant pit. If lanyards are attached to vehicle-mounted reels, the reels should be electrically isolated from the vehicle.
b) All new hydrant pit valves shall be as per E1584 specifications. These must be compatible with hydrant servicer intake couplings.
c) Hydrant lines should preferably be internally epicoated. Before being put into operation, they shall be cleaned by flushing with the product, which the line will eventually carry, until all traces of rust and other impurities completely disappear from samples drawn at delivery points.
d) Hydrant pit valves should have isolation valves.
e) All the hydrant systems shall be provided with equipment that allows the fuel flow to be shut down quickly in an emergency. The preferred hardwired fixed system consists of Emergency Stop Buttons which, when activated, shut down the hydrant pumps (and valves where the pressure head results in continued fuel flow with pump shut down.)
f) Emergency Stop Buttons (ESBs)/Emergency Shut Down (ESD) shall be located close (maximum 80 meters) to fuelling bays. They shall be clearly identified and easily accessible. High visibility identification signs, emergency instructions should be mentioned such that they remain visible at all times.
g) All hydrant pit covers shall be tethered or permanently connected to pits to prevent them from being picked up by jet blast.
h) All hydrant low point drains shall be clearly identified.
j) All hydrant pits, high and low points and dead end points shall be numbered clearly. These facilities should be located at a minimum distance of 4.5 m from any other hazard.
k) Larger hydrants should be split into sections, which can be isolated for emergencies and testing and repairs. Isolation should be by Gate Valve or double block and bleed valves (DBBV).
l) Colour Coding & Identification:

All colour coding shall be in line with Aviation Quality Control and Assurance Manual. All pipelines leading to or from tanks, fittings such as valves/flanges, filters, strainers, delivery/discharge hoses, etc. shall be properly colour coded to the grade of fuel to which they are dedicated.

8.11 SAFETY IN AIRCRAFT REFUELING OPERATIONS:

Driving inside the airport:

Driving inside the airport needs certain discipline. The airport rules are to be followed at all times and importance should be given to the local airport regulations. However, the following driving rules may be taken as guidelines and followed if not contravening the local airport regulations:

a) Right of way shall always be with the pedestrians and aircraft.
b) The vehicle shall pass to the rear of the aircraft.
c) Apron speed limits shall be adhered to.
d) Speed shall be reduced at intersections, in congested areas, on wet roads/apron surfaces or when visibility is reduced.
e) The vehicle shall be halted before crossing any runway and the clearance from the ATC/pilot vehicle is taken before crossing.
f) All road signs such as ‘STOP’,”NO PARKING” shall be observed.
g) A minimum distance of roughly one vehicle length shall be maintained from the vehicle ahead.
h) Necessary signals shall be given when turning left, right or stopping.
i) Double parking, or parking in the opposite lane of drive shall be avoided. Vehicles shall be parked sufficiently away from any intersection, if required.
j) If required to park the vehicle adjacent to the runway. It will be parked parallel to the runway at least 75 feet outside the runway boundary lights.

k) When approaching other vehicles or taxiing aircraft, the headlight beams shall be dipped.

l) Traffic lanes shall be followed as far away as possible from the parked aircraft.

m) Before the aircraft enters the parking ramp area, vehicles shall be parked in a position outside the minimum space envelope as decided by the airline officials.

n) Vehicles shall be moved into position only after the aircraft has come to full stop and all engines/propellers stopped.

o) Vehicles shall not be driven under the wings of an aircraft except with the permission of the responsible representative of the airline concerned and/or airport manager.
   i. When approaching or leaving the aircraft, the vehicle shall be manoeuvred slowly and carefully, taking care not to drive across lanes leading to passenger loading gates.
   ii. The vehicle shall be positioned near the aircraft in a long sweeping single approach in the forward direction, avoiding any manoeuvring.

r) At the sound of an emergency alarm, the moving vehicle shall be parked in a safe position, except when responding to an emergency. The vehicle shall be moved out such that it is not in the emergency area or in the path of the emergency equipment.
   a. Maximum speeds while driving fuelling equipment on a normal dry surface shall be as given below:
      i) Periphery road: 30km/hr
      ii) Transiting ramp: 15km/hr
      iii) Approaching aircraft: 5km/hr

Safety during Refuelling:

I. Positioning of fuelling equipment around aircraft shall be resolved with the local airport and airline authorities. The most suitable position is as near as possible to the fuelling points of the aircraft. The unit shall be parked in such manner as to prevent any of the aircraft surfaces from bearing on the fuelling unit. Fuelling staff shall ensure that clear path is maintained to permit rapid removal of fuelling equipment in case of emergency.

II. After parking, the driver shall not leave the cabin until the Handbrake is on and in locked position and the wheel chocks placed in position.

III. The front wheels are to be turned in a direction so as to permit the equipment to be driven out away from the aircraft, without further guidance.

IV. The driver shall not leave the unit unattended, with the engine running.

V. If the truck has to be left unattended on the ramp for work other than that associated directly with fuelling, the driver shall:
   a. Stop the engine.
   b. Place hand brake in “ON” and “LOCKED” position.
   c. Check brake air pressure.
   d. Chock the tractor drive wheels with a wedge block to ensure absolute firmness.

VI. During fuelling the following precautions shall be observed:
   a. “NO SMOKING” and “NO USE OF MOBILE PHONES” sign shall be prominently displayed.
   b. Fuelling shall only be done outdoors and not less than 15m from any building.
   c. Use of appliance employing naked flame, or any means of igniting the fuel vapour shall not be permitted within 30m of the aircraft/fuelling equipment.
   d. Aircraft and the fuelling equipment shall be bonded to each other.
   e. Fuelling operations shall cease when a turbo-jet aircraft manoeuvres so as to bring the rear jet blast within 50m of the fuelling equipment or the aircraft fuelling point and vent system.

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f. Fuelling of aircraft shall be avoided during severe storm.

VII. **Spills & Leaks:**

Fuelling equipment with leaks of any type shall be removed from service and not operated until properly repaired. Fuelling personnel shall be alert to hose failure or other causes of fuel leaks. Small fuel spills (less than two (2.0) square metres) require no emergency action. Spills covering an area greater than two (2.0) square metres are more hazardous and the following action shall be taken:

a. Stop the fuel flow and close the hydrant valves by operating the lanyard and/or deadman control;
b. In the event of a delivery hose breakage or spills originating at the underwing coupler or upstream of a pressure control valve, stop the flow at the dispenser by operating the deadman or other flow shutdown device and, if possible, close the delivery nozzle or aircraft valves;
c. If an intake hose fails, shut down the flow at the hydrant pit and then at the dispenser;
d. Evacuate people from the area of the spill;
e. Post a refuelling operator/crewman fireguard around the spill equipped with at least one (1) 9/10kg dry chemical fire extinguisher; prevent movement of people or vehicles in the vicinity of the spill to reduce risk of ignition;
f. Cover the spill with sand, dry earth or an absorbent material and contain the fuel to prevent its entry into the airport drainage system. After clean up, remove the fuel soaked material to a safe place for disposal;
g. If a spill is over five (5) square metres in area, or where fuel continues to flow, promptly notify the airport fire service and the nearest airline representative;
h. Do not resume operation until the fuel spill has been cleaned up and the area is safe;
i. Investigate every fuel spill to determine its cause, and to evaluate the effectiveness of the clean-up operation;
j. Ensure to comply with any more stringent airport authority regulations which may exist;
k. In no circumstances shall samples be disposed of on the ground.

8.12 **SAFETY FEATURES IN HYDRANT REFUELING SYSTEMS:**

Fuel is delivered under pressure to the fuel hydrant system from the airport fuel station, via a fixed pipe work installation, which is normally buried, to hydrant pits located at each aircraft fuelling position. These fuelling positions are usually located in the aprons. The aircraft is fuelled by means of one, or in some cases two, hydrant servicer vehicles. These are connected by flexible hose(s) to the hydrant valve(s), located in the hydrant pit(s), and the aircraft fuelling adaptor(s). Hydrant servicers are fitted with filtration, pressure regulation and metering equipment and are designed to provide the required high standard of quality control, safety and efficiency which should attend all aircraft fuelling operations. The system should be designed to ensure that fuel may be delivered at the aircraft coupling at the required pressure and flow rate.

8.12.1 Hydrant pipelines should be sized to handle the fully developed peak design capacity of the system at flow velocities that would not generate unacceptable surge pressures in the event of rapid and simultaneous closure of aircraft tank valves. However, the correct sizing of pipes is but one factor in the design of a safe and efficient hydrant system which must be considered in conjunction with site levels, the product(s) to be handled, the operating temperature range and the design characteristics of all items affecting pressure and flow, including:

a. Tanks;
b. Pumping sets;

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c. Automatic control systems;
d. Filtration equipment;
e. Hydrant pit valves;
f. Shock alleviators;
g. Hydrant servicers (pipe systems and components), flexible hoses; and
h. Aircraft fuel systems (pressure and flow rate limitations).

8.12.2. **Cathodic protection**

Cathodic protection meeting local or national standards should be installed to prevent the corrosion of underground pipeline systems feeding fuel to hydrants.

8.12.3 **External coating of pipeline**

When CS pipes are installed below ground they should be appropriately protected against corrosion. The following are the preferred methods:

a. Factory applied epoxy resin coating.

b. Bituminous primer paint and self-adhesive plastic wrapping.

c. Factory applied polyethylene coating.

Joints made during installation should be protected by an appropriate wrapping system. The integrity of the external coating and wrapping of buried pipes should be verified, and any defects corrected before the trenches are backfilled; great care should be taken to protect the wrapping during back filling.

8.12.4 **HYDRANT PITS:**

Hydrant pits are positioned in the areas where aircraft are parked and they should embody the features described in a) to e) below:

(a) Pits should be capable of accommodating the equipment detailed in 8.12.5.

(b) Pits should be provided with suitable flush fitting covers sealing against rainwater. The design of covers should be such that they can be safely lifted by one person. Materials used for pit covers should not produce sparks when struck. Covers should be hinged to pits to prevent them being carried away by jet blast or propeller vortex. Pit boxes, where riser pipes enter, should be adequately sealed to prevent water entering from below and to prevent any fuel from seeping into the ground. Where there is more than one system in an airport, covers should be provided with a suitable plate to identify the name of the owner/operator and the grade of fuel. If the pit box is fitted with a hinged lid, the lid should be so orientated that, when open, it does not cause the lanyard to become snagged.

(c) High loadings can be imposed on hydrant pit boxes from aircraft wheels, tugs, other service vehicles or from settlement or movement of adjacent aprons. To prevent transmission of these loadings to hydrant risers (to which the hydrant pit valve is fitted), each hydrant pit box should be effectively isolated from its hydrant riser by means of a sealing arrangement that can accommodate both lateral and vertical differential movement.

(d) Pits should be installed so that they project at least 25 mm (1 inch) above the apron level to prevent the entry of surface water. Concrete surrounds should be ramped up at a gradient between 3° and 5° to the top of pits.

(e) Isolating valve should be installed between the riser flange and the hydrant pit valve. (as per API/EI 1584 3rd Edition)

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8.12.5 **HYDRANT PIT VALVES:**

(a) Hydrant pit valves should be of the ‘quick release’ type designed to close at a controlled rate so that during closure the build-up of shock pressure in the hydrant line is minimized.

(b) As a minimum, the pilot device controlling the operation of the valve should be fitted with a manual means of opening and closing, the closing action being made possible by pulling on a lanyard. However, an air-operated pilot device to be installed with the pit valves.

(c) The lanyard should always be of fire-resistant material of adequate strength to enable the valve to be operated remotely should an emergency occur during the fuelling operation and should preferably be red in colour.

(d) Where a dual closure device is provided, the air-operated pilot device should be fitted with a lanyard. (as per latest API/EI 1584).

(e) A self-sealing male adaptor with tethered dust cap should be incorporated in the hydrant pit valve outlet to which the female coupling of the hydrant inlet hose is attached. It should be so designed that the hydrant hose can be connected or disconnected without spillage of fuel.

(f) Hydrant pit valves should be fitted API standard hydrant pit outlet adaptors. The hydrant pit assembly arrangement should conform to API/EI 1584.

8.12.6 **EMERGENCY SHUT DOWN (ESD) CONTROLS:**

Because of the nature of aircraft fuelling operations and the distance between the pumps in the airport fuel depot and the fuelling location, it is essential to have a safe system to shut down the flow of fuel in an emergency. Details provided in Clause 8.10 (f). Hard wired systems have been preferred but new technologies exist that do not require, hard wiring. Regardless of the system used, it should be reliable.

8.13 **SAFETY IN BARREL OPERATIONS:**

8.13.1 **Receipt of Aviation Fuel in barrels:**

The normal packages used to transport Aviation Fuels are the drums with 200/210 litres capacity. The loading location must comply with the quality control and safety requirements, while loading and transporting the stocks in drums.

The stocks in drums are transported in trucks. While unloading the drums, enough care should be exercised, to ensure that the drums are not damaged. It is recommended to stack old unserviceable tyres below the drum unloading point. The drums should be unloaded using an unloading ramp. The drums should be stacked in the place earmarked for this purpose. All drums carrying “DP” products shall be stacked in DP shed. It shall be ensured that the license of the DP shed is valid and the storage does not exceed the authorised capacity.

8.13.2 **Storage:**

For each consignment, placard indicating the grade of product, Batch No. and date of Test Report shall be exhibited.

Each consignment shall be stacked separately to facilitate delivery of stocks on first in first out basis.

All the barrels when stored shall be kept only in sealed condition.

The barrels shall be visually inspected at least once in a day for any leaks and the observations recorded in the shift log. During monsoon, adequate precautions shall be taken to prevent ingress of water into the drums. When drums are stored in the open

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over dunnage with a tarpaulin cover, the water stagnated over the tarpaulin cover shall be removed on priority.

8.13.3 **Loading of Barrels:**

There are certain occasions at an AFS when the loading of barrels are undertaken for delivering packed fuel stock. Following procedures shall be followed. The barrels shall be selected in the following order of priority:

i. New Barrels.
ii. Barrels having stored similar aviation fuel previously
iii. Once used PBM barrels

Lube oil/Black oil drums shall not be selected for filling Aviation fuel. The drum-filling operations shall be taken up only in the licensed area. Before flushing, it should be ensured, that each drums is clean and dry. Each barrel shall be flushed with a minimum of 5 litres of the grade to be filled or till such time, a clear and bright sample is obtained. The flushed quantities shall be downgraded to a similar non-aviation grade.

The electrical bonding connection shall be established between the filling nozzle and the barrel. In the case the drums are filled over a wooden platform instead of ground proper bonding connection shall be established between the drum and the filling source.

While filling, it shall be ensured that 5% of the capacity of the container is left as vapour space for safety reasons.

The barrels shall be sealed tight, using bungs with washers.

It shall be ensured that the barrels are stacked in a vertical position in a single tier in the truck properly covered with tarpaulin.

Fire extinguishers of adequate capacity shall be carried along with the drums.

Before filling the containers of the customer, it shall be ensured that the customer furnishes a certificate that the product shall be used for bonafide aviation use.

The Explosives License authorising the customer to transport and store the fuel shall also be produced before requesting for fuel.

The filling of container shall be taken up only after satisfying conditions mentioned above.

The quantity to be delivered shall not exceed the quantity indicated in the license. All the precautions and procedures given above shall be adhered to. Containers not fit for Aviation use shall be rejected.

The flushed quantities shall be collected in a drum and downgraded to a similar non-aviation grade. However, this downgrade product shall not be handed over to the customer.

8.13.4 **Refuelling of aircrafts from barrels:**

All safety precautions as in the case of a refuellers shall be taken before undertaking refuelling.

Filling of TT/refuellers from barrels:

All precautions and procedures as stated above shall be followed while filing a tank truck or a refuellers from drum stock.

8.13.5 **Disposal of empty barrels:**

Avgas is now being received in barrels & once the barrels are empty, they need to be handled in a special way as Avgas is highly volatile. If not handled properly, the vapour

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of empty barrels may catch fire. Therefore, it is advised that the following Safety procedure is to be followed:

1. Fill empty Avgas barrels with water.
2. Empty out.
3. Dispose off/store.

9 FIRE PROTECTION FACILITIES

Salient features of Fire Protection Facilities for AFS:

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 an AFS 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 AFS, 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 AFSs with above ground aggregate storage capacity of more than 1000 KL.

   a. Fire Water System - (storage / pumps / distribution piping network with hydrant / monitors)
   b. Fixed Spray System
   c. Foam System
   d. First Aid Fire Fighting Equipment
   e. Trolley mounted/Mobile Fire Fighting Equipment
   f. Carbon Dioxide System
   g. Dry Chemical Extinguishing System
   h. Fire Alarm, Actuation & Communication System

For AFSs storing less than & equal to 1000 KL aggregate product, the following fire protection facilities shall be provided:

   a. First Aid Fire Fighting Equipment
   b. CO2 extinguishers for electrical fire
   c. Dry Chemical Extinguisher
   d. Fire Siren

9.2.2 DESIGN CRITERIA FOR FIRE PROTECTION SYSTEM FOR AFSs WITH MORE THAN 1000 KL ABOVE GROUND STORAGE CAPACITY:

   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 locations where total storage capacity is up to 30,000 KL. 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 locations where total storage capacity is above 30,000 KL.

   Wherever water replenishment @ 50% or more is available, single fire contingency shall be considered for Fire water storage.

e) The hazardous areas shall be protected by a well laid combination of hydrants & monitors. AFS having aggregate above ground storage capacity of less than & equal to 1000 KL are exempted.

f) ATF above ground Petroleum storage tanks (fixed roof) of diameter larger than 30 m shall be provided with fixed water spray system.

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

h) Existing AFS having above ground storage capacity more than 1000 KL, where inter distances in a dyke and/or within dykes are not conforming to the provisions of this standard, proper mitigation measures shall be taken to reduce the enhance risk involved, like the following:

   (i) Arrangement of mutual aid scheme with the local airport operator/authority.
   (ii) Arrangement with neighbouring agencies on sharing of firefighting facilities.
   (iii) Clause 6.4.6 (f)

9.2.3 Tank Truck (TT) / Refuellers/ unloading facilities, Manifold area of product pump house and Exchange pit shall be fully covered with alternate double hydrant and 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 facilities 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 of the relevant facility.

i) The high volume long range (HVLR) water cum foam monitors (variable type) to be provided as under:

   (i) AFSs with above ground storage capacity more than 1000 KL and meeting the safety distance norms as per this standard, minimum one no. trolley mounted mobile type water cum foam HVLR monitor shall be placed for covering the above ground tank farms storing Class B products based on single largest tank diameter to be catered @ 8.1 lpm/m2.
   (ii) For existing AFSs with above ground storage capacity more than 1000 KL and not meeting the safety distance norms as per this standard, 2 nos. trolley mounted HVLR monitors shall be provided for tank farms. Requirement of HVLR monitors shall be calculated for full surface fire scenario of the largest tank @8.1 lpm/sq.m. Refer clause 6.4.6 (f)
   (iii) Provision for connecting / hooking the portable monitor shall be made in the hydrant system around the fixed roof tanks at various strategic points.
   (iv) Well laid procedures and plans shall be made and put into use for use of mobile HVLRs to combat emergencies without loss of much time.
   (v) The location of HVLRs 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 minimum distance of 15m subject to:

      a. 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.
      b. The throw is directed on the inner upper surface of the tank and not in the middle of the tank to prevent splash over.

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(vi) For determining the total foam solution requirement, potential foam loss from wind and other factors shall be considered while designing.
(vii) Adequate foam drum/tank or reliable replenishment for foam induction system shall be provided near the hook up points of mobile HVLRs with the hydrant system.

9.3 Fire Fighting at AFSs:

9.3.1 General:

I. Even though all efforts are made to avoid fires from taking place, it is necessary to have firefighting equipment ready for use all times.
II. As stated earlier, to produce fire, three elements are necessary, namely, Fuel, Oxygen, and Ignition. Elimination of any one of these three elements can stop a fire. All Firefighting methods are based on this principle.
III. Fires are classified depending on the nature of fuel and the means of extinction as follows:

a. CLASS A: Fires involving solid materials such as wood, paper, cloth and natural fibres. Fire extinguishers used for this type of fires use water for “Quench cooling”. This reduces the temperature to below the ignition point of the fuel thereby inactivating the ignition and stopping the fire.

b. CLASS B: Fires involving liquids or liquefiable solids such as petroleum products, methanol, oils, fats etc. Extinguishers used for this type of fire are based on the principle of “Blanket Smothering” and use foam, vaporising liquids, carbon-dioxide and dry powder. This cuts off oxygen from the fuel and puts off the fire.

c. CLASS C: Fires involving gases or liquefied gases such as butane, methane, propane etc. Extinguishers for this type of fire are based on “Smothering” and use foam, dry chemical powder.

d. CLASS D: Fires involving metals such as magnesium and aluminium where extinguishers work by smothering and use dry powders only.

e. CLASS E: Fires due to live electrical equipment. The supply to the live electrical equipment involved in the fire must first be isolated before tackling the fire.

9.3.2 Fire Drills:

a) Location should carry out monthly mock fire drills to combat different fire situations that may occur in the location. These Fire Drills should be conducted and recorded as per Monthly Fire Drill Report.
b) Six monthly mock fire drills (DCMP) shall be conducted involving the local neighbouring industries and local statutory authorities. The outcomes of these drills shall act as learning tools for all the personnel for effective fire-fighting.

Types of Fire extinguishers in use at AFS:

a) The most effective equipment to fight fires when they start is Fire Extinguishers. There are different types of fire extinguishers in use at the AFSs given below:
Dry chemical powder (DCP) fire extinguisher: These are used in class B & C fires and fires caused by electricity. It consists of a dry Chemical powder, usually sodium bicarbonate, and a small cylinder of carbon dioxide under pressure, which acts as a propellant and discharges
the powder in the form of a fog. The chemical reaction of the powder, when applied on the fire, smothers the fire. The effective range of discharge is 8 to 12 feet.

b) Carbon dioxide type fire extinguisher: These are used on class B & class C fires and also on electrical and electronic equipment. They consist of a liquid carbon dioxide under pressure which, when discharged, reduces the oxygen content to a point where combustion cannot continue.

c) All extinguishers and firefighting equipment shall be made clearly visible against a bright red background, surrounded by bright yellow stripes. They should be located at easily accessible places. All firefighting equipment shall be regularly maintained and inspected.

9.3.3 Portable Fire Extinguisher Specification:

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.
The no. of extinguishers at various locations shall be provided as under:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Type of Area</th>
<th>Scale of Portable Fire Extinguishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lube Godown</td>
<td>1no. 10Kg DCP extinguisher for every 200m² or min. 2nos. in each Godown, whichever is higher.</td>
</tr>
<tr>
<td>2</td>
<td>Storage of Class A/B in packed Containers and stored in open/closed area (Example- Downgraded ATF in drums or HSD in drums for own use)</td>
<td>1no.10Kg DCP extinguisher for every 100m² or min 2Nos. in each shed, whichever is higher.</td>
</tr>
<tr>
<td>3</td>
<td>Pump House (Class A/B) UPTO 50HP Above 50 HP but below 100HP Beyond 100HP</td>
<td>1No.10Kg DCP for 2 pumps. 1No.10Kg DCP for each pump. 2nos. of 10Kg or 1no. 25Kg DCP for each Pump.</td>
</tr>
<tr>
<td>4</td>
<td>Tank Truck loading &amp; Unloading Gantry for Class A/B products</td>
<td>1No.10KgDCP extinguisher for each bay plus 1no. 75Kg DCP extinguisher for each Gantry.</td>
</tr>
<tr>
<td>5</td>
<td>Aboveground Tank Farm</td>
<td>2nos. 10Kg DCP extinguisher for each tank plus 4nos. 25kg DCP extinguishers for each Tank Farm positioned at four corners. In case of adjoining tank farms, the no. of 25Kg extinguishers may be reduced by 2nos. Per tank farm.</td>
</tr>
<tr>
<td>6</td>
<td>U/G &amp; semi-buried Tank Farm</td>
<td>2nos. 10Kg DCP extinguisher for each Tank Farm</td>
</tr>
<tr>
<td>7</td>
<td>Other Pump Houses (fire pump house or water pumps)</td>
<td>1no. 10Kg DCP extinguisher for every two pumps or min 2nos. 10Kg DCP extinguisher for each pump House whichever is higher.</td>
</tr>
<tr>
<td>8</td>
<td>Admn. Building/ Store House</td>
<td>1no. 10Kg DCP extinguisher for every 200m² or min. 2nos. 10Kg DCP extinguishers for each floor of building/store whichever is higher.</td>
</tr>
<tr>
<td>9</td>
<td>DG Room</td>
<td>2nos. each 10Kg DCP &amp; 4.5Kg CO₂ extinguishers for each DG Room.</td>
</tr>
<tr>
<td>10</td>
<td>Main Switch Room/PMCC/Sub-station</td>
<td>1no. 4.5Kg CO2 extinguisher for every 25m² plus 1 no. 9 litre sand bucket.</td>
</tr>
<tr>
<td>11</td>
<td>SCADA/Server/Computer room/Cabin</td>
<td>2nos. of 2Kg CO₂ or 2nos. of 2.5 Kg clean agent extinguisher per computer room and 1 No. 2Kg CO₂ or 1No.1.0 Kg clean agent extinguisher per cabin.</td>
</tr>
<tr>
<td>12</td>
<td>Security Cabin</td>
<td>1no.10Kg DCP extinguisher per cabin</td>
</tr>
<tr>
<td>13</td>
<td>Canteen</td>
<td>1no.10Kg DCP extinguisher for 100m2</td>
</tr>
<tr>
<td>14</td>
<td>Workshop</td>
<td>1No.10Kg DCP extinguisher &amp; 1no. 4.5Kg CO₂ extinguisher</td>
</tr>
<tr>
<td>15</td>
<td>Laboratory</td>
<td>1no.10Kg DCP extinguisher and 1no.4.5Kg CO₂ extinguisher.</td>
</tr>
<tr>
<td>16</td>
<td>Oil Sample storage Room</td>
<td>1no.10Kg DCP extinguisher per 100m² or min.1no. 10Kg extinguisher per room whichever is higher.</td>
</tr>
<tr>
<td>17</td>
<td>Transformer</td>
<td>1no.10Kg DCP extinguisher per transformer</td>
</tr>
<tr>
<td>18</td>
<td>UPS/Charger Room</td>
<td>1no. 2kg CO₂ extinguisher.</td>
</tr>
</tbody>
</table>

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Wheeled Fire Fighting Equipment
For AFSs having tanks of diameter larger than 9 m, following firefighting equipment shall be provided:-

<table>
<thead>
<tr>
<th>Size of AFS (In KL)</th>
<th>Water/Foam Monitor (Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>having aggregate capacity of 1000 KL</td>
<td>NIL</td>
</tr>
<tr>
<td>having aggregate capacity up to 10,000 KL</td>
<td>Minimum 2 Number of of suitable capacity</td>
</tr>
<tr>
<td>having aggregate capacity more than 10,000 KL</td>
<td>More than 2 Numbers of suitable capacity</td>
</tr>
</tbody>
</table>

Foam compound trolley 200/210 liters shall be provided as under:-

<table>
<thead>
<tr>
<th>Tank diameter (In m)</th>
<th>Water/Foam Monitor (Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 24 m</td>
<td>1 no.</td>
</tr>
<tr>
<td>24 m - 30 m</td>
<td>2 nos.</td>
</tr>
<tr>
<td>Above 30 m</td>
<td>3 nos.</td>
</tr>
</tbody>
</table>

Other Safety and PPE Gadgets required for the locations

Minimum fire accessories to be provided in a location without fire hydrant system areas follows:
- Sand drum with scoop :4 Nos.
- Safety helmet :1 No. per person.
- Stretcher with blanket :2 Nos.
- First Aid box :1 No.
- Rubber hand gloves :2 Pairs.
- Explosimeter :1 No.
- Fire proximity suit :1 Suit.
- Resuscitator :1 No.
- Electrical siren (3Km range) :1 No.
- Hand operated siren :One
- Waterlul blanket :1 No.
- Red & Green flag-fire drill :2 Nos. in each colour.
- Self-Carrying Breathing Apparatus Set (30 minute capacity): 1 set with spare cylinder.

10. COMBINED AFS WITH LPG/POL FACILITIES/RETAIL OUTLETS IN THE SAME PREMISES:

The common water storage facility for fire-fighting purpose may be shared between AFS, POL terminal/depot under following conditions:

a) AFS located within POL/LPG/RETAIL OUTLETS facility shall meet the design, layout & fire protection system requirements of combined facilities corresponding to the stringent OISD standards and have common boundary wall and ownership of both the facilities under same company. A separate PESO license for such AFS located in a Retail Outer/LPG Plant to be obtained. Existing license to be amended for such AFS co-located inside a POL terminal/depot. The fire water requirement shall be based on two fire contingencies simultaneously in the combined facility for above ground tanks at such AFS having aggregated storage capacity more than 1000 KL and fire water storage capacity shall be fixed accordingly. Where the AFS’s above ground storage capacity is less than 1000 KL, single fire contingency shall be considered in determining the fire water requirement. 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 POL/LPG/Retail Outlet with whom AFS will be located facility.

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b) For AFSs located adjacent to an existing LPG bottling plant, POL terminal/depot or retail outlet, separate license to be obtained for such AFS. Requirement of fire-fighting facilities, safety distances shall be guided as per details given in this standard. The common water storage facility for firefighting purpose may be shared between AFS and LPG bottling plant.

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

11. **FIRE WATER SYSTEM DESIGN** (applicable for AFSs with aggregate capacity of more than 1000 KL in above ground tanks):

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 AFS considering the design flow rate. The fire water requirement shall be calculated as per OISD-117.

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

11.1 **FIRE WATER DESIGN FLOW RATE**

The fire water system shall be provided based on single largest fire contingency for all locations where total tankage in the AFS with total above ground tankage more than 1000 KL up to 30,000 KL. The fire water system shall be provided based on two largest fire contingencies simultaneously for all locations where total tankage in the AFS is more than 30,000 KL.

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

   i. For water flow calculations, all tanks farms having class B petroleum storage (above ground) more than 1000 KL capacity, shall be considered irrespective of diameter of tanks and whether fixed water spray system is provided or not.

   ii. Water flow calculated for cooling a tank on fire at a rate of 3 lpm/sqm of tank shell area.

   iii. 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/m² of tank shell area.

   iv. 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.

   v. 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.

   vi. Foam solution applicable rate for cone roof tanks shall be taken as 5 lpm/sqm.

   vii. 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.

Design flow rate shall be based on the combination of the above.

b) **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

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The supplementary water stream requirement shall be in addition to the design flow rates.

11.2 FIRE WATER STORAGE:

a) The total water storage requirement shall be calculated in line with the recommendations of OISD 117.

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

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

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

e) 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.

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

g) In case existing land area is insufficient to have additional water tanks as per requirement, water replenishment rate from the local airport operator/AAI may be added to existing water storage capacity to fulfil the net requirement.

11.3 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. 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 are 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 firefighting purpose only.

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

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

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build up the required pressure in the fire water ring main system the next pump shall start and so on.

11.4 FIRE HYDRANT NETWORK:

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

b) Fire hydrant ring main shall be laid above ground ensuring that:
   i) Pipe line shall be laid at a height of 300 mm to 400mm above finished ground level.
   ii) The pipe support shall have only point contact. The mains shall be supported at regular intervals:
       a. For pipeline size less than 150 mm, support interval shall not exceed 3 mtrs.
       b. Pipe line size 150mm and above support interval shall not exceed 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.

   a. 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.

   b. GENERAL

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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.

iv) Suitable strainer shall be provided on sprinkler branch connection and shall be located outside of dyke.

11.4.1 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 metre 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 may be provided in inaccessible area within the dyke with isolation valve outside the tank farm (In cases inter distances between tanks in a dyke and/or within dykes are not meeting the requirements).

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

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

11.4.2 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, blackish 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

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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/blackish 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/ Aluminum/ Stainless/ Steel/Al-Zn Alloy

d) **Monitors / High Velocity Long Range Water Cum Foam Monitors (HVLR):**
Approved / listed by international certifying agencies like UL/FM/ VdS/ LPC or equivalent Indian certifying agencies. 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:**
a. Fire water mains, hydrant & monitor stand posts, risers of water spray system shall be painted with “Fire Red” paint as per of IS: 5
b. Hose boxes, water monitors and hydrant outlets shall be painted with “Luminous Yellow” paint as per IS: 5

c. Corrosion resistant paint shall be used in corrosion prone areas.

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

**11.4.4 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

**FOAM COMPOUND**

Foam compound e used for fighting liquid fires is mechanical foam:

**A. 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
   i. Foam expansion ratio should be 20 to 1. as typically produced by self-aspirating foam branch pipes.
   ii. 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 varies from 20:1 to 200:1 as typically produced by self-aspirating foam branch pipes with nets. This foam has limited use in controlling hydrocarbon liquid fire because of it's limitations w. r. t. poor cooling, poor resistant to hot surface/radiant heat, etc.

c) HIGH EXPANSION FOAM

Foam expansion ratio vary from 200:1 to 1500:1. 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 fluoro-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) MULTIPURPOSE AFFF/ ATC Foam (Alcohol Type concentrate)

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Multipurpose AFFF concentrate is synthetic, foaming liquid designed especially 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.

To be stored for AFSs storing/handling PBM (Power Boost Methanol) required for preparation of Water Methanol Mixture. The product is as per standard UL-162, Govt. of India specs IS: 4989 Part 4. The foam is to be used for Methanol fire.

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 fluoro-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.

ADVANTAGES OF LOW EXPANSION FOAM:

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

11.4.5 CONVEYING SYSTEMS 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:

i. Fixed
ii. Semi-Fixed
iii. Mobile

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i) Fixed Foam System
Fixed foam conveying system comprises of fixed piping for water supply at adequate pressure, foam concentrate tank, educator, 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.

11.4.6 FOAM PROTECTION.
A. FIXED ROOF TANK PROTECTION
B. PROTECTION FOR DYKE AREA / SPILL FIRE

STORAGE TANK PROTECTION:

A. FIXED ROOF TANK PROTECTION:

Foam conveying system shall have a vapour seal chamber before the foam discharge outlet. Features of the foam system for fixed roof protection shall be as follows:

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

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

iii) 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.

iv) 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 :-

<table>
<thead>
<tr>
<th>Tank diameter and requirement of Foam Pourer</th>
<th>(In M)</th>
<th>(Min. Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 18 &amp; up to 20</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Above 20 &amp; up to 25</td>
<td>3</td>
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</tr>
<tr>
<td>Above 25 &amp; up to 30</td>
<td>4</td>
<td></td>
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<tr>
<td>Above 30 &amp; up to 35</td>
<td>5</td>
<td></td>
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<tr>
<td>Above 35 &amp; up to 40</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Above 40 &amp; up to 45</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Above 45 &amp; up to 50</td>
<td>10</td>
<td></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 educator. This can be suitably adjusted for different pourer capacity in accordance with above. Testing of foam pourer system shall be done by reversing the inlet so as to prevent ATF from entering the storage tank.

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B. PROTECTION FOR DYKE AREA / SPILL FIRE

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

For Class B above ground tanks more than 1000 KL aggregate capacity:
Two nos. portable foam generator for each AFS.

11.4.7 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.

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) containing Class 'B' : 65 minutes.

ii) Where the system's primary purpose is for spill fire protection such as dyked area and non dyked area (TT/refuellers 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 3% 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.

2. For locations aggregate capacity more than 30,000 kl (Double contingency). (Assume, two cone roof tank farm 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) Two hose streams of foam each with a capacity of 1140 lpm of foam solution.

The aggregate quantity of foam solution should be largest of D1(i) & D2(i+ii) whichever is higher in line with recommendations of OISD 117.

FOAM COMPOUND STORAGE

Foam compound should be stored as explained in IS-4989:2006/UL-162. 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 AFSs handling methanol.

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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 above should be stored in an AFS.

11.4.8 SCADA/SERVER ROOM PROTECTION

SCADA/server room should be protected by Clean Agent Fire Extinguishing System. Persons should be evacuated from the areas before the clean agent fire extinguishing system comes into operation. Each hazard area to be protected by the protection system independently. 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.

11.4.9 FIRST AID FIRE FIGHTING EQUIPMENT

Emergency Trolley and Emergency kit
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. Emergency trolley shall be provided at AFSS with above ground storage tanks with aggregate capacity of more than 1000 KL. An emergency kit shall be provided consisting of safety items and shall be readily available at AFSS with above ground storage tanks with aggregate capacity of more than 1000 KL. All the items of the kit shall be kept on a trolley specifically designed for the purpose.
For all other AFSS, Fire Proximity Suit, Water Jel Blanket, Resuscitator, First Aid Box, 2 nos. 10/9 kg DCP fire extinguishers, Safety helmets, Fire buckets, etc shall be placed at an easily accessible location inside the AFS.

11.5. Emergency shut Down (ESD)/Emergency Shutdown Button (ESB) logic for Automation System

The ESD/ESB for automated locations shall be provided in SCADA room as well as at various strategic locations including the tarmac. ESD/ESB system shall be only through push buttons with wired connection.

i) Actuation / pressing of any ESD shall initiate following actions:
1. Shutdown of all operations.
2. Power Shutdown
3. Process Shutdown shall include the following:
   - To stop all unloading and delivery pumps
   - Barrier gates & access control system to open
   - All MOVs to close.

ii) Power Shutdown shall initiate the following:
1. Trip all the panels other than Emergency panel. The Emergency panel should host Siren, Bore wells, critical High Mast tower lights outside the licensed area, security cabin, critical lights in

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unloading/Refuellers loading area, Admin block, MCC room and power to the control room/Automation system.

2. There should be interlock between ESD for operations shut down and ESD for Power shut down so that full power shut down takes after a time lag required for closing the MOVs and full closure of valves shall be ensured. The time lag shall be location specific. At pipe line receipt locations alarm signal should be exchanged between the two control rooms so that necessary actions are taken by the operating personnel at both ends.

iii) Inspection and Testing:

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

11.6 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, firefighting 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/in-house experts/Oil industry approved reputed agency. The training also include usage of personnel protective equipment.

iii) All operating personnel shall be given training on Live Fire training representing fire scenarios likely to occur at AFS installations.

iv) Every employee or authorized person of contractor working in the AFS 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 AFS. The mock drill (ERD: Emergency Response Drill) shall include the full shut down system activation once in six months for all AFSs. AFSs with Hydrant Refuelling System should carry out DCMP with/without shutdown of HRS. However, periodic checking of ESD shall be done at these AFSs.

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, Loading/unloading Gantry, Pump House, etc., shall be covered at least once in six months.

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

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c) Mutual Aid:

Installation shall have a 'Mutual Aid' arrangement with nearby industries to pool in their resources during emergency.
Mutual Aid arrangement (valid for a maximum period of 2 years) shall be prepared and signed by all Mutual Aid members. Fresh arrangement shall be made on expiry of 2 years or whenever there is change in the signatories to the arrangement. Quarterly meeting of Mutual Aid members may be conducted and the minutes to be recorded. The minutes shall be reviewed in the subsequent meetings.

11.7 DISASTER CONTROL MANAGEMENT PLAN

i) Each AFS shall prepare a Comprehensive Disaster Control Management Plan covering all emergency scenarios outlining the actions to be taken by each personnel in the event of all emergencies including fire emergency for effective handling.

ii) Recommendations and its mitigation, based on HAZOP and QRA study shall be incorporated in the DCMP.

iii) The key action points for fire emergency shall be displayed at strategic locations in the AFS.

11.8 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 firefighting equipment shall be complyed 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.

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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

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 the 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.

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 OISD-STD- 142.

j) COMMON FIRE FIGHTING FACILITY FOR CLUSTER OF AFSs

Where there is cluster of AFSs of different companies, provision of jointly owned common firefighting facility may be considered. The cluster of AFSs should be treated as single entity for the purpose of designing firefighting facility, considering one of the following two categories as the case may be:

(a) Total tankage upto 30,000 KI.

(b) Total tankage more than 30,000 KI.

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The common firefighting facility shall be located at a safe distance, beyond the blast overpressure zone.

12 MAINTENANCE & INSPECTION OF EQUIPMENT

12.1 GENERAL :

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

12.2 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.

12.3 PERSONAL PROTECTIVE EQUIPMENT:

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

12.4 WORK PERMIT SYSTEM :

Working in hydrocarbon processing/handling installation presents special risk and in order to provide safe working conditions and to carry out the work safely, a work permit system shall be followed. The basic purpose of the work permit system is to ensure that work is carried out in the safest possible manner to prevent injuries to personnel, protect property from damage, avoid fire etc. Any maintenance, inspection, disassembly or removal of fittings shall not be carried out without a proper work permit and approved procedure.

Cold Work: An activity which does not produce sufficient heat to ignite a flammable air-hydro carbon mixture or a flammable substance.

Hot Work: An activity that can produce a spark or flame or other source of ignition having sufficient energy to cause ignition, where the potential for flammable vapours, gases, or dust exists.

Based on the nature of work to be performed, the following minimum type of work permits shall be used:

1. Cold Work Permit
2. Hot Work Permit
3. Confined Space Entry
4. Electrical isolation and Energisation permit
5. Working at Heights.

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

12.5 APPLICABLE STANDARDS :

1. Electrical maintenance / inspection, provisions of OISD-STD-137 shall be adhered to.
2. OISD STD -130 on Inspection of pipes, valves and fittings shall be followed.
3. OISD Standard No. OISD-119 on Selection, Operation and Maintenance of Pumps

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4. "OISD Standard No. OISD-123 on "Inspection and Maintenance of Rotating Equipment components"

12.6 INSPECTION & MAINTENANCE OF VARIOUS FACILITIES IN AFS :

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 AFSs. 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- 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 AFSs 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-31.4 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 piping. 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.

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b. Comprehensive testing

I. Shall include all parameters as per External Inspections mentioned above.

II. In addition, following one or, more of the tests given hereunder shall also be carried out.

1. Other NDT Tests

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

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

2. Pressure test

Pressure test for all pipelines in operation should be carried out with ATF at as per the code to which the same is designed.

C) FLANGES, GASKETS AND BOLTS:

All valves shall be inspected and tested to ensure conformation to required specifications and for leak tightness. 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 it warrants earlier inspection:

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

F) SAFETY RELIEF VALVES

Safety Relief valves shall be tested once in a year. Further an on-stream visual inspection should be carried out at least once in every 6 months to check the following:

i. Blinds do not exist.
ii. Upstream and downstream isolation valves, if any, are opened and sealed.
iii. Seals protecting the spring setting have not been broken.
iv. Relief device is not leaking. This shall be checked visually or by hand touch at outlet nozzle wherever practicable.

G. ROTARY EQUIPMENT:

i) Pumps:

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

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ii) DIESEL ENGINES:

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

iii) PRESSURE GAUGES

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

iv) QUANTITY MEASURING DEVICES

Calibration of the flowmeters shall be carried out in line with requirement of Department of Legal Metrology.

H. FIRE FIGHTING EQUIPMENT

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

I. 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.

13 MAMANAGEMENT OF CHANGE (MOC)

13.1 **Objective**
Institute a system whereby any intended changes in facilities, documentation, personnel, defined operating procedures & working environment including new processes are thoroughly evaluated, and managed to ensure that health, safety and environmental risks arising from these changes are effectively controlled.

13.2 **Scope & Applicability**
Applicable to all Aviation Fuel Stations. All temporary, permanent & emergency changes are covered by this procedure.

13.3 **Guiding Standard**
OISD-GDN-178 *Guidelines on Management of Change*

13.4 **Types of Changes**

i. **Changes in Facilities and software**
   a. Addition, alteration or removal of an equipment / instrument or, a part thereof.
   b. Modification in piping system including valves
   c. Changes in product / material specifications
   d. Changes in software in computerised environment

ii. **Changes in Operating Procedures**
   a. Deviations from the manualised operating procedures / approved SOPs.

iii. **Changes in Personnel**
   a. Changes in operating personnel (newly recruited / re-assigned officers and workmen).

13.5 **Nature of Changes**

i. **Permanent Change**

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Long term & durable change. Not categorised as a Temporary Change.

ii. **Temporary Change**
   Any change which has a defined lifetime and which will be removed before a defined date. (Usually not more than 6 months).

iii. **Emergency Change**
   Any change which is to be implemented to address an immediate occupational health, safety, environmental or, product quality situations.

13.6 **Procedure for Management of Change (MOC)**
Various steps involved in the MOC process are as follows:

a. Identification of possible improvements to existing processes
b. Initiation of Change Request with justification
c. Scrutiny & Approval Procedure
d. Execution of Change
e. Commissioning, training & updation of documents

A. **Identification of required change**
In order to improve efficiency, operability & safety, changes may be contemplated. But proposed changes shall be thoroughly evaluated by satisfying the following queries:
   i. Is the change necessary?
   ii. Is it economical?
   iii. Is there a better alternative?

B. **Initiating Change Request**
The format (Annexure-4) shall be initiated with the following information:
   i. Description of proposed change, including object of change (facilities / procedure/ new manpower etc.)
   ii. Technical reason for the proposed change
   iii. Potential impact of the change on health, safety, work environment & product quality
   iv. Compliance to guiding Standards & Regulatory requirements
   v. Nature of the change: temporary / permanent, normal / emergency etc.
   vi. Proposed documents incorporating the changes: revised P&ID (for facilities change) or, revised SOP (for changes in procedures) with revised PFD (Process Flow Diagram), & P&ID if required.
   vii. 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.

C. **Scrutiny & Approval Procedure**
The MOC Request will be reviewed & approved / rejected by the appropriate competent authorities as given in the DOA table in Annexure-5. Any change in the existing process or, new processes are required to be discussed and suggestions / acceptance of the Committee are to be recorded in the MOC application. Competent authorities shall ensure that the proposed changes in design / process are completely safe thru’ appropriate checks / evaluations, which may include PHA (Process Hazard Analysis) and HAZOP (Hazard & Operability study).

D. **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

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shall be conducted by appropriate official as per DOA in Annexure-5 and confirmed thru' a signed document.

E. Commissioning, Training & Updation of documents
On completion of the modifications & inspection as stated above, facilities can be commissioned for regular operations, after ensuring that the concerned officers, operators including contract workmen & security personnel - wherever applicable are adequately informed & suitably trained on the impact of these changes.
As built records with the approved MOC, revised P&ID and layout drawings shall be maintained properly.

14 EMERGENCY PREPAREDNESS PLAN AND RESPONSE

14.1 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 a Disaster Control Management Plan to handle such eventuality. Disaster Control 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:

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

14.2 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.

15 TRAINING

15.1 General
Products handled at the AFS 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.

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15.2 Designated safety officer

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

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

a) Advise various functions within the location in planning and organizing measures necessary for safe & secure work environment, including effective prevention and control of personal injuries.
b) Conduct routine safety checks on AFS facilities & equipment to ensure conformity with prevalent norms/guidelines.
c) Update and implementation of fire organization chart, Disaster Control Management Plan, Risk Assessment & other statutory plans.
d) Co-ordinate and conduct regular mock drill, ERD, Mutual aid meeting with neighbouring industries/OMCs

e) Conduct safety meeting and monitor compliance with statutory and OISD norms.
f) Implementation of sound safety culture to promote safe practices including wearing of personnel Protective Equipment (PPEs) amongst all section of personnel at the location-employees, contract labour, TT crew, Security staff and Visitors.
g) Conduct safety audit and co-ordinate/facilitate for conducting other internal and external audits.
h) Prepare & Monitor periodical compliance status of various audit recommendations.
i) Prepare & submit to appropriate authorities various periodical reports on safety, security, health, environment including training. Maintain all related records for the purpose of reference & audits.
j) Monitor the appropriate administration of security measures (gate passes, antecedent verification, access control procedures).
k) Ensure and monitor implementation of effective work permit system and record maintained.
l) Near miss analysis with specific focus on the root causes, reporting, dissemination of finding with all concerned across the location and corrective action required for preventive measures.

15.3 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 AFS personnel.

Training should be based on the needs of the job.

Training on live fire simulation in an area designated for this purpose.

Training through Fire Department.

Training on first aid by recognised agencies.

For supervisors, intimate knowledge of the operators job is essential and this should be ensured.

For AFS-in-charges, 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

15.4 Training techniques

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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:

15.5 Guidelines for Training co-ordinators

A) Course Objective:
The course objective should clearly and explicitly identify the outcomes a training programme is expected to produce. For example, the aim of basic safety course is:
   a) To provide good understanding and identification of the hazards associated with the job.
   b) To provide clear understanding of the safe way to perform the job.
   c) To evoke correct and prompt response in any emergency situation.

The objective of the course will be that on completion of the course, the trainee should be able to:
   i. Recognise hazardous condition at his place of work;
   ii. Perform his job in accordance with the safe operating procedure;
   iii. Help rectify an unsafe condition;
   iv. Escape safely in case of release of toxic gases;
   v. Operate firefighting equipment etc.,

The more accurately and clearly the objective specifies the training outcome, the more helpful it will be to co-ordinators 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

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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  

15.6 COURSE OUTLINE  
This section specifies the minimum safety inputs to be included in safety or functional training course for various categories of employees in selected areas through individual Course Modules. Hazardous/high risk operation should be specifically highlighted indicating the risks and precautions.  
The following points shall also be kept in view:  

I) Safety Officers 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.  

15.7 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.  

15.8 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.  

15.9 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.  

15.9.1 Course Modules  
Area: General Marketing (POL)  
Course Code: 401  
Intended For: Fresh Entrants (Officers & Supervisors) and transferred employees from other locations

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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 Aviation Fuel
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
xviii) Near Miss and accident/incident reporting

15.9.2. 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:

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OISD – STD – 235
STORAGE, HANDLING, REFUELLING AND FIRE FIGHTING AT AVIATION FUELLING STATIONS

i) Industrial Safety in Petroleum Industry & Safety Regulation.
ii) Safety Regulations (Statutory and In-company) & Accident Prevention.
iii) Classification of Hazardous Areas
iv) Work Permit System
v) Hazardous Properties of petroleum Products.
vi) Fire - Causes, Prevention & Control
vii) Fire Protection Facilities Operation & Maintenance
viii) Personal Protective Equipment
ix) Safety Instruments for Detection of Hazardous Atmosphere
x) Safe Operation and Maintenance Procedures
xi) Safe Practices in Tank Cleaning
xii) Safety Audit
xiii) Housekeeping
xiv) Disaster Management Plan/Emergency Procedures / Drills
xv) Industrial First Aid
xvi) Supervisor's Role in Safety
xvii) Electrical Safety
xviii) Occupational Health Hazards.
ix) Near Miss and accident/incident reporting

15.9.3 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 402

ii) Hazardous Properties of Aviation Fuel

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iii) Safe Operation and Maintenance Procedures with Special Reference to the Following:

   a) Receipt Operations.

   b) Refuelling

   c) Work Permit System

   d) Tank Cleaning.

15.9.4 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

15.9.5 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;

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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

15.9.6 Course Module

Course Code: 407
Intended For: Workmen at Field Location including contractor staff

Duration: 1 day

Objective:

To provide knowledge on hazards associated with the job and safe way to perform the job.

To evoke correct and prompt response in any emergency situation.

Course Content:

i) Hazardous Properties of Petroleum Products.

ii) Safe Operating Procedures

iii) Fire-Causes, Prevention and Control


v) Personal Protective Equipment

vi) Housekeeping.

vii) Emergency Procedures/ Drills

viii) Industrial First Aid.

15.10 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.

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15.11 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).

16 SAFETY AUDIT

16.1 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 equipment.

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

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

16.2 Objective & scope of Safety Audits:

   a) Introduction

Identification of vulnerable areas and specific potential hazards is one of the prime functions 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.-

   i. To identify any design deficiencies and also any weaknesses which might have cropped up during modifications / additions of facilities.

   ii. To ensure that fire protection facilities and safety systems are well maintained.

   iii. To ensure that operating / maintenance procedures, work practices are as per those stipulated in the manuals and standards, which might have degraded with time.

   iv. To check on security, training, preparedness for handling emergencies and disaster management etc.

       1. To check on mutual aid scheme, preparedness practice with district authority/fire brigade.

       2. To check the compliance of statutory regulations, standards, codes, etc.

   v. 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.

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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.

16.3 Methodology of internal safety audits

a) Frequency of audits:

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

b) 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 1 to 2 working days for facilities under each group.

c) 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 AFS.

d) 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:

1. Layouts
2. P & IDs
3. Operating Manuals/"SOP"
5. Fire and Safety Manuals, etc.

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6. 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.

e) Briefing:

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

f) 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/In-charge or the assigned officials.

g) Discussions:

Further information can also be gathered through discussions (formal & informal), with site personnel and AFS in-charge or other officers. The audit team should interact with persons from various disciplines such as Operations, Maintenance, Electrical, Instrumentation, etc.

h) 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.

i) 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 member/s.

The audit team shall finalize the audit report based on the discussions with auditee/location-in-charge.

j) 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 crux of the safety audits lie in removing the weakness identified during the audit.

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.

k) 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.

I) 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 walk around checks of AFS</td>
<td>Designated Safety officer (DSO)</td>
<td>Daily/Weekly</td>
<td>Annexure 6</td>
</tr>
<tr>
<td>2</td>
<td>Safety inspection of AFS</td>
<td>In-charge AFS</td>
<td>Monthly/Quarterly/Half yearly</td>
<td>Annexure-6</td>
</tr>
<tr>
<td>3</td>
<td>Electrical audit</td>
<td>Accredited electrical Engineers /Authorised Class A Electrical engineer</td>
<td>Once in 4 years or as per statutory requirement whichever is earlier.</td>
<td>Annexure-7</td>
</tr>
<tr>
<td>4</td>
<td>Internal safety audit</td>
<td>HS&amp;E representative</td>
<td>Yearly</td>
<td>As per OISD-STD-145</td>
</tr>
<tr>
<td>5</td>
<td>Pre-commissioning inspection</td>
<td>OISD/As applicable</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 (ESA)</td>
<td>OISD/As applicable</td>
<td>Two inspections at an interval of 5 years, there after a request audit.</td>
<td>OISD ESA check list</td>
</tr>
<tr>
<td>7</td>
<td>Surprise inspection</td>
<td>OISD/As applicable</td>
<td>As and when decided</td>
<td>Random Checks</td>
</tr>
<tr>
<td>8</td>
<td>Special Inspection by senior officers</td>
<td>Officers of the level of Executive Director/ General Manager of respective oil company.</td>
<td>Two major installations per year</td>
<td>Random Checks</td>
</tr>
</tbody>
</table>

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Annexure-1:

Critical Alarm Levels’ logic in Tank

Overfill Level

Safe Fill Level (HH)

High Level (H)

Normal fill Level

Note: Settings to be such that under no circumstances the Safe Fill level is exceeded.
## Annexure 2
### Checklist for Bulk ATF Tank Trucks at AFS:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily Checks</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Whether 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 (9/10 kg DCP)?</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>Additional Checks</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 in case of emergency?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Whether the vehicle has First Aid Box, Tool Box?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Whether the driver has a copy of standing instructions and TREM 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 equipment 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>

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Annexure-3
MAINTENANCE SCHEDULE OF CRITICAL EQUIPMENT

MAINTENANCE SCHEDULE
CENTRIFUGAL PUMP

<table>
<thead>
<tr>
<th>Sln.</th>
<th>Equipment Parameters to check</th>
<th>Periodicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Weekly</td>
</tr>
<tr>
<td>1.</td>
<td>Check lub oil &amp; top up level if necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check cooling water flow (where provided).</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Check mechanical seal/gland leakage.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Check the &quot;AMPS&quot; are within limits</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Change 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 :</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Product pumps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Other pumps</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Check alignment of pump and motor.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Overhauling</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Greasing of Bearings.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Check alignment of pump and motor</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Vibration Analysis</td>
<td></td>
</tr>
</tbody>
</table>

DIESEL ENGINES
MAINTENANCE STEPS

1. Keep the dirt out of the engine.
2. Maintain a lubricating film on all bearing surfaces.
3. Regulate the engine’s fuel.
4. Control operating temperatures.
5. Guard against corrosion.
6. Let the engine breathe.
7. Prevent over speeding.
8. Know your engine’s condition.
9. Correct troubles while they are simple.
10. Schedule and control your maintenance.

Diesel Engines: “A” Daily Checklist

<table>
<thead>
<tr>
<th>Sln.</th>
<th>Maintenance Steps</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check previous day’s engine log book.</td>
<td>Correct as required</td>
</tr>
<tr>
<td>2</td>
<td>Drain water and sediment from fuel tank and fuel filter through drain cock.</td>
<td>Before starting engine.</td>
</tr>
<tr>
<td>3</td>
<td>Check engine oil level and top up if necessary</td>
<td>Must be slightly less than or equal to “h” mark on dip stick when engine is stopped and has stood for 20 minutes or more (must be measured after all oil is drained back into oil pan).</td>
</tr>
<tr>
<td>4</td>
<td>Check for fuel, oil, water</td>
<td>Correct if leaking.</td>
</tr>
<tr>
<td>5</td>
<td>Fill radiator/surge tank with treated water (Chromate concentration 3500 ppm.)</td>
<td>Radiator cap must be firmly tightened back into the radiator/surge tank neck engine must not be operated</td>
</tr>
</tbody>
</table>

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<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Check air cleaner oil level and change oil, if required (if oil bath type) clean dust pan and pre cleaner of day type air cleaner.</td>
<td>Without the radiator cap since this will cause aeration and overheating of the coolant.</td>
</tr>
<tr>
<td></td>
<td>Use clean engine oil</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Check air line connections for leaks</td>
<td>Correct as required</td>
</tr>
<tr>
<td>8</td>
<td>Remove and clean air compressor breather, if equipped.</td>
<td>Fill with clean oil, upto mark.</td>
</tr>
<tr>
<td></td>
<td>Drain air receiver tank at the beginning of each shift and then close the drain cock.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clean crankcase breather</td>
<td>Discard paper type element, if clogged.</td>
</tr>
<tr>
<td></td>
<td>Check oil level in hydraulic governor, if provided.</td>
<td>Check for leaks, use specified engine oil for topping up.</td>
</tr>
<tr>
<td></td>
<td>Start the engine and note the oil pressure both at idling and maximum speed</td>
<td>If there is a change in oil pressure from that recorded in the long book on earlier occasion then stop engine and check through trouble shooting technique the cause for oil pressure change and correct if necessary (for assistance in diagnosing the change in oil pressure call your service representative if necessary).</td>
</tr>
<tr>
<td></td>
<td>Record oil pressure</td>
<td>Refer O&amp;M Manual for Lube Oil pressure limits.</td>
</tr>
<tr>
<td></td>
<td>Fill fuel tank at the end of the shift.</td>
<td>Use clean fuel and a strainer. Also clean the cap and surrounding area before opening the filler cap.</td>
</tr>
</tbody>
</table>

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

Format for **Request for Management of Change**

<table>
<thead>
<tr>
<th>Request No. :</th>
<th>Location</th>
<th>Request Date</th>
</tr>
</thead>
</table>

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

<table>
<thead>
<tr>
<th>Name, Designation, Emp. No. Of Initiator</th>
<th>Signature of the Initiator</th>
</tr>
</thead>
</table>

Comments of the Reviewer

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

Comments of the Approver

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

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“OISD hereby expressly disclaims any liability or responsibility for loss or damage resulting from the use of OISD Standards/Guidelines.”
### Delegation of Authority (DOA) for MOC: Aviation Fuel Stations

<table>
<thead>
<tr>
<th>Sl. #</th>
<th>Category of Changes</th>
<th>Details of Change</th>
<th>Addl. Requirement / 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.</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 facilities – Administrative block, laboratory, boundary wall, 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 – transformer rating, new DG set, synchronisation 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>
</tbody>
</table>

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<tr>
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<th>Initiator of MOC Request</th>
<th>Reviewer</th>
<th>Approver</th>
<th>Post-execution Inspection for confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Operating Procedure</td>
<td>Any changes in operating procedures other than that given in Aviation Operation Manual, approved SOPs or, convention followed in the location. Probable examples: Line-up for PLT, receipts / deliveries thru’ TT/ TW, Gauging of Tanks, Water Draining, Calibration of TTs &amp; Flowmeters, refuelling ops. thru refuellers/hydrant dispensers, etc.</td>
<td>Risk Assessment, if felt necessary by Designated Safety Officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Operating Procedure</td>
<td>Changes in operating procedure other than given in Aviation Operation Manual to comply newly amended statutory &amp; regulatory norms or recommendations from authorities.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Operating Procedure</td>
<td>Any change / additional new operations involving maintenance of product storage tanks, refuellers, tank repairs, cleaning of tanks, quality control procedure, etc.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
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<th>Details of Change</th>
<th>Addl. Requirement / 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>10</td>
<td>Operating Procedure</td>
<td>Any change in inventory accounting practices including pipeline qty., calculation modality, calibration chart etc. In variance with Accounting Manual / Aviation Ops. Manual.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Facilities</td>
<td>Any changes in software, ERP system / invoicing / documentation and computer hardware changes affecting operating processes</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Facilities</td>
<td>Any changes in automation set points, logic, processes, calibration / accuracy requirements for SCADA, TFMS &amp; other IT systems</td>
<td>Opinion of TAS/TFMS vendor, plus Risk Asses. if required by Safety Officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Operating Procedure</td>
<td>Cleaning / Repairs of the Fire Water Storage Tanks</td>
<td>Risk Assessment by Designated Safety Officer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Operating Procedure</td>
<td>Change in working hours / Addition/Deletion of shifts</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Facilities</td>
<td>Upgradation of refuelling facilities and equipment in line with new API/EI specifications.</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Note:

Designations of requisite authority for initiator, reviewer and approving authorities shall be assigned by respective OMC depending upon the MOC items’ relevant functional areas. However the logic of successively higher authority levels for the 3 stages viz. initiator, reviewer and approver shall be maintained.

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Annexure-6
Check Lists
Safety Audit Check List – AFS
Location __________
Audit/Inspection by __________

A. Fire Protection System & Security check

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency</th>
<th>Observations</th>
<th>Action taken in brief (if any) with date.</th>
</tr>
</thead>
<tbody>
<tr>
<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>Ensure pump suction &amp; discharge valves are full open.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check functioning of water tank level gauges</td>
<td>Weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check &amp; record hydrant line pressure in the log book</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Periodical health checkup of batteries and maintain record</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check fuel level in the fire engine fuel tanks &amp; record.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check functioning of fuel level indicators.</td>
<td>weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check condition of engine exhaust insulation lading</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run one pump &amp; ensure all the pumps are run at least twice in a week and record pressure developed &amp; operating parameters in the log book</td>
<td>Daily/weekly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whether engine trip mechanism is in working condition.</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<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>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>Check Fire siren range (3 km) and hand sirens are in strategic place.</td>
<td>Monthly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whether emergency / DC supply continuously available for fire siren?</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surprise check if frisking of crew members /visitors/contract workmen are done at entry gate and record maintained.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check proper functioning DFMD/HH metal detectors at gate are.</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check functioning of CCTV system &amp; record deficiencies, if any?</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Task</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security check for integrity of boundary wall/fence? Safety officer</td>
<td>Daily</td>
</tr>
<tr>
<td>to review</td>
<td>Weekly</td>
</tr>
<tr>
<td>Random Check if any vehicle with Spark ignition engine is allowed in</td>
<td>Daily</td>
</tr>
<tr>
<td>the hazardous area and vehicles of IC engines are fitted with proper</td>
<td></td>
</tr>
<tr>
<td>exhaust.</td>
<td></td>
</tr>
<tr>
<td>Check work permit in random for the ongoing jobs in the location,</td>
<td>Daily</td>
</tr>
<tr>
<td>whether the same in line with relevant OISD STD and intended jobs.</td>
<td></td>
</tr>
<tr>
<td>Check presence of supervisor &amp; adequacy of firefighting system.</td>
<td></td>
</tr>
<tr>
<td>Deviations to be recorded &amp; report to location I/C</td>
<td></td>
</tr>
<tr>
<td>Check effectiveness of communication between various operating areas</td>
<td>Weekly</td>
</tr>
<tr>
<td>functioning &amp; record deficiency.</td>
<td></td>
</tr>
<tr>
<td>Random Check of emergency gate for any obstruction.</td>
<td>Daily</td>
</tr>
<tr>
<td>Check for Caution signs &amp; speed limit display at appropriate places.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Whether control room is manned continuously / during operations?</td>
<td>Daily</td>
</tr>
<tr>
<td>Random check if persons entering / working at hazardous areas are</td>
<td>Daily</td>
</tr>
<tr>
<td>using PPEs?</td>
<td></td>
</tr>
<tr>
<td>Check for any accumulation of oil in the drains connected to OWS</td>
<td>Weekly</td>
</tr>
<tr>
<td>Randomly check if OWS outlet drain valve is closed</td>
<td>Weekly</td>
</tr>
<tr>
<td>Whether OWS functioning is effective and final discharge free of Oil?</td>
<td>Monthly</td>
</tr>
<tr>
<td>Check illumination level at all operating areas after sun set &amp;</td>
<td>Quarterly</td>
</tr>
<tr>
<td>record the lux level.</td>
<td></td>
</tr>
<tr>
<td>Check if Portable fire extinguishers are placed as per OISD 117?</td>
<td>Monthly</td>
</tr>
<tr>
<td>Check proper functioning of hydrant/monitors in the location.</td>
<td>Monthly</td>
</tr>
<tr>
<td>Check / test of sprinkler system and records performance.</td>
<td>Half yearly</td>
</tr>
<tr>
<td>Check/test of foam pourer system and record performance.</td>
<td>Half yearly</td>
</tr>
<tr>
<td>Whether foam quantity is adequate and meets requirement.</td>
<td>Monthly</td>
</tr>
<tr>
<td>Check deployment of foam drums at field and stored as per OEM</td>
<td></td>
</tr>
<tr>
<td>recommendation.</td>
<td></td>
</tr>
<tr>
<td>Comments on housing keeping</td>
<td>Weekly</td>
</tr>
<tr>
<td>Any other observations?</td>
<td>---</td>
</tr>
</tbody>
</table>

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### B. Bulk storage area – Tank Farm

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Frequency</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 its 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>5</td>
<td>Whether tank level instruments are in working condition?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>6</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>7</td>
<td>Whether any settlement of tank, cracks on pad observed?</td>
<td>Monthly</td>
</tr>
<tr>
<td>8</td>
<td>Whether RO SOV on tank delivery line on remote mode?</td>
<td>Weekly</td>
</tr>
<tr>
<td>9</td>
<td>Whether dyke area &amp; underneath of manifold are free from any oil leakage / accumulation.</td>
<td>Monthly</td>
</tr>
<tr>
<td>10</td>
<td>Whether isolation valve for TSV / expansion line kept open to facilitate taking care of expansion</td>
<td>Monthly</td>
</tr>
<tr>
<td>11</td>
<td>Whether Bonding across flange joints and floating roof deck are rigid.</td>
<td>Quarterly</td>
</tr>
<tr>
<td>12</td>
<td>Whether escape pathway from tank farm is free from obstruction?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>13</td>
<td>Whether road round the dyke is free from any obstruction?</td>
<td>Daily</td>
</tr>
<tr>
<td>14</td>
<td>Whether Housekeeping in order?</td>
<td>Monthly</td>
</tr>
<tr>
<td>15</td>
<td>Any other observations?</td>
<td></td>
</tr>
</tbody>
</table>

### C. Truck/refuellers loading / unloading gantry

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Random check for TT /refuellers speed limit (10 KMPH) inside the premises</td>
<td>Daily</td>
</tr>
<tr>
<td>2</td>
<td>Whether crew members are carrying proper I-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 Quarter</td>
</tr>
<tr>
<td>4</td>
<td>Whether TT/refuellers engine and</td>
<td>Daily</td>
</tr>
</tbody>
</table>

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<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Random check for TT earthing on clit 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/refuellers 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-talkie, wherever provided?</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 hoses are secured properly in the gantry after loading operations and do not obstruct TT movement in the gantry?</td>
<td>Daily (Random)</td>
</tr>
<tr>
<td>18</td>
<td>Whether emergency escape is marked with signage / display and approach is free from obstruction?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>19</td>
<td>Any other observations?</td>
<td></td>
</tr>
</tbody>
</table>

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D. Product Pump House (loading / unloading)

<table>
<thead>
<tr>
<th></th>
<th>Whether electrical termination in the JBs is apparently sound?</th>
<th>Monthly</th>
</tr>
</thead>
<tbody>
<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>

E. Laboratory

<table>
<thead>
<tr>
<th></th>
<th>Whether earthing connection terminals are apparently rigid</th>
<th>Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Whether laboratory electrical fittings are Industrial type closed / tight metal clad fittings for plug and socket assembly?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>3</td>
<td>Whether main electrical circuit is provided with ELCB?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>4</td>
<td>Whether samples of Class ‘A’ petroleum products are kept in airtight containers?</td>
<td>Daily</td>
</tr>
<tr>
<td>5</td>
<td>Whether sample containers are stacked properly?</td>
<td>Weekly</td>
</tr>
<tr>
<td>6</td>
<td>Whether sample room is free from Oil spillage?</td>
<td>Daily</td>
</tr>
<tr>
<td>7</td>
<td>Check functioning of exhaust fans in sample room.</td>
<td>Weekly</td>
</tr>
<tr>
<td>8</td>
<td>Whether “No smoking” board displayed?</td>
<td>Quarterly</td>
</tr>
<tr>
<td>9</td>
<td>Whether Housekeeping in order?</td>
<td>Daily</td>
</tr>
<tr>
<td>10</td>
<td>Adequate fire-fighting facilities are available or not?</td>
<td>Daily</td>
</tr>
</tbody>
</table>

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### F. Transformer yard

<table>
<thead>
<tr>
<th></th>
<th>Activity Description</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check if gate of transformer yard kept closed. And entry of persons other than</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>authorized person is under supervision.</td>
<td></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>

### G. Electrical Sub Station/ Switch room

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

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether driver undergone training on &quot;safe driving practices&quot; &amp; &quot;transportation of hazardous goods&quot;?</td>
<td>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 arresting 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 boxes are properly sealed.</td>
<td>Quarterly</td>
</tr>
<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>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<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 observations?</td>
<td>-----</td>
</tr>
</tbody>
</table>
Annexure-7
ELECTRICAL AUDIT OF AFS

LOCATION _______________ Dated _______________

AUDIT/ INSPECTION BY _______________

<table>
<thead>
<tr>
<th>S.No.</th>
<th>ITEM DESCRIPTION</th>
<th>AUDITORS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. ELECTRICAL SUBSTATION/ SWITCH ROOM

A-01 Is line diagram of power/lighting distribution and shock chart 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.

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B. MOTORS IN PUMP HOUSE/ COMPRESSOR ROOM

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

C. UNIT LIGHTING

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

D. MAST LIGHTS (AREA LIGHTING)

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

E. TANFARM AREA, PIPELINES, LOADING/UNLOADING GANTRY

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

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F. GENERAL

F-01  a) Area classification drawings duly approved by PESO?
     b) Conditions if any, specified by PESO for electrical substation, switch room etc. and their compliance.
F-02  Certificate in respect of FLP for each electrical equipment- records maintained.
F-03  Earthing network diagram available and site checks done from time to time.
F-04  Records for electrical testing/ checks maintained upto date.
F-05  Work permit system is effective and records are maintained.
## ANNEXURE : 8
### CHECK LIST FOR AFS

<table>
<thead>
<tr>
<th>GroupCode</th>
<th>Area</th>
<th>Sno</th>
<th>Audit_Particulars</th>
<th>Observation</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part-A</td>
<td>SAFETY MANAGEMENT</td>
<td>1.01</td>
<td>Whether safety policy approved by Management available.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY MANAGEMENT</td>
<td>1.02</td>
<td>Whether policy displayed in prominent location.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY MANAGEMENT</td>
<td>1.03</td>
<td>Whether declared/approved safety policy is made available to all concerned in written form.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY MANAGEMENT</td>
<td>1.04</td>
<td>Whether policy disseminated to – a) Officers b) Non-Management Staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY MANAGEMENT</td>
<td>1.05</td>
<td>Whether any system prevails to have proper monitoring/ feedback/suggestions on safety issues by appropriate authority.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY MANAGEMENT</td>
<td>1.06</td>
<td>Whether safety slogans are displayed at strategic locations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY COMMITTEE.</td>
<td>2.01</td>
<td>Whether any safety committee is in existence in the location.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY COMMITTEE.</td>
<td>2.02</td>
<td>Whether sufficient representation from non-management cadre exists in the committee as per Factory Rules.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY COMMITTEE.</td>
<td>2.03</td>
<td>Whether meetings are conduct at least once in a quarter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY COMMITTEE.</td>
<td>2.04</td>
<td>Whether safety committee meetings are chaired by the location in-charge or his nominee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY COMMITTEE.</td>
<td>2.05</td>
<td>Whether committee reviews the earlier decisions and action points are recorded with target dates with person responsible for compliance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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| Part-A | SAFETY COMMITTEE. | 2.06 | Whether only safety related issues are discussed in the meeting (Records for last 2 years meeting to be checked and interaction with safety committee members to ascertain their perception) |
| Part-A | SAFETY TRAINING | 3.01 | Whether regular training courses are conducted for all staff including contractor staff on safety and firefighting. If yes, no. of such programmes organised in last one year. |
| Part-A | SAFETY TRAINING | 3.02 | No. of participants on safety programmes from the location in above mentioned courses. a) Officers (including new entrants/trainees) b) Non-management staff c) Security staff d) Tank truck crew e) Contractor’s workmen |
| Part-A | SAFETY TRAINING | 3.03 | Whether course modules are framed as per OISD 154 in relevance of location requirement (company as well as contractors ‘staff’) |
| Part-A | SAFETY TRAINING | 3.04 | No. of Heavy Vehicle Drivers are trained as per Airport authority requirements in last two years. |
| Part-A | SAFETY TRAINING | 3.05 | Whether First Aid Training imparted to staff by Authorised Agencies in line with Factories Act (minimum 20% of total employees) |
| Part-A | SAFETY TRAINING | 3.06 | Comments on assimilation of safety training in respect of – - Officers -Non-management staff - Contractors’ Workmen |
| Part-A | SAFETY TRAINING | 3.07 | Whether refresher courses are organised periodically for improvements. |

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| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.01 | Whether fire organisation chart covers all aspects for a) On shift, b) Off shift hours. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.02 | Whether fire drills are conducted regularly. What is frequency? |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.02.01 | Details of Mock fire drill during this ESA. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.03 | Whether shortcomings recorded and remedial actions taken for improvement of fire drills. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.04 | Whether mutual aid scheme is available. If yes, whether the same is discussed periodically with members and records thereof are available. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.05 | Whether well-defined disaster control plan (on site/off site) is available for the location and approved/acknowledged by Factories Inspector/defence authority. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.06 | Whether Disaster Management Plan is prepared based on risk analysis. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.07 | Whether emergency exit available and direction of the same displayed? |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.08 | Whether any Mock Drill for Disaster Management Plan organised, actions taken on shortcomings and plan updated. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.09 | Whether proper communication system exists in the location including P&T telephones/PA paging system/walkie-talkie etc. |
| Part-A | EMERGENCY MANAGEMENT SYSTEMS | 4.10 | Whether personal protective equipment are available at the location (See Annex.IV) |

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<table>
<thead>
<tr>
<th>Part-A</th>
<th>EMERGENCY MANAGEMENT SYSTEMS</th>
<th>4.11</th>
<th>Whether adequate security arrangements/records are available at the location to identify a person/vehicles entering the premises.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part-A</td>
<td>EMERGENCY MANAGEMENT SYSTEMS</td>
<td>4.12</td>
<td>Whether identity cards are issued and worn by employees, visitors and contractors personnel for admission to restricted areas.</td>
</tr>
<tr>
<td>Part-A</td>
<td>EMERGENCY MANAGEMENT SYSTEMS</td>
<td>4.13</td>
<td>Whether metal detectors and mirror trolleys are available and used.</td>
</tr>
<tr>
<td>Part-A</td>
<td>EMERGENCY MANAGEMENT SYSTEMS</td>
<td>4.14</td>
<td>Whether the boundary wall/compound wall is as per MOHA/BPE/Corp. Security guidelines.</td>
</tr>
<tr>
<td>Part-A</td>
<td>EMERGENCY MANAGEMENT SYSTEMS</td>
<td>4.15</td>
<td>Whether any minor/major accident had occurred in last five years and records available.</td>
</tr>
<tr>
<td>Part-A</td>
<td>EMERGENCY MANAGEMENT SYSTEMS</td>
<td>4.16</td>
<td>Whether remedial actions are taken to prevent recurrence of the accidents.</td>
</tr>
<tr>
<td>Part-A</td>
<td>EMERGENCY MANAGEMENT SYSTEMS</td>
<td>4.17</td>
<td>Whether information of accidents/near misses are disseminated to all concerned.</td>
</tr>
<tr>
<td>Part-A</td>
<td>SAFETY AUDITS</td>
<td>5.01</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Whether following audits are conducted - (Check records for last five years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Internal safety audit as per OISD 145 (Refer Annexure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- i) Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ii) Formation of team</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- iii) Total No. of recomme</td>
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</tr>
<tr>
<td></td>
<td>- iv) No. of recommendations implemented</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- v) Status of implementation on balance points (Refer Annex V)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Electrical safety audits</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- i) Frequency (minimum once in three Years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ii) Formation of team/party</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- iii) Total No. of recommendations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- iv) No. of recommendations implemented</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- v) Status of implementation on balance points (Ref. Annex. VI)</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>SAFETY AUDITS</th>
<th>5.02</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether self-safety audit by location is conducted</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>LAYOUT &amp; FACILITIES</th>
<th>6.01</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether updated and CCE approved drawing showing all facilities is available.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Ref. Annex. II)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>LAYOUT &amp; FACILITIES</th>
<th>6.02</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether inter-distances are as per OISD 235.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>LAYOUT &amp; FACILITIES</th>
<th>6.03</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether updated drawing showing fire hydrant system/firefighting equipment is available.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>LAYOUT &amp; FACILITIES</th>
<th>6.04</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether updated P&amp;I diagram available for product pipelines</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>OPERATIONAL ACTIVITIES</th>
<th>7.01</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether records for checks for T/T as per checklist are available.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part-A</th>
<th>OPERATIONAL ACTIVITIES</th>
<th>7.02</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whether work permits are issued as per OISD 105 and job completion details are recorded</td>
<td></td>
</tr>
<tr>
<td>Part-A</td>
<td>OPERATIONAL ACTIVITIES</td>
<td>7.03</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Part-A</td>
<td>MAINTENANCE &amp; INSPECTION SYSTEMS</td>
<td>8.01</td>
</tr>
<tr>
<td>Part-A</td>
<td>MAINTENANCE &amp; INSPECTION SYSTEMS</td>
<td>8.02</td>
</tr>
<tr>
<td>Part-A</td>
<td>MAINTENANCE &amp; INSPECTION SYSTEMS</td>
<td>8.03</td>
</tr>
<tr>
<td>Part-A</td>
<td>MAINTENANCE &amp; INSPECTION SYSTEMS</td>
<td>8.04</td>
</tr>
<tr>
<td>Part-A</td>
<td>MAINTENANCE &amp; INSPECTION SYSTEMS</td>
<td>8.05</td>
</tr>
<tr>
<td>Part-A</td>
<td>MAINTENANCE &amp; INSPECTION SYSTEMS</td>
<td>8.06</td>
</tr>
<tr>
<td>Part-A</td>
<td>ELECTRICAL SYSTEMS</td>
<td>9.01</td>
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<tr>
<td>Part-A</td>
<td>ELECTRICAL SYSTEMS</td>
<td>9.02</td>
</tr>
<tr>
<td>Part-A</td>
<td>ELECTRICAL SYSTEMS</td>
<td>9.03</td>
</tr>
<tr>
<td>Part-A</td>
<td>ELECTRICAL SYSTEMS</td>
<td>9.04</td>
</tr>
</tbody>
</table>

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| Part-A | LICENCES & DOCUMENTATIONS | 10.01 | Whether following licenses/approvals as applicable are available:
- CCE license -Factory license
- Environment Pollution Consent for
  i) Air Pollution
  ii) Water pollution-
Weights & Measures Approval / certificates. |
| Part-A | LICENCES & DOCUMENTATIONS | 10.02 | Whether following manuals/standards, as applicable, are available at site (printed or in soft form):
1) Petroleum Acts & Rules
2) Pollution Control Acts & Rules
3) Weights & Measure Act/Rules
4) Motor Vehicle Act
5) Aviation Operations manual
6) HS&E manual
7) DGCA approved QC Manual for Aviation product
8) OISD Standards |
| Part-A | LICENCES & DOCUMENTATIONS | 10.03 | Equipment Manufacturer’s Manual-
1) DG sets
2) Fire engines |
| Part-A | STATUS ON IMPLEMENTATION OF RECOMMENDATIONS OF EXTERNAL SAFETY AUDIT. | 11.01 | Date of last Audit |
| Part-A | STATUS ON IMPLEMENTATION OF RECOMMENDATIONS OF EXTERNAL SAFETY AUDIT. | 11.02 | Whether implementation of external safety audits recommendations are monitored. |
| Part-A | STATUS ON IMPLEMENTATION OF RECOMMENDATIONS OF EXTERNAL SAFETY AUDIT. | 11.03 | Total Number of recommendations. Status of pending points of last external safety audit. |
| Part-A | STATUS ON IMPLEMENTATION OF RECOMMENDATIONS OF EXTERNAL SAFETY AUDIT. | 11.04 | No. of recommendations implemented. |

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| Part-A | STATUS ON IMPLEMENTATION OF RECOMMENDATIONS OF EXTERNAL SAFETY AUDIT. | 11.05 | No. of balance recommendations (Ref. Annexure VII)  
a) Under implementation  
b) Action not initiated |
|--------|-------------------------------------------------|-------|__________________________________________________|
| Part-B | TANK FARM | 12.01 | Whether Dyke/fire walls meet OISD – 118/CCE regulations? |
| Part-B | TANK FARM | 12.02 | Whether motorable roads are available around the tank farm for movement for fire tenders for AFS with more than 5000 KL AG storage tanks? |
| Part-B | TANK FARM | 12.03 | Whether house keeping in the area is satisfactory and it is free of dry vegetation. |
| Part-B | TANK FARM | 12.04 | Whether drains are provided in the tank farm & kept clean? |
| Part-B | TANK FARM | 12.05 | Whether drainage from A/G tank farm with more than 1000 KL AG tanks, is routed through oil water separator and isolation valve provided at tank farm exist? |
| Part-B | TANK FARM | 12.06 | Whether important data like tank capacity, product, due date of cleaning/ painting, ref. height and safe filling height are painted on tank? |
| Part-B | TANK FARM | 12.07 | Whether A/G tanks are provided with circumferential railings on roof with toe guards? |
| Part-B | TANK FARM | 12.08 | Whether any depression due to tank settlement observed in A/G vertical tanks on the tank pad along the circumference? |
| Part-B | TANK FARM | 12.09 | Any visible leaks/sweating observed on the A/G tanks? |
| Part-B | TANK FARM | 12.10 | Any corrosion observed on annular/shell/roof plates of A/G tanks & structures? |
| Part-B | TANK FARM | 12.11 | Whether goose neck type vent connections are provided with suitable wire mesh? |

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| PART B | TANK FARM | 12.12 | Whether any blending of WMM product resorted to? If so, what are the procedures & safety precautions taken? |
| PART B | TANK FARM | 12.13 | Whether cross checking of auto level gauge is done through manual gauge, while the tanks are under operation for tanks provided at AFSS with more than 1000 KL A/G storage tanks. |
| PART B | TANK FARM | 12.14 | Check condition of earthing strips and pits for all tanks. |
| PART B | TANK FARM | 12.15 | Provision of double valve segregation on inlet/outlet of A/G tanks. |
| PART B | TANK FARM | 12.16 | Any water logging observed on fixed roof of AG tanks. |
| PART B | TANK FARM | 12.17 | Whether the ladders, stairways/cat walk are in good condition? |
| PART B | TANK FARM | 12.18 | Whether expansion lines are provided on pipelines & are connected to A/G tanks properly. |
| PART B | TANK FARM | 12.19 | Whether sprinkler system is provided for A/G tanks (more than 30 m dia) as per OISD-235. |
| PART B | TANK FARM | 12.20 | Whether foam systems (trolley mounted) are provided as per OISD 235 for A/G tanks (more than 18m dia). |
| PART B | TANK FARM | 12.21 | Whether adequate coverage by hydrant/monitor is provided to A/G tank farms with more than 1000 KL capacity. |
| PART B | TANK FARM | 12.22 | If location receives product through pipeline please check condition of pipelines and maintenance procedures. |
| PART B | TANK FARM | 12.23 | Whether refuelling hoses are pressure tested & record maintained. |

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| PART B | TANK FARM | 12.24 | MOVs provided are in proper working conditions with shut off facilities in control room. |
| PART B | PUMP HOUSE | 13.01 | Whether the pumps details are displayed with number? |
| PART B | PUMP HOUSE | 13.02 | Whether delivery to suction bypass line/re-circulation line to storage tank has been provided for HRS locations? |
| PART B | PUMP HOUSE | 13.03 | Whether adequate ventilation exists (in case of covered pump house)? |
| PART B | PUMP HOUSE | 13.04 | Whether sump is provided to collect spills & is kept clean? |
| PART B | PUMP HOUSE | 13.05 | Whether double earthing are provided for motor. |
| PART B | PUMP HOUSE | 13.06 | Whether all electrical fitting/motors are flameproof, properly installed. |
| PART B | PUMP HOUSE | 13.07 | Whether coupling guards are provided for pump/motor. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.01 | Whether all the drains are routed to OWS for AFS with more than 1000 KL A/G capacity storage. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.02 | Whether unloading hoses are having proper electric continuity. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.03 | Whether proper earthing is provided to Topping up/unloading structure. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.04 | Whether earthing as well as bonding is ensured during loading/unloading operation. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.05 | Whether safety operating instructions are displayed. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.06 | Whether TT unloading section is adequately covered by hydrant system for AFSs with more than 1000KL A/G storage. |
| PART B | UNLOADING/TOPPING UP POINT. | 14.07 | Whether safe operating practices are followed for topping up/unloading of product. |

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<p>| PART B | UNLOADING/TOPPING UP POINT. | 14.08 | Whether proper colour coding as per QC manual is provided. |
| PART B | ELECTRICAL SYSTEM | 15.01 | Whether all electrical fittings, lighting provisions etc. are as per hazard area classification. |
| PART B | ELECTRICAL SYSTEM | 15.02 | Whether all earthing connections/pits are provided as per IS:3043/Oil Co. spec. |
| PART B | ELECTRICAL SYSTEM | 15.03 | Whether separate earthing is provided for lightening arresters, if provided |
| PART B | ELECTRICAL SYSTEM | 15.04 | Whether fencing to transformer yard is provided with efficient earthing. |
| PART B | ELECTRICAL SYSTEM | 15.05 | Whether suitable breaker system is provided to break in full load condition. |
| PART B | ELECTRICAL SYSTEM | 15.06 | Whether clear spacing is provided in front and rear of the main panels. |
| PART B | ELECTRICAL SYSTEM | 15.07 | Whether rubber mats of adequate rating with ISI marking are provided in front of and rear of the main panels. |
| PART B | ELECTRICAL SYSTEM | 15.08 | Whether proper ventilation is provided for the room for battery charging. |
| PART B | ELECTRICAL SYSTEM | 15.09 | Whether the cable ends in switch boards/bus bars/motors and other equipment are provided with lugs and properly secured. |
| PART B | ELECTRICAL SYSTEM | 15.10 | Whether emergency lights are provided in sub station and switch room, DG set room. |
| PART B | ELECTRICAL SYSTEM | 15.11 | Whether proper identification of cables and switches is provided. |
| PART B | ELECTRICAL SYSTEM | 15.12 | Whether proper interlocking between two different supply sources has been provided, wherever 2 sources are available. |
| PART B | ELECTRICAL SYSTEM | 15.13 | Does the reservoir contain sufficient transformer oil for locations with transformer? |</p>
<table>
<thead>
<tr>
<th>PART B</th>
<th>ELECTRICAL SYSTEM</th>
<th>15.14</th>
<th>Provision of adequate ventilation for transformer, (if installed in door).</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART B</td>
<td>ELECTRICAL SYSTEM</td>
<td>15.15</td>
<td>Whether security is trained for isolating the supply in emergency.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.01</td>
<td>Whether fire water storage capacity is adequate as per OISD-117 (Annexure III)</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.02</td>
<td>What are the sources of water</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.03</td>
<td>Whether pumps are installed as per OISD.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.04</td>
<td>Is main hydrant line, wherever provided, kept under pressure?</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.05</td>
<td>Whether the pumps are in auto or manual mode.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.06</td>
<td>Is logbook available for operation and maintenance of FW pump.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.07</td>
<td>What are the types and quantity of foam available?</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.08</td>
<td>What are the storage arrangements of foam and its accessibility?</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.09</td>
<td>Whether hydrant system is laid properly to avoid corrosion.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.10</td>
<td>Are monitors/ hydrants properly distributed in critical areas and all facilities covered &amp; are easily operable.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.11</td>
<td>Check the pressure at farthest point.</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.12</td>
<td>Are portable extinguishers meeting OISD requirements? Are they BIS approved (Refer Annexure IV)</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.13</td>
<td>Whether wheeled equipment are placed as per OISD standards. (Refer Annex. IV)</td>
</tr>
<tr>
<td>PART B</td>
<td>FIRE PROTECTION SYSTEM</td>
<td>16.14</td>
<td>Whether hoses, nozzles and accessories are available as per OISD standards. (Refer Annexure IV)</td>
</tr>
</tbody>
</table>

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| PART B | FIRE PROTECTION SYSTEM | 16.15 | Whether adequate cartridges and DCP available in the store (10% of the total extinguishers). |
| PART B | FIRE PROTECTION SYSTEM | 16.16 | Whether hand operated / electric fire siren (3km range) is provided at strategic locations. |
| PART B | GATE SECURITY | 17.01 | Whether security checks are carried out at the main gate for matches/lighters. |
| PART B | GATE SECURITY | 17.02 | Whether the movement of tank trucks is properly regulated at the main gate for easy escape during emergency. |
| PART B | GATE SECURITY | 17.03 | Whether NO SMOKING signs, Explosives License Number, Speed Limit are displayed at the main gate. |
| PART B | GATE SECURITY | 17.04 | Whether metal detectors and mirror trolleys are provided and are being regularly used. |
| PART B | GATE SECURITY | 17.05 | Whether important telephone numbers at the main gate/office are displayed. |
| PART B | GATE SECURITY | 17.06 | Whether First Aid boxes with requisite medicines are provided. |
| PART B | GATE SECURITY | 17.07 | Whether telephone is provided to watch and ward for communication after shift hours. |
| PART B | LABORATORY | 18.01 | Whether fire extinguishers are adequately positioned. |
| PART B | LABORATORY | 18.02 | Whether important instructions, emergency procedures displayed. |
| PART B | LABORATORY | 18.03 | Whether ELCB/ MCB installed in the main power switchboard. |
| PART B | LABORATORY | 18.04 | Whether the switches/plug sockets for various equipment safe and should be provided with metal cladding. |
| PART B | STORE/WAREHOUSE | 19.01 | Materials are stacked properly in the warehouse for proper identification. |
| PART C | REFUELLING OPERATIONS | 20.01 | Whether valid explosive/PESO licences available for refuellers |

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<table>
<thead>
<tr>
<th>PART C</th>
<th>REFUELLING OPERATIONS</th>
<th>20.02</th>
<th>Each refuellers/hydrant dispensers are equipped with 2 nos. DCP extinguishers and 1 CO2 type extinguisher inside cabin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.03</td>
<td>Soak pads are available in the refuellers/ hydrant dispensers as oil spill recovery kit.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.04</td>
<td>Whether spark arrestors are provided on refuellers/dispensers and are IS marked, unless exempted.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.05</td>
<td>Continuity maintained for bonding wire in refuellers/hydrant dispensers.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.06</td>
<td>Deadman control of refuellers/hydrant dispensers are in working conditions.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.07</td>
<td>Whether SOP is followed during refuelling.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.08</td>
<td>Whether safety devices like PCV, PV vents on top of refuellers, brake interlock of refuellers/dispensers, etc are in working condition.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.09</td>
<td>Cathodic protection of HRS PL is in working condition and records maintained.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.10</td>
<td>Emergency shutdown (ESD) points are located on the tarmac in accessible position and in sealed condition.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.11</td>
<td>The hydrant pits are clean, free of water and fuel with with pit covers and isolation valves.</td>
</tr>
<tr>
<td>PART C</td>
<td>REFUELLING OPERATIONS</td>
<td>20.12</td>
<td>The high and low points on the hydrant line are clean, free of water/fuel with arrangement for sampling.</td>
</tr>
<tr>
<td>PART C</td>
<td>PACKED STORAGE</td>
<td>21.01</td>
<td>Whether Class A product stored in barrels are as per manualized instructions.</td>
</tr>
</tbody>
</table>