PETROLEUM AND NATURAL GAS REGULATORY BOARD

NOTIFICATION

New Delhi, the 11th November, 2020

F. No PNGRB/Tech/7-T4SPl (1)/2020.-In exercise of the powers conferred by section 61 of the Petroleum and Natural Gas Regulatory Act, 2006 (19 of 2006), the Petroleum and Natural Gas Regulatory Board hereby makes the following Regulations, namely: -

1. Short title and commencement:

(1) These Regulations may be called the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Regulations, 2020.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions-**

(1) In these regulations, unless the context otherwise requires,

(a) "Act" means the Petroleum and Natural Gas Regulatory Board Act, 2006 (19 of 2006);
(b) "Board" means the Petroleum and Natural Gas Regulatory Board established under sub-section (1) of section 3 of the Act;
(c) "Bonding" means the process by which two electrical conducting bodies are connected using a conductor to maintain electrical continuity to prevent sparking;
(d) "Clean agent" means electrically nonconductive, volatile or gaseous fire extinguishing medium that does not leave a residue upon evaporation and meets the requirements given in the latest NFPA 2001 on clean agent fire extinguishing systems in line with environmental considerations of Kyoto and Montreal Protocol and latest MOEF regulations (Government of India, Ministry of Environment, Forest and Climate Change);
(e) "corrosion" means all forms of wastage, and includes oxidation, scaling, mechanical abrasion and corrosion;
(f) "design pressure" means the pressure used in the design of equipment, a container, or a vessel for the purpose of determining the minimum permissible thickness or physical characteristics of its different parts and where applicable, static head shall be included in the design pressure to determine the thickness of any specific part;
(g) "Dyke" means an area that may be defined through the use of structure or the topography at the site for the purpose of containing any accidental spill of petroleum products;
(h) "Earthing" means 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;
(i) "Effluent Treatment Plant (ETP)" means a mechanism and process used to treat waters

that have been contaminated due to presence of Oil or sludge or Grease or chemicals or sewage generated of different activities or operations in petroleum installations;

(j) "Emergency Shutdown System" means a system that safely and effectively stops whole plant or an individual unit before unrecoverable incidents occurs;

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

(i) "Lower explosive Limit (LEL)" means 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 and such limit is usually expressed as volume percentage of the vapour in air;

(ii) "Upper Explosive Limit (UEL)" means 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 and such limit is usually expressed as a volume percentage of vapours in air;

(l) "Failsafe" means design features which will maintain or result in safe operating conditions in the event of a malfunction or failure of power, instrument air, components or control devices;

[1][(la) "Fire station" means building housing facilities for parking fire tenders and for keeping in readiness, other fire-fighting equipment for meeting plant emergencies and, fire control room with required communication facilities mimic panel.]

(m) "Fixed-Length Dip Tube" means a pipe that has a fixed open end fitted inside a container at a designated elevation that is intended to show a liquid level;

(n) "flammability range" means the difference between the minimum and maximum percentage by volume of the gas in mixture with air that forms a flammable mixture at atmospheric pressure and ambient temperature;

(o) "Flash Point" means 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);

(p) "Hazardous Fluid" means a liquid or gas that is flammable or toxic;

(q) "Hazardous Area" means the locations classified according to Zone System which defines the probability of the hazardous material, gas or dust, being present in sufficient quantities to produce explosive or ignitable mixtures which require special precautions for the construction, installation and use of electrical apparatus as specified below:

(i) "Zone 0" means ignitable concentrations of flammable gases or vapours which are present continuously or for long periods of time;

(ii) "Zone 1" means ignitable concentrations of flammable gases or vapours which are likely to occur under normal operating conditions; and

(iii) "Zone 2" means ignitable concentrations of flammable gases or vapours which are not likely to occur under normal operating conditions and do so only for a short period of time;

(r) "Intrinsically Safe" means a circuit or part of a circuit, which 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

[1] Ins. by cl. (i) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

specific test conditions for such purpose, of causing ignition of a specific gas or vapour and an intrinsically safe apparatus is one in which all electrical circuits are intrinsically safe;

(s) "Non- Hazardous area" means 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;

(t) "Ignition Source" means any item or substance capable of an energy release of type and magnitude sufficient to ignite any flammable mixture of gases or vapours that could occur at the site;

(u) "Maximum Allowable Working Pressure" means the maximum gauge pressure permissible at the top of equipment, a container or a pressure vessel while operating at design temperature;

(v) "NDT" means Non-Destructive Testing methods like Dye Penetration Inspection, Wet Fluorescent Magnetic Particle Inspection, Ultrasonic thickness checks, Ultrasonic Flaw Detection, Radiography, Hardness Test and other relevant Inspection procedures carried out to detect the defects in the welds and parent metal of the pressure vessel;

(w) "Oil water separator (OWS)" means a system designed to separate gross amount of oil and suspended solids from the oily water effluent generated due to different activities or operations in Petroleum Installations;

(x) "onshore" means areas other than offshore which shall form the scope of these regulations and Feeder lines from or to jetty or other storage points shall also form a part of the onshore pipelines;

(y) "petroleum" means any liquid hydrocarbon or mixture of hydrocarbons and any inflammable mixture (liquid, viscous or solid) containing any liquid hydrocarbon, including crude oil and liquefied petroleum gas, and the expression 'petroleum product' shall mean any product manufactured from petroleum and Petroleum products are classified according to their closed cup flash points as given below; namely: -

   (i) Class-A Petroleum: Liquids which have flash point below 23 °C;
   (ii) Class-B Petroleum: Liquids which have flash point of 23 °C above but below 65 °C;
   (iii) Class-C Petroleum: Liquids which have flash point of 65 °C and above but below 93 °C;
   (iv) Excluded Petroleum: Liquids which have flash point of 93 °C and above; and
   (v) Liquefied gases including Liquified Petroleum Gas (LPG) do not fall under this classification but form separate category;

(z) "Petroleum Installation" means a depot or terminal having facilities for storing, handling, distribution, transportation, loading or unloading of petroleum, oil and lubricants;

(aa) "pressure vessel" means any closed metal container of whatever shape, intended for the storage and transport of any compressed gas which is subjected to internal pressure and whose water capacity exceeds one thousand liters and includes inter connecting parts and components thereof up to the first point of connection to the connected piping and fittings, but does not include containers wherein steam or other vapour is or is intended to be generated or water or other liquid is or is intended to be heated by the application of fire or the products of combustion or by electrical means, heat exchangers, evaporators, air receivers, steam type digestors, steam type sterilizers, autoclaves, reactors, calorifiers, pressure piping components such as separators or strainers and vessels containing a liquid under a blanket of compressed inert gas;

(bb) "Pumpable Capacity (Net Capacity)" means 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;

(cc) "Safe Capacity of a Tank" means the capacity of the tank up to the maximum safe filling height (safe filling level) of the tank as per statutory requirements and 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;

(dd) "Safety relief device" means an automatic pressure relieving device actuated by the pressure upstream of the valve and characterized by fully opened pop action, intended to prevent the rupture of a pressure vessel under certain conditions of exposure;

(ee) "Schedule" means the schedule appended to these regulations;

(ff) "Service Building" means building housing facilities for inspection or maintenance or other supporting services which are directly required for operation of the installation;

(gg) "Shall" indicates a mandatory requirement;

(hh) "Should" indicates a recommendation or that which is advised but not mandatory;

(ii) "Slop" means off-specification products obtained from market that is to say Retail Outlet and like other outlets, during any disturbance in operation and draining and like other activities from various equipment or tanks or pumps containing oil - water mixture, but does not include interface generated during pipe line transfer operations;

(jj) "Source of ignition" means naked lights, fires, exposed incandescent materials, electric welding arcs, lamps, other than those specially approved for use in flammable atmosphere, or a spark or flame produced by any means;

(kk) "Stabling Line" means an additional railway line or spur reserved for additional rake or stabling;

(ll) "Utilities" means buildings consisting of administrative building, QC Laboratory, canteen, parking shed, air compressors with or without dryers, dryers and like other device which shall be separated from other POL facilities and located as per the separation distance as specified in the standard in this regard.

(2) Words and expressions, used and not defined, in these regulations, but defined in the Act or in the rules or regulations made there under, shall have the meanings respectively assigned to them in the Act or in the rules or regulations, as the case may be.

3. Application:

Definitions, layout, design, standard operating procedures, maintenance, inspection, competence assurance, fire protection, safety management plan and vehicle management system of Petroleum Installations shall be in accordance with the requirements of these regulations. [1][These regulations will apply to petroleum installations with aggregate above ground storage capacity equal to or more than 1000 KL.]

4. Scope:

(1) Requirements of these regulations shall apply to all existing and new Petroleum

[1] Subs. by cl. (ii) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

Installations.

(2) These regulations cover safety in design, material and equipment, piping system components and fabrication, installation and testing, commissioning, corrosion control, operation and maintenance and safety of Petroleum Installations [1][including Aviation Fueling Station (AFS) and Lube manufacturing and filling plants.]

(3) These regulations also cover engineering considerations in design and installations including fire protection and safety systems.

(4) These regulations do not cover the requirements in respect of liquified petroleum gas (LPG) installations.

5. Objective:

These standards are intended to ensure uniform application of design principles in layout, material and equipment selection, construction, operations, maintenance and like other process, as mentioned in regulation 3 above for safe operation at the facilities associated with Petroleum Installations.

6. The standard:

The technical standards and specifications including safety standards (hereinafter referred to as standards) for Petroleum Installations [2][including Aviation Fueling Station (AFS) or Aviation Service Facilities (ASF) and Lube manufacturing and filling plants are specified in Schedule-1, which are as under, namely: –

(a) Part - A to Part - I which covers layout, design, standard operating procedures, maintenance, inspection, competence assurance, fire protection, safety management plan and vehicle management system;

(b) Part - J for Aviation Fueling Station (AFS) or Aviation Service Facilities (ASF) which covers layout design, design considerations, safe operating practices in storage and handling of bulk aviation fuels, fire protection facilities and vehicle management system;

(c) Part- K for lube manufacturing and filling plants which covers lube manufacturing and filling plant layout design, design considerations, safe operating and handling practices in lube manufacturing and filling plant operations, fire protection facilities, maintenance and inspection of equipment, and vehicle management system.]

7. Compliance to these regulations:

(1) The Board shall monitor the compliance to these regulations either directly or through an accredited third party as per regulations applicable for such purpose on third party conformity assessment.

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[1] Ins. by cl. (iii) *ibid.* (w.e.f. 29.03.2023)

[2] Ins. by cl. (iv) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(2) The Board of the concerned entity, within ninety days of the commencement of these regulations shall appoint one of its directors, who shall be responsible for ensuring compliance to these regulations

(3) Any entity intending to set up a Petroleum installation shall make available its detailed plan including design consideration conforming to these regulations to Petroleum and Explosives Safety Organisation (PESO) for their approval.

(4) If an entity before the commencement of these regulations, has laid, built, constructed, kept under construction or expanded the Petroleum Installation based on some other standard or is not meeting the requirements specified in these regulations, the entity shall carry out a detailed Quantitative Risk Analysis (QRA) of its infrastructure and the entity shall thereafter take approval from its highest decision making body or its board for non-conformities and mitigation measures and the entity's board approval along with the compliance report, mitigation measures and implementation schedule shall be submitted to Petroleum and Natural Gas Regulatory Board by such entity within six months from the date of commencement of these regulations.

8. Default and Consequences:

(1) There shall be a system maintained by the entity concerned for ensuring compliance to the provision of these regulations through conduct of technical and safety audits during the construction, commissioning and operation phase.

(2) In case of any deviation or shortfall in compliance with the provision of these regulations, the entity shall be given time limit for rectification of such deviation, shortfall, default and in case of non-compliance thereafter, the entity shall be liable for the penal action under the provisions of the Act or termination of operation [1][****].

9. Requirements under other statutes:

It shall be necessary to comply with all statutory rules, regulations and Acts in force as applicable and requisite approvals shall be obtained from the relevant competent authorities for Petroleum Installations.

10. Miscellaneous:

(1) If any dispute arises with regard to the interpretation of any of the provisions of these regulations, the decision of the Board shall be final.

(2) The Board may at any time, by notification in the Official Gazette, effect appropriate modifications in these regulations.

(3) The Board may issue guidelines consistent with the Act to meet the objective of these regulations as if deems fit.

[1] The words and expression mentioned are omitted by cl. (v) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

SCHEDULE – 1

Technical Standards and Specifications including Safety Standards for Petroleum Installations

(See regulation 6)

–PART- A
(Design and Layout)

1.0 INSTALLATION LAYOUT:

1.1 LAYOUT PHILOSOPHY:

Following philosophy, which is fundamental in the implementation of these regulations relating to lay out of installation, should be adopted in layout of an installation:

(1) Presence of ignition source shall always be contemplated beyond the boundary wall of installation;
(2) Quantitative Risk Analysis or Assessment shall be carried out at the layout stage with an objective to arrive at any specific mitigation measures required for Hazards identified. Risk reduction or mitigation measures shall be given due credit as below:

(i) Risk assessment shall include Unconfined Vapour Cloud Explosion (UVCE). The outcome shall guide in preparation of onsite or off-site emergency plan; and
(ii) Quantitative Risk Assessment (QRA) shall be done whenever major addition in facilities or major change in the surrounding areas, operating parameters, product grade takes place or once in every five years, whichever is earlier;

(3) Approaches from the highway or major road should be provided for normal or emergency movement with minimum road width of 3.5 metres for one-way movement;
(4) Roads inside the hazardous area of Installation shall be restricted to vehicles required for operational, maintenance and safety or security reasons and allowed only with proper safety fittings and authorization from location in-charge or designated safety officer, except tank trucks coming inside for filling or decantation;
(5) Alternative access shall be provided for each facility so that it can be approached for firefighting in the event of blockage on one route;
(6) Road widths, gradient and turning radii at road junctions shall be designed to facilitate movement of the fire-fighting vehicle envisaged in the event of emergency. Minimum road width of 3.5 M should be maintained for each way. The turning radius at the gantry shall be designed to facilitate the smooth movement of the tank trucks (including trailer mounted);

(7) Rail spur should be located close to the boundary of the installation to minimise road or pipe crossings and blockage of roads during shunting. The rail spur should be designed in line with the Railway Guidelines;

(8) Layout should consider the space requirements for -

(i) Maintenance and inspection of each equipment or facility;
(ii) Dedicated area for construction or fabrication activities; and
(iii) Future expansion for addition of facilities;

(9) Vehicles with spark ignition engine shall not be allowed in the hazardous area. Vehicles with internal combustion engine (compression ignition) such as tank truck (fuelled by HSD) required to be permitted for business shall have Petroleum and Explosives Safety Organization (PESO) approved tank body with approved spark arrestor fitted on the vehicle; and

(10) Layout drawing indicating hazardous and non-hazardous area segregation or demarcation shall be available. Hazardous area segregation or demarcation shall be as per IS 5572:2009.

1.2 LAYOUT OF FACILTIES:

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

(1) Storage tanks, utility requirements;
(2) Town planning;
(3) Product receipt or dispatch and mode of transport (Rail, Road, Pipeline and Tanker or Barge);
(4) Warehouses, storage areas for bitumen or asphalt, lube and like other lubricants and other open storage areas like scrap yards and dumping ground;
(5) Chemicals or Toxic chemicals storage, Sludge, hazardous waste storage or disposal facilities and like other facilities;
(6) Service buildings, fire station and allied facilities;
(7) Site topography including elevation, slope, and drainage;
(8) Meteorological data;
(9) Bathymetric data (high tide level, surge wave height and like other tidal surge) for installations in coastal areas;
(10) Seismic data and probability of Tsunami in coastal areas;
(11) Highest flood level in the area, water table, natural streams or canals;
(12) Approach roads for functional areas;
(13) Aviation considerations to and from adjacent facilities;
(14) Environmental considerations including water treatment plant and reuse of treated water, rain water harvesting and roof top solar system with connectivity to grid; and
(15) Statutory requirements.

1.2.1 GENERAL CONSIDERATION:

While locating the various facilities the following should be considered, namely: -

(1) Tank farm, loading or unloading gantry, utilities, Effluent Treatment Plant (ETP) or mechanised OWS, Drains and culverts and approach roads should be suitably constructed to prevent flooding;
(2) Control room should be located in a non-hazardous area, upwind (Majority of the year) of hydrocarbon storage and handling facilities and at a distance from potential leak

sources. It shall not be located on a lower level than surrounding plants and tank farms. There shall be no structure in close vicinity that would fall on the control room in case of a blast. Control Room should be situated at such a place in the layout from which most of the facilities or activities of the location are visible;

(3) In case, it is unavoidable to comply with inter distance requirements for control room, [1][from Product tanks or Tank Lorry Filling (TLF) or Tank Wagon (TW) gantry or Unloading area or other hazardous equipment, then] the control room shall be made blast resistant;

(4) The control room for Pipeline Tap off Point (TOP) (if applicable) at the same location of the same company, shall be in the same building where the Control room for Depot or installation is located;

[2][Provided that this clause is not applicable for existing locations with separate control rooms having facility for real time exchange of signal and data sharing;

(5) Utility block should be located outside the hazardous area;]

(6) Overhead power transmission lines shall not pass over the installation including the tank truck parking areas. Horizontal clearance shall be in line with the Central Electricity Authority;

(7) High Tension (HT) line and HT sub-station shall be terminated or located outside the hazardous area as per distance as specified in Table-1 in this Part;

(8) Tank truck movement inside the installation shall be kept to minimum and for this purpose the truck loading or unloading facilities should be located at a safe distance near the gate meant for its movement and should be oriented to provide one-way traffic pattern for entrance and exit. Tank truck in the gantry shall always be in drive out position for easy escape in case of emergency;

(9) Rail loading or unloading facilities should be located along the boundary of the installation. In case Tank wagon (TW) unloading facilities are located outside of installation boundary that should also have a boundary wall as per MOHA or Government Guidelines;

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

(11) Effluent Treatment Plant should be located at a distance as per distance as specified in Table-1 in this Part. This should be closer to disposal point by the side of the boundary and at lower grade to facilitate gravity flow of effluent;

(12) Roads should be provided in a symmetric manner to serve all areas requiring access for the operation, maintenance and firefighting;

(13) Smoking booths shall not be provided in Petroleum Installations, but, drinking water booths can be provided at prominent work stations like TLF, TW siding and like other places;

(14) Firewater storage and firewater pump house should be located upwind of hydrocarbon storage area with straight approach from outside area to enable easy receipt of mutual aid and make up water;

(15) The provision shall be made to receive water from external sources directly into fire water storage tanks and this can be from mutual aid members, fire brigade and like other devices;

(16) All buildings which are not related to terminal operation should be located at upwind of hydrocarbon storage and handling facilities and they shall be located outside the hazardous area, and such areas include administration, canteen with a separate entry and

[1] Ins. by sub-cl (a) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

[2] Ins. by sub-cl (b) *ibid.* (w.e.f. 29.03.2023)

special care needs to be taken for canteen location where any spark or open flame is likely to exist;

(17) Congestion inside the hazardous area because of buildings, structures, pipelines, trees and like other things shall not be allowed. The location of such addition of facilities in existing installation shall be decided based on Risk Assessment;

(18) Room for storing hydrocarbon samples shall be provided with bottom exhaust for release of flammable vapours. The racks and flooring should be made of fire resistant material. Electrical fittings as well as electrical equipment shall be flame-proof. Adequate number of portable fire extinguishers should be placed, where required;

(19) The additives or blue dye and like other substances should be stored at the designated or segregated area as per respective Material Safety Data Sheet; and

(20) Special precautions should be taken as required where ambient temperatures or the handling temperatures are higher than the flash point of the product or where product handled is artificially heated to a temperature above its flash point.

1.2.2 LAYOUT OF STORAGE TANKS:

1.2.2.1 Dyked Enclosures:

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

(i) 60,000 KL for a group of fixed roof tanks.
(ii) 120,000 KL for a group of floating roof tanks

Safe Capacity limits do not apply to a single tank in a dyke.

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

If a group of tanks contains both fixed and floating roof tanks, then, it shall be treated as a group of fixed roof tanks for the purpose of above limits specified in clauses (i) and (ii).

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

Enclosure capacity shall be calculated after deducting the following volumes, namely: -

(i) Volume of the tanks other than largest tank up to enclosure height without free board;
(ii) Volume of all tank pads;
(iii) Volume of fire breaks walls; and
(iv) Volume of pipes/supports or steps and like other volume.

(3) 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, and -

(i) Tank farm area shall be covered through CCTV surveillance system and same shall be continuously monitored;
(ii) The dyke wall made up of earth, concrete or solid masonry shall be designed to withstand the hydrostatic load and shall be impervious;
(iii) Dyke enclosure area (inside area of the dyke) shall be also impervious to prevent the ground water pollution;
(iv) Dyke enclosure (entire area of the dyke) shall have impervious layer of suitable material such as EPDM (ethylene propylene di-monomer) liner or polyethylene sheet to prevent the ground water contamination in addition to brick or stone pitching PCC and like other materials [1][for existing facilities, imperviousness should be ensured using a suitable technology];
(v) The dyke and the enclosures will be inspected for cracks, visible damage and like other deficiencies. every six months (pre and post monsoons) and after every major repair in the tanks or dykes and like other appliances so as to keep it impervious;
(vi) The dyke area shall have proper slope outward of tank pad towards the inner periphery of the dyke enclosure to prevent reverse flow;
(vii) Earth-pits shall be provided outside of Dyke area and strips buried under the earth except at termination points from a shortest possible distance. The earthing lay out diagram of each facility should be displayed near each facility for reference;
(viii) For excluded petroleum, the capacity of the dyked enclosure should be based on spill containment and not for containment on tank rupture. The minimum height of dyke wall in case of excluded petroleum shall be 600 mm;
(ix) Pump stations and piping manifold should be located outside dyke areas by the side of roads;
(x) Horizontal above ground tanks mounted on pedestals shall meet separation distances and shall have dyked enclosure;
(xi) The construction of dyke exceeding 2 M may be considered where there is severe constraint on space availability. In such case, additionally following conditions must be fulfilled, namely: -

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

(xii) In case of Under Ground Tanks:-

(a) kerb wall of minimum 300 mm height shall be provided in the UG tank Farm Area to contain accidental overflow;
(b) a minimum of 3 M clear distance around the tank shall be maintained (from structures or boundary wall);
(c) vents shall be located / terminated at a distance of 15 M from electrical hazards.
(d) pressure or Vacuum vents for –a class intends that a product and free vents for other class of products shall be provided and vent shall be at minimum 4 M height from the grade level;

[1] Ins. by sub-cl (c) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(e) the open end of free vent pipe shall be covered with two layers of non- corrodible metal wire gauze having not less than 11 meshes per linear centimetre and shall be further protected from rain by hood or by suitably bending it downward;
(f) the petroleum products shall enter a tank through closed piping system or coupled electrically continuous and sound hose;
(g) under Ground tanks for Ethanol service shall be provided with Silica Gel Traps in the Vents to prevent moisture ingress;
(h) the manholes should be 30 cm above the grade level; and
(i) corrosion control measures shall be undertaken.

1.2.2.2 Grouping of Storage tanks:

(1) Grouping of tanks in a dyke should be made by grouping the storage tanks in a dedicated dyke according to their respective classification of petroleum product;
(2) In case, different class of products are stored in any combination of product classification, the following shall, be applicable, namely:-

(i) Grouping of petroleum products for storage shall be based on the product classification. Class-A and Class-B petroleum may be stored in the same dyked enclosure and such Class–A and Class–B are stored in common dyke, so that fixed water spray system shall be provided on all tanks except for small installations as mentioned in paragraph 5.1.2 (8) of this schedule and the Rim seal fire detection and extinguishing system shall be applicable only to floating roof tanks on Class – A service.
(ii) Class-C petroleum should preferably be stored in separate enclosure;
(iii) Where Class-C petroleum is stored in a common dyke along with Class-A and/or Class-B petroleum, the fixed water spray system shall be provided on all Class C tanks irrespective of diameter except for small installations as mentioned in paragraph 5.1.2 (8) of this schedule;

(3) Excluded petroleum shall be stored in a separate dyked enclosure and shall not be stored along with Class-A, Class-B or Class-C petroleum. In case, it is stored in the same dyke, the requirements that is to say Firefighting, interlocks, alarms, foam and like other requirements shall be in line with the requirements for the Class of product that is to say Class -A or Class -B or Class -C stored in the same dyke.
(4) Tanks shall be arranged in maximum two rows so that each tank is approachable from the road surrounding the enclosure and such arrangements need not be applied to tanks storing excluded petroleum class;
(5) Tanks having 50,000 KL capacities and above shall be laid in single row.
(6) For tertiary containment, provision shall be made to prevent escape of spills due to failure of secondary containment for any reasons and not to allow such spill over to outside of the boundary of the installation that may lead to any damage to outside; and to meet the objective, all installations shall be provided with boundary wall with gates and sluice gates on drain. Pipe line openings and like openings shall be sealed. Efforts should be made to minimize such openings for drainage.

1.2.2.3 Fire walls inside dyke enclosure:

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

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

1.2.2.4 General:

(1) The tank height shall not exceed one and half times the diameter of the tank or Maximum 20 m, whichever is less;
(2) Every Piping from or to any tank including connected sprinkler or foam line shall comply the following, namely: -
  (i) It shall not pass through any other dyked enclosure;
  (ii) It shall run directly to outside of dyke to minimise piping within the enclosures; and
  (iii)It shall not pass through other tank areas or fire walls.
(3) Piping layout design inside tank dyke area should ensure easy accessibility for any operations in the tank farm and wherever necessary, well designed, cross-overs shall be provided to cross the pipelines running within the dyke area. Elevated Catwalks connecting the tank manifold to the dyke wall above the height of the dyke wall shall be provided for safe access and exit in case of normal or emergency situations. The catwalks shall run at the same level and terminate directly outside the dyke;
(4) No part of the dyked enclosure shall be below the level of surrounding ground immediately around the outside of dyke area;
(5) 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; and
(6) Properly laid out road shall be provided for easy access on all four sides of each dyke.

1.2.2.5 Protection of facilities:

(1) Properly laid out roads around various facilities shall be provided within the depot or terminal for smooth access of fire tenders and like other trends in case of emergency;
(2) The boundary wall shall be constructed as per the directives of the Ministry of Home Affairs or any other Government directive. In any case the boundary wall shall be of minimum 3 M height from either side of boundary wall with V/U shaped barbed wire fencing on the wall with 600 mm diameter concertina coil on top;
(3) There shall be a [1][pathway] along the inside perimeter of the boundary wall for security patrolling. Security [2][watch tower] watchmen tower (if provided) shall have clear access;
(4) 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;
(5) CCTV shall be installed in depot or terminal locations covering entry or exit gate, periphery of installation and all critical operating areas (such as Tank farm, TT or TW operating area, product pump house, fire water pump house and like other places) which shall be monitored continuously;
(6) The CCTV monitoring station shall be provided in control room, Security cabin and in-charge room. The CCTV data shall be stored for a minimum period of 60 days or in line with prevailing IB norms;
(7) Proper sized TT parking area based on fleet size shall be provided with following facilities, namely: -

[1] Subs. by point (i) of sub-cl (d) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)
[2] Supra 1 (w.e.f. 29.03.2023)

(i) Well laid out hydrant system with alternate double headed hydrant post and water or water cum foam monitors covering the parking area;
(ii) Segregation of parking area through chain link fence or boundary wall;
(iii) Separate entry and exit gate with access [1][control]
(iv) Parking lane demarcation or slotting to ensure independent and quick evacuation [2][in emergency; and]
[3][(v) For existing locations, wherever the parking area is inadequate due to space constraint, remote parking for empty Tank Trucks (TT) should be provided at designated place. In case remote parking for empty TTs are not feasible due to space constraint, proper monitoring of vehicle parking and movement shall be ensured in liaison with local administration. Such remote parking for empty TTs shall be covered under ERDMP of the installation.]

(8) Hydrocarbon (HC) detectors shall be installed near all potential leak sources of class "A" petroleum products that is to say that tank dykes, tank manifolds and pump house manifold and such detectors shall be placed in a way that entire possible source of leaks and collection of products are continuously detected and alarm is set at 20% of lower explosive limit of class "A" petroleum products. (Refer clause 5.8.1 for details).

1.2.2.6 Separation distances:

(1) Minimum separation distances between various facilities specified in preceding paragraph 1.2.2.5 shall be as per Table-1 in this part and the table shall be read in conjunction with the notes specified with the table.

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

1.2.2.7 Separation Distances between tanks or offsite facilities:

The following conditions shall apply for the separation distances for above ground tanks storing petroleum products, namely: -

(1) For larger installation, minimum separation distances shall be as specified in Table- 2 and Table-3 in this part and the Tables are applicable where total storage capacity for Class-A and Class-B petroleum products is more than 5000 KL or the diameter of Class-A or Class-B product tank is more than 9 meters;

(2) For smaller installation, minimum separation distances shall be as specified in Table-4 in this part and the Table is applicable where total storage capacity of Class-A and Class-B petroleum is less than 5000 KL and diameter of any tank storing Class-A and Class-B petroleum product does not exceed 9 meters. Table-4 in this Part shall also be applicable for the installation storing only Class-C petroleum;

(3) Excluded petroleum should be treated as Class-C petroleum for the purpose of separation distances and Table–4 in this Part shall be applicable for their separation distances; and

[1] Subs. by sub-pt. (A) of point (ii) of sub-cl (d) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)
[2] Subs. by sub-pt. (B) of point (ii) of sub-cl (d) of cl. (vi) of reg (2) *ibid.* (w.e.f. 29.03.2023)
[3] Subs. by sub-pt. (C) of point (ii) of sub-cl (d) of cl. (vi) of reg (2) *ibid.* (w.e.f. 29.03.2023)

(4) Separation distances between the nearest tanks located in separate dykes shall not be less than the diameter of the larger of the two tanks or 30 meters, whichever is more.

TABLE – 1

SEPARATION DISTANCES BETWEEN FACILITIES

S.No.	From/To	1	2	3	4	5	6	7	8	9	10	11	12
1	Control Room (Note –1)	X	Note-2	Note-3	30	45	12	X	6	15	30	X	15
2	Storage Tanks Class-A	Note-2	Note-4	Note-4	Note-4	30	60	30	T2	60	50	60	60
3	Storage Tank Class-B	Note-3	Note-4	Note-4	Note-4	30	60	30	T2	30	50	30	30
4	Storage Tank Class-C	30	Note-4	Note-4	Note-4	30	60	30	T2	30	50	15	30
5	Bulk Loading or unloading PETROLEUM (Rail or Road)	45	30	30	30	Note-5	60	Note-6	T2	30	30	30	30
6	Fire water storage and pump house	12	60	60	60	60	X	30	X	12	50	6	6
7	Rail Spur-stabling line	X	30	30	30	Note-6	30	X	20	6	50	6	15
8	Boundary wall around installation	6	T2	T2	T2	T2	X	20	X	6	15	15	6
9	Service buildings	15	60	30	30	30	12	6	6	X	50	12	6
10	OWS or effluent Treatment Plant or Oil sludge pit	30	50	50	50	30	50	50	15	50	X	45	30
11	Electrical Sub Station	X	60	30	15	30	6	6	15	12	45	X	6
12	Utilities(Broad Definition)	15	60	30	30	30	6	15	6	6	30	6	X

General Notes to Table-1:

(a) All distances are in meters. “T” indicates the Table number in this part to be referred;

(b) All distances shall be measured between the nearest points on the perimeter of each facility except (i) in case of tank vehicle loading or unloading area where the distance shall be from the centre of nearest bay;

(c) Service building shall have minimal manning and normally no hot work would be done there;

(d) “X” means any distance suitable for constructional or operational convenience; and

(e) Fire station shall be in safe area or at least 60 m from other facilities.

Specific Notes to Table-1:

Note-1: These distance norms are applicable to the locations where product receipt is through cross country pipelines. At all other locations, the building or room housing, the automation equipments or system shall be treated as utility building for the purpose of separation distance;

Note-2: The distance shall be 60 meters for non-blast resistant construction and 30 meters for blast resistant construction;

Note-3: The distance shall be 45 meters for non-blast resistant construction and 30 meters for blast resistant construction;

Note-4: Separation distances between the nearest tanks located in two dykes shall be equivalent to the diameter of the larger tank or 30 M, whichever is more. For distances within a dyke, it shall be as per Table-2 and Table-3 in this part;

Note-5: Separation distance between-

(i) tank truck gantry and tank wagon gantry shall be 50m;

(ii) distance between two Tank trucks gantries shall be 15 M; and

(iii) distance between two tank wagon gantries shall be 50 M.

Note-6: Separation distance between tank truck gantry and rail spur-stabling line shall be 50 M.

[1][Note -7: Distance of product pump house (loading or unloading) from utilities and electrical sub-station shall be 30 mtrs.]

TABLE - 2
SEPARATION DISTANCES BETWEEN TANK OR OFFSITE FACILITIES

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

	Tanks or Facility	1	2	3	4	5	6
1	Storage Tank for Petroleum Class A or Class B.	T3	T3	30	30	8	0.5 D Min 20 m
2	Storage Tank for Petroleum Class C	T3	X	30	X	X	0.5 D Min 20 m
3	Tank vehicle loading or Unloading for petroleum class A or class B	30	30	X	X	8	20
4	Tank Vehicle loading or unloading for Class C	30	X	X	X	X	10
5	Flame proof Electric Motor	8	X	8	X	X	X
6	Boundary wall	0.5 D Min 20 m	0.5 D Min 20 m	20	10	X	X

TABLE– 3
SEPARATION DISTANCES BETWEEN STORAGE TANKS WITHIN A DYKE

[1] Ins. by sub-cl (e) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

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

	Item	Between floating Roof Tanks Class –(A and A) or (A and B)or (B and B)	Between fixed Roof Tanks Class – (A and A) or (A and B) or (B and B)	Between fixed and Floating roof Tanks Class-(A and A) or (A and B) or (Band B)	Between Class C Petroleum Storage tanks
1	All tanks with Diameter up to 50 meters	(D+d) / 4 or Min 10 m	(D+d) / 4 or Min 10 m	(D+d) / 4 or Min 10 m	(D+d) / 6 or Min 6 m
2	Tanks with Diameter exceeding 50 meters.	(D+d) / 4	(D+d) / 3	(D+d) / 3	(D+d) / 4

General notes to Table – 2 and 3

(a) All distances are in meters;

(b) "x" indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements;

(c) D and d stands for diameter of larger and smaller tanks;

(d) In Table – 2 all distances shall be measured between the nearest points on the perimeter of each facility except in the case of tank vehicle loading or unloading area where the distance shall be measured from the centre of each bay;

(e) In Table –3, distances given are shell to shell in the same dyke;

(f) For different combination of storage tanks, the stringent of the applicable formulae shall be considered for minimum separation distance;

(g) The distance of storage tanks from boundary wall is applicable for;

  (i) floating roof tanks having protection for exposure; and

  (ii) tanks with weak roof-to-shell joint having approved foam or inert gas system and the tank diameter not exceeding 50 meters;

(h) Distances mentioned in Table-2 are for electric pump motor located outside dyke, but, for side entry mixer attached to tank shell, the motor can be mounted on the tank shell; and

(i) For the facilities not covered in Table- 2, refer Table-1.

TABLE – 4
SEPARATION DISTANCES BETWEEN TANKS OR OFFSITE FACILITIES

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

		1	2	3	4	5	6	7	8	9	10
1	Storage Tank Class A petroleum	0.5D	0.5D	0.5D / 6.0	15	15	15	3	15	15	15

2	Storage Tank Class B petroleum	0.5D	0.5D	0.5D / 6.0	9	4.5	4.5	3	4.5	D Min 4.5	D Min 4.5
3	Storage Tank Class C petroleum	0.5D / 6.0	0.5D / 6.0	X	9	4.5	X	X	X	0.5D Min 3.0	0.5D Min 3.0
4	Tank truck Loading or unloading Class – A petroleum	15	9	9	X	9	9	3	9	9	9
5	Tank truck Loading or unloading Class – B petroleum	15	4.5	4.5	9	X	4.5	1.5	4.5	4.5	4.5
6	Tank truck Loading or unloading Class – C petroleum	15	4.5	X	9	4.5	X	X	X	3	3
7	Flame proof Electric motors	3	3	X	3	1.5	X	X	3	X	X
8	Non Flame proof Electric motors	15	4.5	X	9	4.5	X	3	X	X	X
9	Office building, stores, amenities	15	D Min 4.5	0.5 D Min 3.0	9	4.5	3	X	X	X	X
10	Boundary wall	15	D Min 4.5	0.5D Min 3.0	9	4.5	3	X	X	X	X

General notes to Table –4:

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

(b) "x" indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements;

(c) "D" indicates the diameter of the larger tank;

(d) Distances given for the tanks are shell to shell in the same dyke;

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

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

(g) Pig launcher or receiver at liquid hydrocarbon handling pipeline installations should be located at least 5 m from boundary wall; and

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

PART – B

(Design Considerations)

2.0 DESIGN CONSIDERATIONS:

(1) External Floating roof tanks (EFRT) with single deck pontoon roof or Double deck or Internal Floating Roof Tanks shall be designed as per API STD 650;

(2) Atmospheric or low pressure fixed roof tanks shall be designed as per API STD 650 or API STD 620;
(3) Selection of type of tank generally depends on ambient conditions and the product handled;
(4) The external floating roof storage tanks with Pan Roof shall not be used as they are considered unsafe;
(5) IFRT and EFRT shall be provided with double seal with minimum vapour recovery of 96%;
(6) Primary seal shall be liquid or shoe mounted for EFRT and vapour mounted for IFRT. Maximum seal gap width should be 4 cm and maximum gap area should be 200 cm^2/m of tank diameter;
(7) Secondary seal shall be rim mounted. Maximum seal gap width should be 1.3 cm and maximum gap area should be 20 cm^2 /m of tank diameter; and
(8) Tank bottoms shall be of cone up or cone down ("Apex down").

2.1 TANK APPURTENANCES:

(1) Ladders and Handrails shall be such that individual tank shall be provided with access to the roof. A platform with railing should be provided from the top of the stairway to gauge well and roof ladder. On floating roof tanks, non-sparking self-levelling tread type rolling ladder with suitable double earthing connection are to be provided;
(2) Stairs should be made of grating. All staircases shall have resting or landing platform for every 5m height;
(3) Number of manholes shall depend on diameter of the tank as per API650; and
(4) Walkway with handrail on the roof of the tank should be provided to facilitate inspection or checking of vents or flame arrestor and like other devices so that movement of personnel on roof is safer.

2.2 TANK FARMS OR MANIFOLDS:

2.2.1 Tank Farm Drains:

(1) The dyke drain shall be provided along the inside periphery of the dyke enclosure wall and in case circular drain around tank pad is provided, the same needs to be connected to the peripheral drain;
(2) The outlet from dyke shall have the provision to either divert to the effluent Treatment plant or OWS or to main storm water drain; and
(3) Dyke drain Valves shall be provided with position indication and alarm system in the event of opening the valve.

2.2.2 Tank Manifold:

(1) The number of inlet or outlet connections to the tank shell should be kept minimum;
(2) Tank body valves on process lines (inlet, outlet and recirculation) of all storage tanks storing class-A and class-B products shall be remote operated shut off valves. Mitigation measures due to sudden closure of shut off valve shall be incorporated in the design;
(3) The second valve which is motor operated valve (MOV)on inlet, outlet and recirculation lines should be outside the dyke;
(4) Tank body valves including remote operated shut off valves should remain shut after closure of day operations.
(5) For positive isolation a suitable Valve other than Hammer Blind shall be provided so that under no circumstances the product is exposed to atmosphere from the valves and in any case Hammer blind valves of any type shall not be used in the depot or terminals.
(6) ROSOV shall be fail safe and fire safe (shall close in case of signal failure) and the actuator shall be fail-safe. The cables leading to the control room shall be fire resistant;

(7) ROSOV shall have only close operation from control room or at a strategic remote location;
(8) The Open or Close push buttons of ROSOV shall also be provided in field that is to say just outside the dyke and such push buttons shall have distinctive feature so that opening is different than action required for closing (such as pull type and push type). The push button assembly shall be mounted at a place where it is easily visible and accessible to the operator;
(9) MOV or DBBV shall have open and close remote operation from control room and at field outside of dyke;
(10) Tank manifold, if provided, shall be located outside the dyke area. The floor underneath the manifold shall be paved and have Kerb walls and connected to oil water drainage system leading to ETP or OWS;
(11) Thermal safety valve (TSV) or Expansion line shall be provided for blocked portion of pipe line to take care of the thermal expansion of product due to rise of temperature;
(12) TSV outlet line or expansion line shall be connected back to tank or tank inlet or outlet line before ROSOV is connected with suitably positioned isolation valve. One isolation valve on TSV outlet line or expansion line shall be installed close to the tank shell or inlet or outlet line to the maximum extent possible;
(13) The expansion lines to be connected at roof tops in case of CRVTs and through combined gauge well in case of FRVTs or IFRVTs and shall be extended inside up to the tank bottom to avoid freefall of product through vapour space with provision of siphon breaker on top and expansion lines should be provided with class 800 flanged gate valves;
(14) Termination of expansion line on tank roof top shall not be allowed as free fall through vapour space is unsafe;
(15) At existing locations where ever the arrangement specified in the paragraph 2.2.2(13) does not exist, the same shall be provided on all tanks during scheduled tank maintenance or cleaning;
(16) Any electrical fittings and fixtures inside the dyke shall be as per the hazardous area classification. but, such fittings and fixtures except for actuators of ROSOV or MOVs or HC detectors or PESO approved ex-proof water flow switch or ex-proof pressure transmitter should be above the dyke height.

2.2.3 Tank Settlement:

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

2.3 TANK HEATERS:

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

2.3.1 Heaters:

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

2.3.2 Steam Heating:

Manway and such heaters consist of a tube bundle, usually of hairpin type, fixed through a manhole of the tank and such heaters shall be designed so that its removal can be done without

the requirement of person entering in the tank. Steam coils should have no flange connections inside the tank and provision should exist in condensate outlet lines to check for oil leak. Gradient of the coil bundle inside the tank should be such that condensate accumulation is avoided.

2.3.3 Electric Heating:

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

2.3.4 Crude tanks: Crude tanks may be provided with side entry swivel angle type mixers.

2.4 DRAINS FROM THE TANKS:

2.4.1 Bottom Drains:

(1) Drains should be provided in all tanks for draining water and also for emptying out the tank for cleaning and such arrangement would also be useful for draining water after a hydro test or initial flushing during a start-up operation. Number and details of the drains shall be as per the applicable tanks design standard.
(2) Each drain line shall have minimum two isolation valves separated by spool piece and pipe shall be extended beyond tank pad up-to drain point. One of such valves shall be of quick closing type. Ends of each drain point should have provision of blind flange or capping arrangement.

2.4.2 Floating Roof Drains:

(1) Roof drain shall be of robust design to prevent oil coming out during draining operation. Maximum hourly rainfall rate during the past 15 years shall be considered for designing the number and size of drains for open floating roof tank. Rain water should not be taken directly into the tank;
(2) The roof drain system shall have provision for connection to the drain through a suitably designed robust system and shall include a suitable outlet valve;
(3) Due care shall be taken while designing to ensure the system integrity and performance when roof is resting on the low legs; and
(4) The inlet of roof drain shall have a check valve to prevent product from flowing to the roof in the event of failure of the system.

2.4.3 Emergency Roof Drain:

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

2.5 VENTS:

2.5.1 Open Vents:

Flash Back Arrester (Flame arrester) should be fitted to Vents as per IS 11006:2011. For sizing the vents API STD 2000 is to be referred and the following are the basic guidelines need to be considered, namely: -

(1) Maximum and minimum ambient temperatures;
(2) Vapour pressure of the product at operating or design temperature;
(3) 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; and
(4) Blending components likely to be handled in the tank.

2.5.2 Breather Valve:

(1) The breather valves for the blanketed tanks and low-pressure tanks shall be provided as per API STD 650 and API STD 620 respectively and the tank breathes - in air will be when the tank pressure is lower than the atmospheric pressure and breathes- out will be when tank pressure is greater than the set pressure;
(2) Pressure and Vacuum Relieving Valves (PVRVs) provided on cone roof tanks usually have 20% accumulation and while designing, it is necessary to ensure that under full relieving conditions, the design pressure or vacuum in the tank is not exceeded. Set pressure of PVRV shall be decided according to API STD 2000.
(3) Breather vents or flame arrestors are known to fail through the formation of crystalline waxy or heavy hydrocarbon deposits or ice on the seats of valve diaphragms or inside the nozzle connection upon which the valve is mounted, as such Breather vents or flame arrestors shall not be recommended on these services, instead only open vents should be provided; and
(4) Where tanks are blanketed, breathing-in will be from the blanketing gas system and necessary control valve shall be provided for supply of blanketing gas at constant pressure. The tank shall be provided with a safety valve by way of lift disc or diaphragm or any other suitable device. Gauge hatch and other manholes shall be of gas tight construction.

2.5.3 Emergency Vents:

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

2.6 DIP HATCH OR SAMPLING:

(1) Dip hatch or gauge hatch is used for gauging the height of the liquid in a tank as well as to take out samples for testing as such, the gauge hatch shall be non-sparking (or lined with non-sparking material) [1][should be] and self-closing type;
(2) Gauge well pipe should be provided with slots; and
(3) The gauge well shall be properly supported by means of angles or strips with bottom plate of the tank and such arrangement also makes the tank safer with respect to dissipation of static charge accumulation.

2.7 INSTRUMENTATION:

2.7.1 Safety Integrity Level (SIL):

The SIL classification study shall be carried out to determine the required SIL level. SIL of the safety instrumented function for the tank including overfill protection shall meet the requirement of Part 1 of IEC 61511. The SIL level of the entire interlock loop shall also meet the requirement of IEC 61511.

[1] Ins. by sub-cl (f) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

2.7.2 Level controls on Tanks:

For all storage tanks storing Class A/B products, the following instruments or alarms shall be provided, namely: -

(1) High Level (H), High High Level (HH) alarms, that is to say that each tank shall have provision of level instruments for sending audio visual alarms to the control rooms. All the alarms shall be of different type so that the "H" level alarm and "HH" alarms can be distinctively identified;
(2) Level for "H" and "HH" alarms shall be decided based on site specific operating parameter that is to say diameter of tank, flow rate and operators response time for corrective measures to stop product level reaching curb angel or maximum floating position, but such, these levels shall be lower than the level corresponding to PESO approved safe filling capacity;
(3) Independent level switch shall be provided at the "HHH" which in any case shall not be above the level corresponding to PESO approved safe filling capacity of the tank;
(4) The level switch shall enable initiation of action for closure of the respective inlet valve that is to say the ROSOVs, MOVs and product pumps so that the entire receipt operation closes on safe mode and the product does not over flow;
(5) Two nos. independent level instruments shall be provided out of which one instrument shall be of radar gauge type and each of the instruments shall have provision both for "H" and "HH" alarms. Provision shall be made in the system configuration for transmitting only two signals (one for "H" and one for "HH"). The signals that is to say the "H" and "HH" from each level instrument shall be available parallel in the control room using OR gate PLC logic;
(6) Over spill Level switch, that is to say that an independent hardwired level switch like Vibrating Fork and like other switches shall be provided for actuating remote operating shut off valve. Over spill level switch should be connected to remote operating shut off valve through safety PLC for SIL loop compliance;
(7) For tanks storing class that is to say that C products two nos. independent level instruments shall be provided out of which one instrument shall be of radar gauge type. Each of the level instruments shall have provision for both "H" and "HH" alarms and the signal transmitting shall be as so explained;
(8) There shall be exchange of signals between the receiving and dispatch location in case of receipt of product through cross country pipe lines and provision shall be made for monitoring of level of the receiving tank along with pressure in the pipe line and ROSOV status and to ensure safe shut down of the system in case of any abnormal situation; and
(9) Care need to be taken for tanks receiving product from ship or 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 or pump tripping to be provided.

2.7.3 Tank farm management system integration:

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

2.7.4 Temperature and Insulation:

When product storage temperatures are likely to be higher than 100°C, a remote temperature indicator with alarm should be provided in addition to local indicators. For tank capacity higher than 5000 kl a minimum of two numbers of local temperature indicators should be so located (within 500 mm above the inlet or outlet nozzle) as not to sense the direct heat of the coil. Insulation shall be provided for heat conservation. The tanks having higher surface temperature shall have insulation up to minimum 2 meters high for personal protection and also, patch insulation should be provided on the shell along with spiral stairway and provision for inspection.

2.8 PIPING OR VALVES OR FLANGES:

2.8.1 Piping:

(1) Piping shall be designed for handling of hydrocarbon liquid as per "ASME B 31.3: Process Piping" or ASME B 31.4 (for cross country pipelines only entering the terminal) or API 5L or equivalent as applicable;
(2) Pipe joints should be welded as far as practicable with full penetration weld and number of flanged or threaded joints should be kept to a minimum;
(3) In case sampling point is provided on receipt line for operational requirement, the same should be provided outside of dyke in the manifold;
(4) Sectionalizing of the pipe lines with isolation valves and arrangements for injection or draining of water shall be provided for facilitating hydro-testing of the pipe lines;
(5) Buried piping shall be protected against physical damage and corrosion with suitable protective coating;
(6) At road crossings, in addition to protective coating, pipes should pass through secondary encasing with properly sealed at both the ends;
(7) The pipe lines should be provided with low point's drains and high point vents to facilitate emptying or hydro-testing and like other testings and ends of each drain point shall have provision of blind flange or capping arrangement; and
(8) Jetty lines should be provided above ground properly spaced and approachable to maintain the lines.

2.8.2 Valves:

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

2.8.3 Fittings:

(1) Steel flanges and flanged fittings shall conform to relevant ASME or ASTM or ANSI or equivalent;
(2) Slip on or weld neck flanges should be used;
(3) Screwed flanges for sizes 50 mm or smaller may be used;
(4) Steel flanges should conform to the applicable provisions of ASME B 16.5 or equivalent;
(5) Steel screwed fittings and couplings shall conform to ASME B 16.11 or equivalent;
(6) Steel unions shall have ground metal to metal seats. Gasket type unions shall not be used;
(7) Plugs shall be of steel. Cast iron or brass plugs shall not be used; and
(8) Electrical continuity across flange joints shall be maintained by providing metallic gaskets or jumpers.

2.9 BULK LOADING OR UNLOADING OPERATIONS:

2.9.1 Loading or unloading Pumps:

(1) Pumps conforming to relevant API standards shall be used;
(2) Product pumps shall be provided with suitable sized strainers on suction and NRVs on discharge lines. All drain points of strainers shall be provided with double isolation valve and ends having provision for blind flange or screw capped;
(3) Pumps shall be located in an exclusive paved area with drainage facilities routed to OWS or ETP;
(4) Tank lorry loading or unloading pump house shall be positioned at an elevated level and shall be well ventilated on all four sides;
(5) Open roof Pump house are to be provided with suitable IP protection for the equipment;
(6) In case of sunken pump house for Tank Wagon unloading facilities, Pump house shall be so positioned that it ensures proper ventilation and efficient disposal arrangements of accumulated products;
(7) 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;
(8) Locations having automation shall be provided ESD feature through Automation system;
(9) Dedicated pumps for individual products shall be provided. Minimum one stand by pump for each product shall be provided;
(10) Separate pumps shall be provided for Tank truck loading/unloading and wagon loading or unloading; and
(11) All closed sections of pipings shall be provided with thermal safety relief device to relieve pressure due to ambient temperature rise. Thermal Safety relief device may vent into a tank or piped to OWS located in safe area and when connected to tank, TSV shall be provided with isolation valves. One isolation valve shall be installed close to the tank shell to the maximum extent possible. The vent should be piped to closed blow-down system.

2.9.2 Tank truck and tank Wagon Loading Gantries:

(1) Loading points shall have quick shut-off valves such as Cast steel Plug or Ball Valves;
(2) No vehicle shall be loaded at a rate exceeding (volumetric flow rate corresponding to linear velocity one meter per second at the delivery (at the least dia fitting) and of the filling pipe until the filling pipe is completely submerged in petroleum and thereafter the loading rate should be gradually increased but it shall at no point of time exceed six meters per second at the [1][delivery end of the filling pipe. Further, adequate measures should be taken to avoid accumulation of static charge in case of loading low Sulphur or low conductivity petroleum products;]
(3) Location should be provided with facilities where loading and unloading of Tank trucks is possible in a closed loop system that is to say top or bottom loading provisions with Vapour Recovery System;
(4) Where flow indicators or totalizers are provided for gantries, vapour eliminators shall be incorporated;
(5) The provision for Kerosene and MS or Naptha loading in TT (tank truck) loading gantry shall not be in the same bay;
(6) For safety reason the level adjustment in the tank lorry compartments should be done through suitable system wherein product is not exposed in open atmosphere at any point of time;
(7) In case of loading hoses, only neoprene impregnated hoses having electrical continuity between nozzle and flange shall be used;

[1] Ins. by sub-cl (g) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(8) All tank wagons and tank trucks shall have a fill pipe extended up to the bottom to avoid splash filling;
(9) The splash filling is permissible for asphalt loading in tank truck or tank wagons;
(10) Where bottom loading is done, deflector plates in the trucks to be ensured;
(11) Bottom flameproof lighting shall be provided for night time checking of wagon bottom leaks and also for proper sealing and inspection, wherever loading or unloading during night is required to be done;
(12) Loading gantry should be provided with at least one suitable explosion-proof telephone or paging device for communication with pump house, control room and like other communication in normal and emergency operations and in addition, operating personnel shall be provided with intrinsically safe walky-talky suitable for use in oil installations;
(13) Tank wagon and truck loading gantries shall be suitable for all weather conditions;
(14) Tank Truck loading gantries shall be provided with safety harness to protect the operating crew against [1][fall from height. Integrity check of anchoring point with gantry should be conducted prior to installation of harness and at periodical intervals];
(15) [2][****] loading ladders [3][have to] and hand railing [4][and] shall be light in construction. Neoprene packing shall be provided at the bottom rest to avoid spark generation due to impact.
(16) Proper handrail arrangement shall be provided on platforms and stairs for safe movement of personnel;
(17) Adequate safe escape ladders including from overhead platform shall be provided at intervals on the gantry for emergency use and escape ladders shall be prominently identified from distant view;
(18) Protection against pressure surge in the loading header due to sudden change in loading rate need to be considered and provision of shock absorber as one of the surge protection method at suitable locations on rail or road loading header should be considered;
(19) Provision shall be made for quick isolation of main product headers in case of emergency and for such purpose, suitable type hand operated valves or remote operated valves shall be considered as per the site conditions and overall automation system in the installation;
(20) Loading gantry area including areas below railway lines shall be paved for smooth draining and collection of spillages into drains;
(21) Open drains along the railway line or gantry shall be covered with gratings so as not to endanger movement of personnel;
(22) All trucks entering truck loading gantry shall be PESO approved and provided with approved spark arrestor or flame arrestors at the exhaust. The Vehicle conforming to emission level BS IV and beyond are exempt from fitment of spark arrestor;
(23) Oil and water collected from loading or unloading areas shall be routed to Oil water separator system or Effluent Treatment Plant or similar facility and a slop tank should be earmarked for storing separated oil;
(24) The tank truck gantry shall be so designed that all the compartments of the tank truck are filled at one bay only. The layout shall ensure that all operations are planned in a manner so that no zigzag movement of the tank truck around the gantry should take place;
(25) For tank wagon gantry where placement of tank wagon is by electrical LOCO, traction line must terminate 15 M short of the first loading or unloading point at all Installations;

[1] Ins. by sub-cl (h) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)
[2] The words and expression mentioned are omitted by sub-cl (i) *ibid.* (w.e.f. 29.03.2023)
[3] Ins. by Supra 2 (w.e.f. 29.03.2023)
[4] Subs. by Supra 2 (w.e.f. 29.03.2023)

(26) For placement, brake van or dummy wagons shall be used. Separate segregation gate shall be provided at terminating point and area between boundary wall and segregation gate [1][shall be outside the Hazardous area];
(27) Main railway track shall be isolated from wagon gantry siding at least 15 meters from 1st loading or unloading point by providing insulation joint at terminating point and loco shall stop before the insulation joint; and
(28) Sampling points shall be provided as per requirement of Industry Quality Control Manual (IQCM).

2.10 Design layout for handling of sick wagon:

When a wagon is found leaking during loading, provision shall be kept for safe handling of such wagons and such methods should include the following, namely: -

(1) Arresting of leaks using cold weld as a first aid measure till the wagon is unloaded safely at the gantry itself and in no case such wagons to be used for transportation;
(2) A dedicated drain header for instantaneous unloading of the sick wagons shall be provided and alternately, the existing headers may be utilized for immediate decantation of product from sick wagons by providing suitable arrangements in the manifold; and
(3) A portable pump with flame proof or explosion proof motors and other electrical fittings to be used with suitable flexible hose connection for quick withdrawal of products into sump tanks and such drained products to be handled further as per IQCM (Industry Quality Control Manual).

2.11 Design Layout for handling slop:

2.11.1 Collection and Drainage:

A network of drainage system shall be provided to collect oil drains from various equipments, gantry areas, pump houses and like other passages and they should also collect surface drains from places where oil spillages are likely to occur and such drainage shall lead to OWS or ETP as the case may be.

2.11.2 Mechanised OWS:

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

2.12 Layout and Selection of electrical equipment:

(1) Electrical equipment including the lighting system shall conform to hazardous area classification. The hazardous area shall be classified as per IS: 5572. The electrical fittings or equipment in the respective classified area or zone shall be of a type suitable for the particular area or zone as per classification in line with IS: 5571;
(2) Electrical equipment shall be selected, sized and installed so as to ensure adequacy of performance, safety and reliability and the equipment in general shall conform to relevant Indian Standards and shall be suitable for installation and satisfactory operation in the service conditions envisaged;
(3) The protective system shall be designed to ensure Protection of Personnel and plant equipment against damage which can occur due to internal or external short circuits,

[1] Subs. by sub-cl (j) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

overloading, abnormal operating conditions, switching, lightning surges, and like other damages 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;

(4) The outer PVC sheath of all cables used inside the dyke shall be fire retardant type conforming to category AF as per IS: 10810;

(5) All cables shall be laid in proper cable trenches or cable trays suitably designed to ensure their protection and identification at all times;

(6) All power and control cables shall have extruded inner and outer sheaths and such cables should be Aluminium or Copper Conductor, PVC or XLPE insulated, PVC sheathed and armoured type;

(7) Instrument and signal communication cables shall not be laid in the same trench or tray along with electrical cables and the overall cable layouts shall be designed for minimum interference between signal and power cables; and

(8) 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.

2.12.1 Earth resistance:

(1) Earth resistance can be directly read through an earth resistance tester which has associated Test, auxiliary Current and Potential electrodes and such instrument shall be a combination of ohmmeter and generator works on 'fall of potential' principle and the test voltage shall be derived from the generator of the earth resistance tester. Earth resistance also can be measured through Direct Earth Clamp Tester (DECT);

(2) The testing of the Earth Pits shall be done six monthly, once in dry and once in wet weather and records thereof shall be maintained;

(3) Removable link shall be provided to allow measurement of an earth electrode-resistance;

(4) The resistance value of an earthing system to general mass of the earth should not exceed, -

(i) 4 Ohms for electrical systems and metallic structures;

(ii) 7 Ohms for storage tanks;

(iii) 1 Ohm for main earth grid, and bonding connections between joints in pipelines and associated facilities; and

(iv) 2 Ohms for each electrode to the general mass of the earth.

(5) Earth resistance can be directly read through an earth test Megger which has associated Test, auxiliary Current and Potential electrodes and such instrument shall be a combination of ohmmeter and generator works on 'fall of potential' principle and the test voltage shall be derived from the generator of the Megger.

2.12.2 INSTALLATION EARTHING:

(1) Installation earthing design shall be carried out in accordance with the requirements of Central Electricity Authority Regulations -2010 and IS: 3043 or equivalent system recognised by statutory authorities under the law in force relating petroleum and electricity and 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.

(2) Earthing system shall be designed for the following, namely: -

(a) System neutral earthing;

(b) Protective Equipment Earthing for personnel safety;

(c) Protection against Static discharges;

(d) Lightening Protection; and

(e) Earthing for Data Processing system.

2.12.2.1 Electrically independent earth electrodes:

(1) 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;
(2) The Lightning Arrestor (LA) of the Two Pole or Four Pole structure shall be connected to two distinct earth pits. The strips shall run on insulators or 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;
(3) The Two Pole or Four Pole structure shall be earthed with two distinct earth connections. The Gang Operated Switch shall also be earthed;
(4) Fencing of Two Pole or Four Pole, Transformer yard shall be earthed and also electrical continuity between various structures the fencing shall be ensured;
(5) 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 and such Grid shall be distinct and shall not be connected to any other earth Grid;
(6) 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 and such Grid shall be distinct and shall not be connected to any other earth Grid;
(7) The transformer body shall be earthed at two points separately leading to earthing system;
(8) 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 i.e. exceeding 650 volts in case of faults.
(9) All the electrical equipment operating above 250 volts shall have two separate connections to the earth Such as Sub Station Panels, Motors, FLP JBs and like other separate connections;
(10) All Steel structures, loading platform or gantries and like other structures shall have two separate and distinct connections and such connections will be made to the pit directly and then pits will be connected to each other to form a grid; and
(11) Product Storage Tanks and like other storage chamber shall have two separate and distinct connections and each connection will be made to the respective earth pit directly, then, such earth pits should be inter-connected to form a dedicated grid for Tank Farm. The number of earth pits or connections to be increased for large tanks so that the distance between the connections does not exceed 30 meters on the tank perimeter.

2.12.3 Bonding:

(1) All flanged connections shall be effectively bonded by strips of suitable material.
(2) Continuity between rail spur and gantry in tank wagon loading or unloading gantry shall be ensured by checking at a suitable frequency. The gantry structure to be suitably earthed in earthing pits of standard specifications and the tank wagon siding to be insulated from main running track.
(3) In tank truck loading and unloading gantry, 6 mm Sq. braided copper wire with one end firmly bolted to the Loading Unloading Arm or hoses and the other end provided with G.I or Copper or Non-corrodible metal crocodile clips shall be used and the crocodile clips being attached to the tank-truck under loading or discharging, for External Bonding of Loading unloading arms or hose with the Tank Truck.
(4) For sampling jars to be inserted into product tanks, use only manila or sisal ropes.

2.12.4 Static earthing:

(1) Static earthing (earthing for static charge dissipation) shall be provided at Tank Lorry or Wagon Filling or Decantation Gantries, to prevent building up of Static Charges; and
(2) Earthing connections for static charge dissipation, electrical system, structure and instrumentation system shall be separate from each other, but such separate leading strips can be connected with main grid below the ground.

2.12.5 Lightning Protective System:

(1) Lightning 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;
(2) Self-conducting structures (having min thickness 4.8 mm) do not require lightning protection with aerial rod and down conductors and they shall be connected to the earthing system at two points of the base; and
(3) If lightning arrester is provided an independent earthing network shall be provided for lightning protection.

2.12.6 Earthing for data processing system:

(1) Low noise earthing is required for critical data processing equipments and such earthing shall be independent of any other earthing of the Building. The RFI (Radio frequency interference) suppression filters fitted to the data processing equipment may produce high earth leakage current and in such cases failure of protective earth connection may lead to high touch voltages; and
(2) Where ever isolation transformers are used the output neutral of the transformer shall be independently earthed so as to ensure that the Earth-Neutral Voltage is less than 1 volt.

2.12.7 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.

2.12.8 No of earth pits:

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

Equipment	**Nos**
Earthing for Lightning Arrestor	2 Nos independent
For Di or Four Pole Structure, GO, Fence	2 Nos (All metal bodies connected)
Neutral of the transformer	2 Nos independent
Neutral of the DG Set	2 Nos independent for each DG Set
Body of DG Set or control panel for DG Set	2 Nos
Sub-station –PMCC Room	4 Nos
Fire Pump House	2 Nos
Air Comp House	2 Nos

All structures Shed of Pump House or Fire Engine or Loading unloading Gantry or Air Compressor or Engg. Store and like other structures	2 Nos for each structures
Static Earth for Loading or unloading Gantry (Tank Truck) operations.	2 Nos earth pits for 8 bay gantry.
Static Earth for Loading unloading Gantry (Tank Wagon) operations.	Min. 4 nos. earth pits for each (single or two spur) gantry. For rail track as per railway norms.
All 3 Phase Motors or FLP lights in each shed	2 Nos
High Mast Tower (HMT)	2 Nos for each HMT
Admin Blocks	2 Nos
Data Processing	One for Metallic body parts of equipments and one for neutral of isolation-transformer
Inspection Platform or Watch Tower or Weigh Bridge	1 Nos each
Water Storage Tanks (Fire Water Tank)	2 per tank
Product Storage Tank	Minimum 2 nos and further as defined in Clause 2.12.2 (11) above.

2.12.9 General:

(1) Fail safe Interlock or change over switch shall be provided between the Grid Power and the DG power to ensure that the equipments get supply from one source only;
(2) Insulation mats shall be provided in the Sub Station, control panels and like other points;
(3) Relays/Cables shall be tested once in a year and records maintained.
(4) Transformer oil shall be tested once in a year and records maintained.

2.12.10 Emergency Feeder:

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

2.13 INSTALLATION LIGHTING:

(1) Sufficient lighting shall be provided so as to enable terminal operators to move safely within the accessible areas of installation and to perform routine operations. In the event of normal power failure, emergency lighting shall be provided in critical areas;
(2) Normal lighting system shall be on 415/ 240V AC supply. Emergency lighting shall be provided in critical areas like Sub-Station, D G Room, Control Room and Security cabin;
(3) Under normal operation, both emergency and normal lighting shall be fed by normal power source. On failure of normal supply, emergency lighting shall be available until the start of D.G.;
(4) Lighting shall be provided for the various facilities in the Depot or Terminal as per good engineering practice;
(5) 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;

(6) Lighting requirements provided during the failure of power supply is intended broadly to such failure;
(7) Facilitate carrying out of specified operations, for safe shutdown of the installation;
(8) Gain access and permit ready identification of firefighting facilities such as fire water pumps, fire alarm stations and like other facilities;
(9) To gain access to escape route for safe evacuation of operating personnel; and
[1][(10) Depending on the nature of job activities carried out, the minimum required illumination levels for various areas shall be ensured for safe movement or operations or emergency handling, as under , namely:-

Sl. No.	Area	Lux Level
1	Main roads (Gate entry or exit, roads around TT gantry	20
2	Secondary roads (along storage tanks and Periphery and like other places)	10
3	Tank farm area	20
4	Pump or Compressor or Dosing Sheds or Fire Pump House	100
5	Main Operation Platforms and Access Stairs (TT and TW gantry, Tank manifold)	60
6	Ordinary Platforms	20
7	OWS or ETP Area	60
8	Sub Station or PMCC room	150
9	Transformer yard or HT Di pole area	100
10	Battery room, Charger or UPS rooms	100
11	Control Room building or laboratory	150
12	Lube Warehouse	100
13	Admin Building	200
14	Security Cabin or Watch Booth	100
15	Stairs	50
16	Corridors	70
17	Tank truck Parking area	20

Notes:

(a) The lighting fixtures on various circuits shall be suitably designed so that failures of any one circuit do not result in complete darkness.
(b) Switches controlling the lighting fixtures and exhaust fan shall be installed outside the battery room.
(c) Switches of lighting panels installed in hazardous area, shall have a pole to break the neutral, in addition to the poles for phases.
(d) Low pressure sodium vapour lamps shall not be installed in hazardous areas.

PART- C

(Safe Operating Practices)

3.0 Safe Operating Practices:

(1) Operational safety aspects for Petroleum Product terminal or depot shall be built into the design which should also be reviewed during the construction phase from safety or

[1] Subs. by sub-cl (k) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

maintenance point of view and only skilled and trained personnel shall be deployed for effective operation, inspection, maintenance and like other work for the installation;

(2) The operating procedures shall provide plant specific instructions on what steps to be taken or followed while carrying out Start-up, Normal operation, Temporary operation, Normal shut-down and Emergency operation and shut-down;

(3) Manuals of operating procedures shall be made available to the employees. Training shall be imparted to the operators on operating procedures and should be certified as competent;

(4) When changes are made in facilities, operating procedures should be reviewed as part of the management of change procedure. In addition, operating procedures should be reviewed periodically to verify that they reflect current and actual operating practices. Operating manuals should be certified as updated by authorized or competent person every year; and

(5) The Safe Operating Practices (SOPs) mentioned in paragraph 3.1 shall outline the general guidelines and are not intended to override sound engineering practices and safety parameters regarding when and where the operating procedures should be used and any additional steps that may be sought to be included to ensure process safety.

3.1 Safe Operating Practices (for general guidelines), namely:-

Safe Operating Practices to outline the general guidelines shall include the following

(1) Terminal or depot Control room where ever provided shall be manned on continuous basis during operations and in emergency;

(2) No Person shall be allowed to smoke, carry matches, lighters, flammable material or any other appliances capable of producing ignition or explosion inside the licensed area of the installation;

(3) Non-flame proof or Non-intrinsically safe Mobile phones and any other source of ignition shall not be allowed inside the Petroleum Installation operational areas where petroleum products are stored pumped and handled;

(4) Site specific Standard Operating Procedures (SOPs) for each operation or activity shall be developed and complied with;

(5) SOPs shall be periodically reviewed, updated and records and maintained especially whenever any changes or modifications to the facilities are made as per Management of Change procedure (MOC);

(6) The critical operating steps based on Safe Operating Practices (SOPs) shall be displayed on the board near the location wherever applicable. In local language also and shall be made simple and user friendly;

(7) All operations shall be carried out under supervision of designated personnel [1][and periodic training and refresher needs should be given to such personnel];

(8) All precautions shall be taken to ensure isolation of sources of ignition during maintenance (such as welding, cutting, and other process) from potential sources of flammable vapours. Presence of vapour at location of maintenance and its surrounding shall be constantly monitored by suitable portable device for flammable gas detection;

(9) Maintenance or repair work or entry into confined space including closed drains or manholes [2][or work at height or any non-routine activity] shall be carried out in accordance with the Work Permit System;

[1] Ins. by sub-cl (l) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

[2] Ins. by sub-cl (m) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(10) Non-Sparking tools shall be used to carry out the maintenance jobs in operational areas where flammable materials are handled or stored;
(11) Check list for operators for monitoring and checking safety system and equipment shall be prepared, followed and records maintained thereof;
(12) Roads inside the hazardous area of Installation shall be restricted to vehicles required for operational, maintenance and safety or security reasons and allowed only with proper safety fittings and authorization from designated officer;
(13) Vehicles with internal combustion engine (compression ignition) such as tank truck required to be permitted for business shall have Petroleum and Explosives Safety Organization (PESO) approved spark arrestor fitted on the vehicle. Vehicles with spark ignition engine shall not be allowed inside hazardous area;
(14) TTs to be parked in drive-out position in parking area having separate entry and exit gates;
(15) All electrical equipment shall be maintained to ensure its integrity and type of protection as well as electrical area classification;
(16) Suitable interlocks shall be provided for tripping or alarm or remote valves operation based on the events such as low level, high level, high-high level, high pressure, low pressure and like other events;
(17) 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) or Effluent Treatment Plant for safe disposal;
(18) Personnel protective equipment such as safety shoe, hand gloves, apron, safety goggles, safety belt, helmet, ear muff, dust respirator, self-contained breathing apparatus (SCBA), resuscitator, fire proximity suits and like other protection equipments as applicable shall be worn while carrying out operations in normal and emergency situations;
(19) Intrinsically safe handsets working on VHF or UHF or any other acceptable frequency band shall be used in operating areas;
(20) Manning level in the shift shall be adequate to ensure coverage for normal and emergency operations;
(21) The Petroleum Installation shall have provisions for handling leakage or spills at high risk areas, tank lorries and tank wagons;
(22) Hydrocarbon Gas detection system shall be installed with audio or video alarm system in the control room as well as in the effective risk zones or areas;
(23) All personnel who are handling petroleum products shall be suitably trained on use of firefighting, equipment and first aid. Thorough training shall be incorporated to all personnel on various levels of emergency response;
(24) All other contract personal and supervisors entering the premises shall have basic safety training and should be aware about emergency duty and knowledge of the emergency exit route at all work locations;
(25) The Petroleum Installation shall have effective CCTV system covering the entry or exit gate roads, periphery of installation and all critical operating areas (such as Tank farm, TT or TW operating area, product pump house, Fire water pump house and TT Parking area and like other areas) which shall be monitored continuously; and
(26) The CCTV monitoring station shall be available in Control room, Security cabin and Depot in-charge room. The CCTV data shall be stored for a minimum period of 60 days.

3.2 Tank Farm area:

(1) Ladders and Handrails of the product tank shall be free from any obstruction and to be in impeccable condition. The platform and railing on the top of the stairway to gauge well and roof ladder should have free access. Walkway with handrail on the roof of the tank should be inspected or checked, so that movement of personnel on roof is safe;
(2) The tank farm management system shall be integrated with Enterprise Resource Planning (ERP) or Terminal Automation System (TAS) with provision of recording and display of

real time inventory levels and ensure the effectiveness at regular interval and whenever the system is by pass, all necessary record shall be maintained;

(3) Dyke drain Valves shall be provided with position indication and alarm system in the event of opening the valve. The dyke drain shall be provided along the inside periphery of the dyke enclosure wall and in case circular drain around tank pad is provided, the same needs to be connected to the peripheral drain. The outlet from dyke shall have the provision to either divert to the effluent Treatment plant or OWS or to main storm water drain;

(4) Dyke drain valves shall be in closed condition and shall be operated only under supervision of an authorized person and log book maintained. Piping through dyke wall, if any, shall be sealed to make dyke impervious;

(5) All electrical fittings and fixtures inside the dyke shall be as per the hazardous area classification and its integrity maintained;

(6) The dyke and the enclosures shall be inspected for cracks, visible damage and like other damages every six months (pre and post monsoons) and after every major repair in the tanks or dykes and like other devices so as to keep it impervious;

(7) All the tanks inside the dyke shall have fire-fighting system in operating condition;

(8) There shall be ensured "No" chocking of water spray nozzles.

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

(10) The Remote Operated Shut Off Valve (ROSOV) and Motor Operated Valve (MOV) of the tanks and pipeline manifold (inlet, outlet and recirculation) of all storage tanks storing class A and class B products shall be operational and should remain shut after closure of day operations;

(11) ROSOVs and MOVs shall be fail safe and fire safe (shall close in case of signal failure). The actuator shall be fail-safe. The cables leading to the control room shall be fire resistant and the ROSOVs shall be operational from the field and also from control room;

(12) Thermal safety valve (TSV) and Expansion line shall be connected for blocked portion of pipe line to take care of the thermal expansion of product due to rise of temperature. Temperature Safety Valves (TSV's) and downstream valves shall be always kept open and its discharge should be routed to slop collection system and alternatively, the discharge may be connected to a common header and back to the tank through NRV;

(13) The area floor underneath of the pipeline manifold shall be paved and the Kerb walls or drain connected to oil water drainage system leading to ETP or OWS;

(14) Product storage Tanks must be periodically inspected and checked for leakages or sweating. Repairs must be immediately carried out, whenever scaling or pitting are observed;

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

(16) Floating roof deck must be kept clean and free from all foreign materials or dust and like other materials so as to avoid clogging of roof drain sump;

(17) Tank farm area shall be covered through CCTV surveillance system and monitored;

(18) Water seal must be maintained in the emergency drain in floating roof tanks and it shall be ensured that adequate water is maintained in the water pot of the emergency drains;

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

(20) Safe Operating Practices (SOPs) for entry on floating roof or confined spaces for maintenance and inspection (when the tank is with product for normal operation) shall consider the following, namely: -

(i) Floating roof is levelled, free of oil and excessive water and is at higher operating level;

(ii) Adequate manpower with a canister mask or breathing apparatus and like other apparatus is deputed;

(iii) A life line with safety belt to be used for entering into confined space and the other end of the line held by the standby person at the top of platform; and

(iv) In case of requirement of going on floating roof deck for inspection during normal operation, at least one person should accompany the person making the inspection.

(21) No gauging or sampling of tanks shall be undertaken during thunder or hail storms;

(22) Water draining from tanks should be done under close supervision as per approved Safe Operating Practices (SOPs);

(23) Receipt and withdrawal rate from the tanks shall be limited to the design parameters of the tank below and the flow velocity at tank inlet shall not exceed 1 m/s until the inlet is completely submerged;

(24) Breather vents provided on cone roof tanks shall be checked to ensure normal operation and ensure its effectiveness;

(25) Special attention shall be given during receipt as well as transfer from the floating roof tanks when roof is in semi floating condition that is to say operating in erroneous zone;

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

(27) Tank dip pipes shall be extending to tank bottom and if dip pipes are not provided, give a settling time of 30 minutes after receipt or discharge before sampling or gauging;

(28) Synthetic fibre cord shall not be used for sampling, dipping, gauging and like other process If in the sampling, gauging, dipping, like other process, equipment is a conductor, the cord must be conductive, such as a metal wire. Metal chains shall not be used, instead Natural fibres such as sisal and manila which have sufficient conductivity to prevent the operator from becoming charged by handling it, can be used;

(29) There shall be ensured that gauge tapes and other sampling equipment are of non-sparking type;

(30) During receipt, tank level shall be monitored at regular intervals. Effective communication shall be provided in the tank farms, which may include Intrinsically safe VHF or UHF or any other acceptable frequency band handset and like other devices and such system can also be utilised for communication during emergency;

(31) Cleaning of tanks should be carried out as per plan in line with the approved Safe Operating Practices (SOPs). Gas oil spray and steam shall not be used for cleaning of Class A and class B tanks;

(32) Earthing and bonding connections shall be ensured during the entire operating process. The earthing system shall be checked for bonding and earth continuity as required and the records maintained thereof;

(33) Hydrocarbon (HC) detectors shall be installed near all potential leak sources of class “A” petroleum products that is to say tank dykes, tank manifolds and pump house manifold And such detectors shall be placed in a way that entire possible source of leaks and collection of products is continuously detected and alarm is set at 20% of lower explosive limit of class A petroleum products; Further, hydrocarbon detectors shall be installed near all potential leak sources of class “B” petroleum products as and when such effective and proven detectors are available.

(34) Fire-fighting system provided for above ground Tanks shall be operational, and the effectiveness of the system to be ensured checked periodically for operation as per design capacity;

(35) The tank farm must be kept clean and shall be free from dry vegetation;

(36) OWS system shall be maintained [1][clean] by periodic cleaning. End of the vent of Inspection chamber of the OWS system shall be provided with wire mesh. The accumulated oil from the OWS sumps shall be collected and sent to slop tanks at regular intervals;

(37) Disposal of sludge collected during cleaning of the tanks shall be done as per the applicable guidelines; and

(38) The product storage tanks shall have level indicators as well level alarms and interlocking with MOV and ESD. The effectiveness of the system or interlocking shall be checked regularly. The interlocking or ESD shall not be bypassed. In case of any such exigency, the approval from authorised person in this behalf shall be taken with requisite precautions and records maintained thereof.

3.3 Bulk handling:

3.3.1 Tank Truck (TT) Loading or Unloading:

Transportation of petroleum products by road is regulated by PESO in accordance with the provisions of the Petroleum Rules 2002 the carriage by Road act, 2007(4 of 2007) and the rules made thereunder and the Central Motor Vehicle Rules, 1989, Legal Metrology Act 2009(1 of 2010).

3.3.1.1 Before Commencement of Loading or Unloading:

(1) Open source of ignition shall not be allowed in any part of the Petroleum Installation operational area including tank lorry loading or unloading area;

(2) The following shall be ensured in a tank truck as per statutory regulations before accepting it for filling, namely: -

(i) Provision of PV vent, emergency vent, Master valve and other safety fittings;

(ii) Fire screen between cabin and tank is provided and for such purpose, cabins with metallic back cover without any opening will be considered as fire screen;

(iii) Provision of 2 nos. of Fire Extinguishers of ISI mark (1 no. X 10 or 9 kg DCP and 1 no. 1 kg CO2 or DCP or equivalent approved fire extinguisher);

(iv) Spark arrestors of the approved designed shall be welded with the exhaust in front of the vehicle and the vehicle shall have valid Explosive License and RTO certificate along with PESO approved drawings of the tank and such arrangement in case of BS-IV and future models may not be required if exempted by PESO;

(v) Availability of brazed copper strip for earthing or bonding connection; and

(vi) Tank trucks should be equipped with ABS.

(3) The Double pole master switch shall be put off immediately after parking the truck in the position. No electrical switch on the truck shall be turned "on" or "off" during the loading or unloading operation;

(4) Wheel choke shall be placed at wheels to prevent accidental movement of the truck and hand brakes should also be applied during the entire loading or unloading operation;

(5) The first process after positioning the truck shall be to provide appropriate earthing and after the loading or unloading operation, earthing shall be disconnected just before the release of the truck;

(6) Vapour Space of 3% of its capacity shall be kept in each tank truck in respect of Petroleum Class A and Class B products and 2% vapour space in tank trucks in respect of Petroleum class C products;

(7) No repairs shall be made on the Tank Lorries, while it is in the loading or unloading area;

[1] Subs. by sub-cl (n) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(8) Personnel deployed in the loading or unloading area shall make use of Personal Protective equipment and wear all throughout the working period;
(9) Loading or unloading area pipeline manifold shall have provision of quick shut-off valves;
(10) No tank vehicle shall be loaded at a rate exceeding (volumetric flow rate corresponding to linear velocity) one meter per second at the delivery (at the least dia fitting) and of the filling pipe until the filling pipe is completely submerged in petroleum and thereafter the loading rate should be gradually increased, but it shall at no point of time exceed six meters per second at the delivery end of the filling pipe;
(11) Oil and water collected from loading or unloading areas shall be routed to Oil water separator system or Effluent Treatment Plant or similar facility. A slop tank should be earmarked for storing separated oil;
(12) The tank truck gantry shall be so designed that all the compartments of the tank truck are filled at one bay only and the layout shall ensure that all operations are planned in a manner so that no zigzag movement of the tank truck around the gantry should take place; and
(13) The maximum safe carrying capacity in weight of Petroleum that can be carried in a tank vehicle shall not exceed the difference between the unladen weight of the vehicle and the maximum gross weight permitted for the class of vehicle under the appropriate transport regulations.

3.3.1.2 During Loading or Unloading Operation:

The following shall be ensured during the loading and unloading operation, namely: -

(1) Move truck to the loading or Unloading bay and position the TT in the loading or unloading bay and place wheel chokes at front and rear wheels of the vehicle. Keep the TT in neutral mode with hand brakes;
(2) Certified ISI Mark fire extinguishers shall be placed near the tank trucks, during loading or unloading operations at a designated marked place;
(3) Stop the engine of TT and "Switch off" Master switch, so that the TT cannot be started incidentally, and the TT electrical supply shall be disconnected totally;
(4) The TT driver and cleaner shall be outside the vehicle to meet any exigency, and "no" person shall be in the driver's cabin;
(5) Provide earthing connections of the vehicle at specified point on tanker tank to the fixed grounding system;
(6) Ensure that TTs manifold valve are closed and capped;
(7) Test the connections for any product leakages;
(8) Loading of TTs shall be through dedicated loading arms and through flow meters. The correctness of the mass flow meter shall be ascertained periodically. Splash loading shall be avoided;
(9) Start the loading operations with initially loading rate which shall not exceed 1 m/s till fill pipe is completely submerged with petroleum products and there after gradually increased loading rate but shall not exceed 6 m/s (should preferably not exceed 4 m/s);
(10) The quantity loaded into the truck can be assessed by-
    (i) Liquid level through manual dipping; and
    (ii) Filling through Flow meter;
(11) Filling or transfer operations shall be suspended immediately in the event of-
    (i) Uncontrolled leakage occurring; or
    (ii) A fire occurring in the vicinity; or
    (iii) Lightning and thunder storm;

(12) The personal working engaged in loading unloading operation, shall use fall protection system designed for the purpose;
(13) An authorized person of the company shall supervise the filling operation and respond immediately in the event of an emergency; and
(14) Trucks meant for loading may be inducted in line with approved acceptance checklist, Filling Checklist and records thereof shall be maintained.

3.3.2 Tank Wagon (TW) Loading or Unloading:

Before Commencement of Loading / Unloading, the following shall be complied with, namely:-

(1) Ensure that the loco is at least at a distance of 15 metre from the first loading / unloading point when the wagons are being placed or removed in the gantry for loading or unloading;
(2) Main railway track shall be isolated from wagon gantry siding at least 15 meters from 1st loading or unloading point by providing insulation joint at terminating point and loco shall stop before the insulation joint using adequate number of dummy wagons;
(3) The loading or unloading operation shall be carried out under close supervision of authorized person;
(4) After the wagons have been placed at the gantry for loading or unloading breaks are to be applied before detaching the loco;
(5) Open source of ignition shall not be allowed in any part of the area where product transfer operations are being carried out. Use of mobile phone is prohibited in the zone or area;
(6) Ensure that all fittings on the tank wagons are checked physically that is to say before and after loading or unloading;
(7) Always use gantry platform for movement from one wagon to other wagon. Movement from wagon to wagon is prohibited, but [1][movement] from wagon to wagon with adequate Fall protection system or Safety harness shall be permitted;
(8) The first operation after positioning the wagon shall be to provide appropriate earthing of all the tank wagons. Ensure that electrical continuity of the system is intact by providing bonding in flanges and checking of continuity;
(9) Ensure all the firefighting equipments are in good working condition, and the fire fighting ring main system is pressurized and maintained;
(10) The loading unloading system or equipment's shall not operate more than its designing capacity;
(11) Any non-routine work in the operational area shall be permitted with work permit only;
(12) Every individual working in the Tank Wagon operating area must be familiar with all the firefighting equipment, their care and their use in the event of fire;
(13) Use of right kind of equipment to handle loading or unloading operation. After using the equipment or material or tools shall not be placed at rail track;
(14) Maintenance jobs on rail track during placement or removal of rake are strictly prohibited;
(15) Oil and water collected from loading or unloading areas shall be routed to Oil water separator system or Effluent Treatment Plant or similar facility. A slop tank should be earmarked for storing separated oil;

[1] Subs. by sub-cl (o) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(16) Open drains along the railway line or gantry shall be covered with gratings so as not to endanger movement of personnel;
(17) Minimum Vapour space for tank wagons carrying different classes of petroleum products shall be for Petroleum Class A - 4%and for Petroleum Class B and C - 2.5%;
(18) Tank wagon loading or unloading operations shall be suspended immediately in the event of uncontrolled spill, or fire in the vicinity;
(19) Before the wagons are moved from the spur, brakes on all the wagons shall be released;
(20) The railway siding railway track shall be properly insulated from the main line and grounded, vis-a-vis main rail track;
(21) Wagon to be checked for mechanical condition, dents, and leaks and the report of defective wagons to be provided to Railways;
(22) All drain and vent point in pipe line shall be kept closed and caped; and
(23) Good housekeeping to be ensured all the time in Railway siding or gantry and all the personnel working in the area shall wear Personal Protective equipment.

3.3.2.1 During Tank Wagon Loading Operation:

During tank wagon loading operation, the following shall be observed, namely: -

(1) Accept the tank wagons for loading only after the railway staff declares the tank wagons are fit for loading or unloading operation;
(2) Before loading of a wagon, a bonding connection shall be made before opening of manhole cover and shall remain in place until filling is completed and all dome covers shall be closed and secured;
(3) Dip tape or sampler shall not be lowered during loading time or just after completion of loading in a wagon to permit relaxation of charges; and
(4) No Wagon shall be loaded at a rate exceeding (volumetric flow rate corresponding to linear velocity) one meter per second at the delivery or at the least smallest pipe fitting and of the filling pipe until the filling pipe is completely submerged in petroleum and thereafter the loading rate shall be gradually increased but it shall at no point of time exceed six meters per second at the delivery end of the filling pipe.

3.3.2.2 During Tank Wagon Un-Loading Operation:

During tank wagon un-loading operation, the following shall be observed, namely: -

(1) Ensure health of unloading pumps required for unloading of wagons;
(2) Ensure mobilization of required hoses, gaskets, adapters, nuts, bolts and like other devices at the site;
(3) Ensure correct line up from unloading pump discharge to product tank;
(4) Record all seals numbers, density and DIP in “sick wagon unloading register”;
(5) Confirm the correctness of the line-up hoses and product pipeline connections. Recheck and ensure that product exchange shall not take place;
(6) Ensure earth continuity from Wagon to unloading point by providing required copper jumpers at flange joints;
(7) Measure the initial dip of the tank wagon prior to unloading;
(8) Record the initial dip of the tank wagon and the designated tank dip prior to unloading;
(9) Open air vent valve and filling pipe cover for air breathing;
(10) Open the master valve and bottom valve of the tank wagon; and
(11) Monitor the physical dip of the product in the Tank wagon, particularly towards end of the unloading.

3.3.3 Handling and Unloading of Sick Tank Wagon:

While handling and unloading Sick Tank Wagon, the following shall be observed, namely: -

(1) In case of minor leak, try to arrest the leak at the site with the help of railway staff only through cold repair methods only;
(2) When a wagon is found leaking during loading or unloading, provision shall be kept for safe handling of such wagons and as a first aid measure arresting of leaks using cold weld compounds at gantry itself and in no case such wagon to be used for transportation;
(3) If the leak is minor and not stopped by TXR staff or Maintenance, then, make arrangements to decant the wagon into Product Tank;
(4) If the leak is major, then, immediately inform the concerned Railway staff and in the meantime try to contain the spill using container or drums;
(5) Connect the un-loading hose to wagon's unloading flange and nearest sick wagon unloading point of the gantry;
(6) Product should be then transferred to suitable storage and leakage shall be arrested by cold repair methods and in case leakage cannot be arrested, wagon shall be declared sick in concurrence with the railways staff and emptied out completely;
(7) A dedicated drain header shall be provided for instantaneous unloading of the sick wagons and alternately, the existing headers may be utilized for immediate decantation of product from sick wagons by providing suitable arrangements in the manifold; and
(8) A portable pump with flame proof or explosion proof motors and other electrical fittings to be used with suitable flexible hose connection for quick withdrawal of products into sump tanks and such drained products to be handled further as per IQCM (Industry Quality Control Manual).

3.3.4 Tank Wagon Unloading in Slop Tank:

While Tank Wagon unloading in Slop Tank, the following shall be observed, namely: -

(1) Ensure earth continuity from Wagon to unloading point by providing required copper jumpers at flange joints and appropriate earthing connection shall be made before the start of unloading activity;
(2) Ensure that required ullage is present in the slop vessel to accommodate the quantity to be unloaded from the sick tank wagon and check the dip of product in the slop vessel physically and record it;
(3) Ensure mobilization of required hoses, gaskets, adapters, nuts, bolts and like other devices near the sick wagon;
(4) Ensure that the all other stub or branch pipe of the sick wagon unloading header throughout the gantry are properly blinded;
(5) Record the product specification and density and DIP in "sick wagon unloading register";
(6) Confirm the correctness of the line up to the slop vessel;
(7) Connect the un-loading hose to wagon's unloading flange and nearest sick wagon unloading point of the gantry;
(8) Open air vent valve and filling pipe cover of wagon for air breathing;
(9) Open the master valve and wagon bottom valve of the wagon;
(10) Continuously monitor the dip level of the wagon during unloading operation;
(11) Check and ensure that there is no leakage of product from other flanges of the unloading header in the gantry area;
(12) Monitor level of product in the slop vessel;

(13) Monitor the physical dip of the product in the Tank wagon, particularly towards end of the unloading;
(14) Check the emptiness of the wagon;
(15) Disconnect the flexible hose carefully; decant the remaining material of the hose into slop vessel;
(16) Close bottom valve as well as master valve of the tank wagon;
(17) Place the unloading hoses and other material at designated place;
(18) Check the closing stock or physical dip of product in slop vessel and record it; and
(19) Reconcile the quantity unloaded from Tank Wagon and quantity received in the slop vessel.

3.4 Transfer of Product through Pipeline:

Where ever pipe line transfer is envisaged between various entities, a mass flow meter with integrator shall be installed on receipt line at both ends that is to say dispatch and receipt ends and signal shall be provided in the control rooms of both dispatching and receiving companies or locations for monitoring.

The following safe practices to be followed, namely: -

(1) Gauging procedure shall be completed and line shall be made through;
(2) Physical inspection shall be carried out up to the exchange manifold for any leakage or damage and like other harms;
(3) Monitoring systems such as SCADA shall be installed in cases of cross country pipeline transfers;
(4) Seal the pressure relief lines of receipt nozzles of product tanks connected to the same common receipt header;
(5) After ensuring that there are no leaks, pumping shall be commenced;
(6) Pumping shall be commenced initially at low flow rate and only after stabilizing of flow and the flow rate may be increased;
(7) Product shall not be pumped beyond safe filling height of the tank and necessary alarms and interlocks in the automation shall be put in place to ensure the safe filling;
(8) After completion of the receipt, pumps must be stopped;
(9) In case of Emergency Shutdown, care shall be taken so that back pressure is not developed in the pipelines and pump head;
(10) Sampling shall be carried out as per provisions of Industry Quality Control Manual(IQCM);
(11) Pipe Line transfer (PLT) shall not be taken simultaneously in more than one tank; and
(12) In case product is required to be taken into more than one tank, tank shall 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.

3.5 Marine Loading or Unloading:

(1) Marine facilities handling petroleum products shall have clearly marked out escape route, and at the same time have sufficient access to fire fighting.
(2) Fire fighting facility for a marine facility handling petroleum products shall be provided as per design standard.
(3) Vessels berthed at the wharf shall be fastened with mooring ropes, ensuring that the vessel is well secured to the wharf.
(4) Before commencement of loading or discharge of the vessel, shore and vessel representatives to jointly sign off safety check list covering all aspects of the vessel loading or discharge shall

be ensured and such safety Check list shall also cover emergency evacuation measures in event of emergency on shore and on board the vessel.

(5) Clear communication channel shall be established between vessel and shore terminal.

(6) Loading pumps capable of building up pressures that exceed the safe working pressure of cargo hose or loading arms shall be provided with bypasses, relief valves, or other arrangements to protect the loading facilities against excessive pressure. Relief devices shall be tested at least annually to determine that they function satisfactorily at their set pressure.

(7) Vessel tanks nominated for loading petroleum products shall have oxygen content below 8% to ensure safe loading operation and such safe loading operation has to be ensured in all vessel or tanks nominated for loading, before any product loading can commence into any of the vessel tanks.

(8) Loading or unloading arms or hoses connected to the vessel for loading or unloading shall have facility for emergency shut off and break away.

(9) Loading or unloading quantity and rates shall be monitored on an hourly basis and corresponding ship and shore figures shall be hourly compared.

(10) Loading or unloading arms or hoses shall be inspected hourly for leakages during the operations.

(11) Vessel shall ensure and confirm to shore on hourly basis and the status of various vessel tanks shall ensure that no product migration is taking place between vessel tanks.

(12) Abnormalities observed during operations shall be immediately communicated between ship and shore. In case of abnormality in operations, operations shall be stopped immediately. Operations shall only commence after conditions have been restored to normal. Abnormalities which shall be considered are the following, namely: -

(a) Large differences between vessel and shore tank hourly quantity;

(b) Variation in product densities from the certified density of the product under operation; and

(c) Leakages observed on board vessel or shore pipelines or hoses or spillage observed in the sea water.

(13) Mechanical work shall not be performed on the wharf during cargo transfer, except under special authorization based on a review of the area involved, methods to be employed, and precautions necessary.

3.6 Ethanol Handling:

In case ethanol is used for blending with Motor Spirit at the petroleum installation, facilities for storing and handling of ethanol shall be provided and all practices as being followed in handling Class `A' Petroleum Products are required shall be adhered to while handling Ethanol and Ethanol Blended Motor Gasoline. [1][Adequate flame or heat detection mechanism shall be provided for detection of ethanol fires as ethanol burns with a flame which is not clearly visible in bright sun light. Alcohol Resistant foam shall be provided to fight ethanol fires. For fighting other fires including ethanol Blended MS, Aqueous Film Forming Foam (AFFF) can be used.]

3.6.1 Receipt, storage and handling of ethanol:

(1) Ethanol shall be received at installations/ depots in dedicated tank trucks and all care shall be taken to prevent ingress of water into the compartments during transportation.

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

[1] Ins. by sub-cl (p) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(3) Ethanol can be stored in above ground or underground tanks depending on local requirement.
(4) The unloading operations shall be carried out through special Nitrile rubber or any other compatible hoses. Hose shall have external bonding wire to ensure electrical continuity.
(5) Ethanol being hygroscopic in nature, utmost precaution needs to be taken to ensure that there is no ingress of water or humidity. Both the ends of the hoses after use shall be capped and 80 mesh strainers shall be provided before the pump or tank inlet, as the case may be.
(6) Appropriate recommended dosage of Corrosion inhibitor shall be added during the decantation of Ethanol from tank truck into the storage tank, so as to ensure homogeneity of additives with ethanol in the storage tank.
(7) Storage tanks and allied facilities for Ethanol shall be positively segregated and the tank shall be absolutely free from water at all times.
(8) Ethanol, being hygroscopic, will absorb moisture from the air and Silica Gel trap shall be provided in the vent pipe of the tank to prevent ingress of moisture into the tank. Regular check on the colour of silica gel shall be maintained (Blue Colour) and shall need immediate replacement on showing signs of saturation by way of change of colour.
(9) Ethanol storage tanks shall be cleaned once in two years or more frequently depending on the need.
(10) Storage tank openings or pipeline fittings shall be airtight and the threaded connections if any shall be tightened with the help of Teflon paste or Teflon tapes and Bolted connections shall have gaskets of Teflon.
(11) To ensure uniform doping of Ethanol with Motor Gasoline, on line doping of Ethanol shall be carried out through a closed system, with proper interlocks, while maintaining efficacy of mixing Ethanol in the right proportion of % v/v as per specification.
(12) An 80-mesh filter shall be provided on the delivery side of Ethanol storage tank that is to say between pump and tank lorry filling (TLF) Gantry point.
(13) Safety requirements as specified in Material safety data Sheet (MSDS) shall be ensured.
(14) "Safe Operating Practices (SOP)" shall be displayed. Persons handling ethanol shall be trained for handling of ethanol.
(15) Emergency instructions and hazardous instruction shall be displayed and PPE as per MSDS requirement shall be in place.
[1][(16) Ethanol should be stored either in underground tanks or semi-buried tanks or above ground tanks and aboveground tanks for ethanol storage shall be of Internal Floating Roof Type or Cone Roof type. External Floating Roof tank or Internal Floating Roof tank with window opening on the shell shall not be used for ethanol storage.
(17) Adequate corrosion protection measures should be taken for ethanol service tanks.
(18) Fire fighting on fires related to Ethanol –
(i) for spill of ethanol at TLF gantry or during unloading of Ethanol TT alcohol resistant foam cover to be immediately spread over the spilled contents using portable Medium Expansion Foam Generator (MEFG) or appropriate equipment;
(ii) for leak of ethanol from gaskets in Pump House or in Tank farm, alcohol resistant foam covers to be immediately spread over the spilled contents using portable MEFG or appropriate equipment;
(iii) if in Tank Farm, common HVLR is used for tanks storing MS or ethanol or ethanol blended MS, then, appropriate SOP for use of such HVLR for different fires shall be prepared, displayed and practiced in mock drills;
(iv) minimum two MEFG for each tank inside dyke area storing ethanol or ethanol blended MS shall be provided. Separate Alcohol Resistant Foam feeding arrangement shall be made for such MEFGs. Appropriate SOP shall be prepared and displayed near the operating area;

[1] Ins. by sub-cl (q) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(v) Hydro Carbon Detection system as applicable for ethanol shall be provided at all possible places of leak including isolation valve inside dyke and at sump near dyke drain valve;

(vi) foam pourer system as provided in Internal Floating Roof Vertical Tank (IFRVT) or in Cone Roof Vertical Tank (CRVT) for ethanol service shall have dedicated provision for Alcohol Resistant Foam for fire-fighting; and

(vii) inspection frequency: Internal inspection of ethanol tanks shall be done once in 5 years; External inspection shall be done visually six monthly and Ultrasonic Thickness testing shall be done once in 3 years.]

PART - D

(Commissioning or De-commissioning of facilities)

4.0 Commissioning or De-commissioning of facilities:

Commissioning is the process of assuring that all systems and components of a facility, a process, or a plant are installed, tested, and operated according to the design parameters and operational requirements. De-commissioning is the process of assuring that all systems and components of a facility, a process, or a plant are tested and confirmed that there is no Hazard available or balance, which may cause any potential damage to the personal and also equipment or facilities installed in the vicinity before shutdown of the facility. The commissioning or de-commissioning process shall include the following aspects, namely: -

(1) Standard operating procedures for commissioning or decommissioning of the equipment and facility shall be formulated, reviewed and approved by designated personnel;

(2) Only experienced and trained personnel shall be deployed for commissioning or de-commissioning activities;

(3) The de-commissioning or commissioning of the facility shall be carried out under the close supervision of the experienced and expert supervisors;

(4) The role and responsibilities of each personnel associated with the commissioning or de-commissioning activities shall be clearly defined and approved;

(5) The commissioning process comprises the integrated application of a set of engineering techniques and procedures to check, inspect, test, and verify every operational component of the project, from individual functions, such as stand-alone equipment and instrumentation to complex combinations of modules, subsystems and systems;

(6) There shall be an approved commissioning or de-commissioning plan for each facility or process unit of the project;

(7) The procedures shall be developed taking into account the various hazards that are likely to be encountered during the commissioning process and shall also address the prevention or mitigation systems that need to be in place prior to commencing each activity;

(8) The procedure referred to in clause (7) should also take into account any risks to the operators, facility, and environment based on a risk assessment;

(9) Procedures shall ensure that all necessary checks or safeguards are correctly addressed. Procedures shall be supported with proper checklists for verifying compliance;

(10) Pre-commissioning activities like vessel entry, work at height, hot work, and all commissioning or de-commissioning activities shall be carried out complying with work permit system;

(11) Compliance to work permit requirements should be monitored via regular safety inspection;
(12) All staff and the associated contractors, vendor representatives at site shall use Personal Protective Equipment (PPE) as specified for such purpose;
(13) In the event of an emergency occurring in the Project site or area, the emergency response shall be in accordance with the established Emergency Response Procedures;
(14) Hazardous waste and non-hazardous waste produced in the pre-commissioning or commissioning activity (that is to say flushing lube oil, oil contaminated water or soil) shall be handled in accordance with established environmental procedures of waste management;
(15) A comprehensive testing procedure shall be developed which address the safety of all personnel involved therein and include the provision of specific work instructions and related training and induction for all personnel involved in testing operations. The testing must be supervised by trained and experience personnel. Coordination and team work between Construction, QA or QC, Safety, and Contractor is very important;
(16) Any pressure test activity shall have approved pressure test Certificates of relevant testing equipment or instruments, work permit and job safety analysis*;*
(17) The hydrostatic and pneumatic test pressure utilized for testing of systems shall be as indicated in the data sheet and the relevant Codes and Specifications for the system shall be used for determining the hydrostatic or pneumatic test pressures;
(18) Test facility shall be set up with provision of a relief valve and calibrated pressure gauge (at least two units in the test loop) shall be deployed;
(19) Prior to commencement of any pressure test, the relief valves shall be correctly set and not isolated, and the pressure gauges shall be functional;
(20) Equipment or piping system isolation spades, gaskets, flanges and like other devices should be checked for correct size, thickness and rating;
(21) All vents and other connections which can serve as vents shall be open during filling, so that all air is vented prior to applying test pressure to the system;
(22) Temporary spades and blanks installed for testing purposes shall be designed to withstand the test pressure without distortion;
(23) Piping shall be tested prior to installation of inline items such as rupture discs, displacement and turbine meters, orifice plates, flow nozzles, level gauges, rotameters, strainers and like other devices; and
(24) Many potential hazards can be realized during start-up or shut-down of a plant or a process unit. Specific Emergency procedures should be provided which take into account all possible eventualities.

PART - E

(Fire Protection and Prevention Facilities)

5.0 Fire Protection and Prevention Facilities:

5.1 Fire Protection Philosophy:

Fire protection philosophy is based on loss prevention and control. It considers that a depot or terminal carries an inherent potential hazard due to flammable nature of petroleum products stored therein. A fire in one facility can endanger other facility of the depot or terminal, if not

controlled or extinguished as quickly as possible to minimize the loss of life and property and to prevent further spread of fire.

5.1.1 Fire protection:

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

(i) Fire Water System-(storage or pumps or distribution piping network with hydrant or monitors);
(ii) Fixed Water Spray System;
(iii) Foam System;
(iv) First Aid Fire Fighting Equipment;
(v) Trolley mounted or Mobile Fire Fighting Equipment;
(vi) Carbon Dioxide System or Clean Agent Fire Fighting System or Dry Chemical Fire Fighting System;
(vii) Dry Chemical Extinguishing System;
(viii) Clean Agent Protection System;
(ix) Leak detection System and Alarm System;
(x) Fire Detection and alarm systems; and
(xi) Communication System.

5.1.2 Design criteria for fire protection system:

(1) Facilities shall be designed on the basis that city fire water supply is not available close to the installation. The Installation or Depot should have its own independent Fire Fighting System. Pipeline installation co-located with Refinery or Marketing installation may be covered by fire fighting system of later and need not require independent fire fighting system.
(2) The fire water pumps shall be provided with auto start facility with pressure drop in fire water network.
(3) The fire water system shall be based on single contingency for all locations where total storage capacity in the location is up to 30,000 KL (Including storage of Class C products if stored with Class A and / or Class B). Wherever water replenishment @ 50% or more is available, the storage capacity can be reduced to 3 hours aggregate rated capacity of main pumps.
(4) The fire water system shall be provided based on two largest fire contingencies simultaneously for all locations where total storage capacity in the location is above 30,000 KL (Excluding Class-C products stored in a separate dyke conforming to prescribed separation distances) and wherever water replenishment @ 50% or more is available, single fire contingency shall be considered for Fire water storage. This clause shall not be applicable for locations exclusively storing class C and / or excluded products.
(5) At locations where cluster of OMCs exist, fire water shall be shared. Water requirement shall be worked out based on fire scenario of single largest tank, CR or FR tank, as the case may be. At locations where single OMC exist, it shall have water requirement for 4 hours.
(6) For location or dyke storing exclusively Class C or excluded or combination of Class-C and excluded products, the water requirement shall be based on 1 monitor of 144 kl/hr and 4 hose streams of 36 kl/hr that is to say a total of 288 kl per hr for four hrs.
(7) The hazardous areas shall be protected by a well laid combination of hydrants and monitors and the installations having aggregate above ground storage capacity of less than 1000 KL (Class A+B+C) are exempted from such protection.

(8) The installations storing Class A petroleum in above ground tanks shall have fixed water spray system, but the installations above 1000 KL storage fulfilling the following both conditions are exempted from the provision of fixed water spray system, namely: -

(i) Aggregate above ground storage of Class A and Class B petroleum up to 5000 KL; and

(ii) Floating roof tank storing Class A petroleum having diameter up to 9 M.

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

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

(11) When Class A and Class B above ground storage tanks are placed in a common dyke then, the fixed water spray system shall be provided on all tanks except for small installations as mentioned in sub-para (8).

(12) Installations where inter distances between tanks in a dyke or within dykes are not conforming to these regulations, the following additional facilities shall be provided to enhance safety namely: -

(i) The fixed water sprays system on all tanks, irrespective of diameter in the installations; and

(ii) The Fixed or semi fixed foam system on all tanks, irrespective of diameter in the installation.

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

(14) The hydrants and monitors shall be located at a minimum distance of 15 m from the hazard (such as TW and TT loading or unloading facilities) to be protected.

(15) Tank wagon loading gantries shall be provided with manually operated fixed water spray or sprinkler system. The gantry shall be divided into suitable number of segments (each segment having minimum length of 15 m length and width of 12 m) and three largest segments operating at a time shall be considered as single risk for calculating the water requirement and accordingly, a provision shall be made to actuate the water spray system from a safe approachable central location that is to say affected zone and adjoining zones.

(16) Portable monitors or foam hose streams shall be provided for fighting fires in dyke area and spills.

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

(18) Installation of medium expansion foam generator shall be as per following criteria, namely: -

(i) Class A tanks: Two Nos. Fixed type foam generators (minimum) for each tank dyke, and

(ii) Class B tanks: Two Nos. Portable foam generator (minimum) for each location.

(19) Remote or manually operated high volume long range water cum foam monitors (capacity 500/750/1000 GPM and above) to fight tank fires shall be provided at petroleum installations. Numbers and Capacity of monitor or foam pourer shall be provided in such a way that the foam delivery rate from the monitors' meets requirement of foam application rate (8.1 LPM/m2) for full surface tank fire.

(20) The location of HVLRs monitors shall be planned in such a way that the very purpose of such monitors is served and throw of the monitors is safely delivered at the aimed object and such

high volume long range monitors shall be positioned located at a distance of 15 m to 45 m from the hazardous equipment subject to the following, namely: -

(i) 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; and

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

(21) Fixed or mobile HVLRs shall be used for fighting full surface fire on external floating roof tanks.

(22) Care need to be taken for petroleum installations located in habituated areas or adjoining to other objects such as High tension line and like other objects and there should not be any High tension line passing through the depot or installation.

(23) Water cum foam monitors shall be installed in such a way that all the tanks in the installation are within the horizontal range of foam throw.

(24) Additional monitors shall be provided in such a way that each tank is in the coverage area of at least two monitors.

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

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

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

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

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

(i) The system must detect fire in Rim Seal area immediately but not later than 10 seconds and extinguish the fire in its incipient stage that is to say within 40 seconds of its indication;

(ii) The system must be robust, such as it should not be affected by environmental conditions like low or high ambient temperature, dust, external corrosion, hydrocarbon vapour, rain and like other environmental conditions;

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

(iv) The detection and extinguishing system shall be coupled with fire control panel with audio-visual alarm for necessary fire alert.

(30) In alternative to the system specified in sub-paragraph (29), the following system can be provided, namely: -

(i) The detection system shall detect the fire immediately but not later than 10 seconds;

(ii) The actuation system shall be actuated immediately on detection of fire;

(iii) Minimum 10 minutes foam discharge for below seal application or minimum 20 minutes discharge for above seal application shall be undertaken; and

(iv) The application rate shall be 20.4 lpm/m^2 of the area.

(31) In addition, the individual components shall have certification from competent authority for suitability for applicable hazardous zone.

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

(33) Clean Agent (Halon substitute) based flooding system should be provided for control rooms, computer rooms or repeater station and pressurized rooms in major locations having automated pipeline receipt or dispatch or TW or TT loading facilities. Selection of clean agent and design of fire protection system for control rooms, computer rooms and pressurized rooms should follow the Standard on "Clean Agent Extinguishing systems NFPA Standard 2001 including its safety guidelines with respect to "Hazards to Personnel", electrical clearance and environmental factors in line with environmental considerations of Kyoto and Montreal Protocol and MOEF&CC regulations.

5.1.3 In case, combined Petroleum and LPG facilities have been provided in the same premises, the common water storage facility for fire fighting purpose may be shared between Petroleum Installation and LPG Plant under following conditions, namely: -

(1) If both locations are located within same premise, then, one largest fire scenario to be considered and water requirement shall be worked out accordingly. In case, the premises are separate, water requirement to be worked out for independent location;
(2) Each Petroleum or LPG facility shall independently meet the design, layout and fire protection system requirements of PNGRB regulations and have common boundary wall and ownership of both the facilities under same company; and
(3) The pump house may be common or separate and in case common pump house is provided the control of the pump house shall remain with group whose premises such pump house is situated.

5.2 Fire water system design:

Fire water system shall be designed for a minimum residual pressure of 7 kg/cm^2 at hydraulically remotest point in the installation considering the design flow rate, namely: -

(1) A fire water ring main shall be provided all around perimeter of the location facilities with hydrants or 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 or equipment to be protected, and
(2) The installation shall have facilities for receiving and diverting all the water coming to the installation to fire water storage tanks in case of an emergency.

5.2.1 Fire water design flow rate:

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

(i) For water flow calculations, all tanks farms having Class A or Class B petroleum storage shall be considered irrespective of diameter of tanks, 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 / sq.m 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/m^2 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 or foam monitors whichever is higher (Foam

solution applicable rate for cone roof tanks shall be taken as 5 lpm/sqm and for floating roof rim seal protection it shall be 12 lpm / sqm); and

(vi) 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.

(2) For location or dyke storing exclusively Class C or excluded products, the water requirement shall be based on 1 monitor of 144 kl / hr and 4 hose streams of 36 kl / hr that is to say a total of 288 kl per hr for four hrs.

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

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

(5) Fire water flow rate for TT and TW loading Gantry in a depot or terminal shall be calculated at a rate of @ 10.2 lpm / sq.m. The gantry shall be divided into suitable number of segments (each segment having minimum length of 15 m length and width of 12 m) and three largest segments operating at a time shall be considered as single risk for calculating the water requirement. Design flow rate shall be largest of 5.2.1.a, 5.2.1.b, 5.2.1.c, 5.2.1.d and 5.2.1.e. Design flow rate for roof sinking case of largest tank shall be calculated and wherever, the design flow rate of roof sinking case is higher than single or two contingencies, as the condition applicable, the same shall be considered for calculating water requirement.

(6) 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 and the supplementary water stream requirement shall be in addition to the design flow rates.

5.2.2 Fire water storage

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

(2) The effective capacity of the reservoir or tank above the level of suction point shall be minimum 4 hours aggregate rated capacity of pumps. Subject to the design criteria specified in sub-paragraph (3) and sub-paragraph (4) of paragraph 5.1.2.

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

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

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

5.2.3 Fire water pumps:

(1) 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 and pumps shall be provided with suitable sized strainers on suction and NRVs on discharge lines.

(2) 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.

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

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

(5) Fire water pumps and storage shall be located far away from the potential leak sources or tankage are and shall be at least 60 M (minimum) away from equipment or where hydrocarbons are handled or stored.

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

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

(8) Jockey pump shall be provided for keeping the hydrant system or line pressurized at all times. The capacity of the pump shall be sufficient to maintain system pressure in the event of leakages from valves and like other devices and besides the main jockey pump the stand by pump of same capacity and type shall be provided.

(9) Auto cut-in or cut-off facility should be provided for jockey pumps to maintain the line pressure.

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

(11) The fire hydrant system should be able to maintain a pressure of minimum 7 kg/cm^2 in the line at the farthest end.

5.2.4 Fire hydrant network

(1) 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.

(2) Fire hydrant ring main shall be laid above ground ensuring that-

(i) the 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;

(iii) for pipeline size shall be less than 150 mm and support interval shall not exceed 3 meters;

(iv) the pipe line size shall be 150mm and above not exceeding 6 meters or design approved; and

(v) the system for above ground portion shall be analysed for flexibility against thermal expansion and necessary expansion loops where called for shall be provided.

(3) Fire hydrant ring main may be laid underground at the following places, namely: -

(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; and
(iv) Where Frost conditions warrant and ambient temperature is likely to fall below zero degree Centigrade, then, underground piping at least 1 meter below the ground level should be provided and alternatively, in such cases for above ground pipelines, water circulation to be carried out.

(4) Fire water ring main laid underground shall ensure the followings, namely: -

(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 or 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 or wrapping with or without cathodic protection; and
(iv) In case of poor soil conditions it may be necessary to provide concrete/ masonry supports under the pipe line.

(5) Size of hydrant pipeline shall be as specified below, namely: -

(i) The hydraulic analysis of network shall be done at the design time and 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 and 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; and
(iv) The stand post for hydrants and monitors shall be sized to meet the respective design water flow rates.

(6) The following requirements shall be complied with, namely: -

(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 or brick masonry chamber of suitable size to facilitate operation during emergency and maintenance;
(ii) Associated Sprinkler or foam riser or 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; and

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

5.2.5 Hydrant or monitors:

(1) Hydrants or monitors shall be located considering various fire scenario at different sections of the premises to be protected and to give most effective service.
(2) 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 and for non-hazardous area, the hydrant post shall be spaced at 45 mtrs. intervals. The horizontal range and coverage of hydrants with hose connections shall not be considered beyond 45 mtrs.
(3) Hydrants shall be located at a minimum distance of 15 mtrs. from the periphery of storage tank or equipment under protection and in case of buildings such distance shall not be less than 2 mtrs. and not more than 15 mtrs. from the face of building.
(4) Provision of hydrants within the building shall be provided in accordance with IS: 3844.
(5) Hydrant or Monitors shall be located along road side berms for easy accessibility.
(6) Fixed water or water cum foam monitors on the network shall be provided with independent isolation valves and Double headed hydrants with two separate landing valves. Hydrants or Monitors shall be located with branch connection.
(7) Double headed hydrants and monitors on suitably sized stand post shall be used. All hydrant outlets or monitor isolation valves shall be situated at workable height from ground or hydrant or monitor operating platform level.
(8) 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.
(9) Hydrants and monitors shall not be installed inside the dyked areas, but, as an additional requirement, oscillating monitors shall be provided in inaccessible area within the dyke with isolation valve or ROV outside the tank farm (in cases inter distances between tanks in a dyke or within dykes are not meeting the requirements).
(10) TW or TT loading and unloading facilities shall be provided with alternate hydrant or 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.
(11) The hydrants and monitors shall be located at a minimum distance of 15 M from the hazard (such as TW and TT loading or unloading facilities) to be protected.

5.2.6 Material specifications:

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

(1) In respect of pipes, Carbon Steel as per IS: 3589/IS: 1239/IS: 1978 or Composite Material or its equivalent for fresh water service and in case saline, brackish or treated effluent water is used, the fire water ring main of steel pipes, internally cement mortar lines or glass reinforced epoxy coated or pipes made of material suitable for the quality of water able to withstand the temperature and pressure shall be used and alternately, pipes made of composite materials shall be used. The composite material to be used may be as per API 15LR/API 15HR / IS12709. In case composite pipes are used they shall be used underground;
(2) In respect of Isolation Valves, Gate valve or quick shut off type isolation valves made of Cast Steel having open or close indication shall be used and other materials such as

cupro-nickel for saline or brackish water can be used and the material of the valve shall be suitable for the service.

(3) In respect of Hydrants post-

(i) Stand post made of Carbon Steel shall be used; and
(ii) Outlet valves made of Gunmetal or Aluminium or Stainless or Steel or Al-Zn Alloy shall be used.

(4) Monitors or High Volume Long Range Water Cum Foam Monitors (HVLR) or Rim seal shall be approved or listed by any of the national or international certifying agencies like UL, FM, VdS or LPC, BIS or any other like agency and the electrical or hydraulic remote control mechanism shall be in line with Hazardous Area Classification;

(5) In respect of Fire Hoses, Reinforced Rubber Lined Hose shall be as per IS 636 (Type A) or Non-percolating Synthetic Hose (Type B) or Equivalent Standard.

(6) In respect of Painting, -

(i) Fire water mains, hydrant and monitor stand posts, risers of water spray system shall be painted with "Fire Red" paint as per of IS: 5;
(ii) Hose boxes, water monitors and hydrant outlets shall be painted with "Luminous Yellow" paint as per IS: 5; and
(iii) Corrosion resistant paint shall be used in corrosion prone areas.

5.2.7 Fixed water spray system:

(1) 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 and the piping system is connected to the hydrant system water supply through an automatically or manually actuated valve which initiates the flow of water and in case the system is manually actuated, the isolation valve shall be located outside the dyke for ease of access and operation.
(2) Spray nozzles shall be directed radially to the tank at a distance not exceeding 0.6 M from the tank surface.
(3) While calculating the water rates for spray application for cases other than tanks such as pump house and tank wagon gantry, the area should be divided into suitable segments so that maximum water requirement can be optimized.
(4) For TW loading gantry, sprinklers shall be provided to ensure full surface coverage and three largest segments shall be considered for water requirement.
(5) For Tank Truck loading gantries specifically for those cases which have obstructions in water throw, sprinklers should be provided.
(6) The flow rate in the sprinkler system shall be either 1 lpm or 3 lpm depending upon whether tank is outside or within a distance of R+30 m from the tank on fire.

5.3 Foam protection system:

5.3.1 Storage tank:

5.3.1.1 Floating roof tank:

For floating roof tank, foam shall be poured at the foam dam to blanket the roof seal and the features of foam system for floating roof tank protection shall be as follows, namely: -

(i) The system shall be designed to create foam blanket on the burning surface in a reasonably short period;

(ii) The foam shall be applied to the burning hazard continuously at a rate high enough to overcome the destructive effects of radiant heat; and

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

5.3.1.2 Fixed roof tank :

Foam conveying system shall have same features as of floating roof tank as specified in paragraph 5.3.1.1 excepting that a vapour seal chamber is required before the foam discharge outlet and features of the foam system for fixed roof protection shall be as follows, namely: -

(1) 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 and

(2) Where two or more pourers are required such pourers 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 or pourers as indicated below, namely :-

Tank diameter (In M)	Requirement of Foam Pourer (Minimum. Nos.)
Above 18 and up to 20	2
Above 20 and up to 25	3
Above 25 and up to 30	4
Above 30 and up to 35	5
Above 35 and up to 40	6
Above 40 and up to 45	8
Above 45 and up to 50	10

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

5.3.1.3. Floating cum fixed roof tank:

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

5.3.1.4 Protection for dyke area or spill fire :

(1) Portable monitors or foam hose streams shall be provided for fighting fires in dyked area and spills; and

(2) In addition to as specified in clause (i), Medium expansion foam generators shall be provided to arrest vapour cloud formation from spilled volatile hydrocarbons and the installation of medium expansion foam generator shall be as per following criteria, namely: -

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

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

5.3.2 Foam application:

5.3.2.1 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, namely: -

(1) 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 and for floating roof tanks containing liquid hydrocarbons foam solution, delivery rate shall be at least 12 lpm/ sqm of seal area with foam dam height of 600 mm of the tank to be protected; and

(2) The height of foam dam shall be at least 51 mm above the top of metallic secondary seal. In the case of Floating roof tank roof sinking, the application rate shall be considered as 8.1 lpm/ sqm. In determining total solution flow requirements, potential foam losses from wind and other factors shall be considered.

5.3.2.2 Duration of foam discharge:

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

(1) Tanks (fixed roof or floating roof) containing Class 'A' and Class 'B', the minimum duration shall be 65 minutes, and
(2) Where the system's primary purpose is for spill fire protection such as dyked area and non dyked area (TT and TW and like other non dyked) the minimum duration shall be 30 minutes.

5.3.2.3 Water for foam making:

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

5.3.2.4 Foam quantity requirement:

The foam quantity requirement shall be based on the following, namely: -

(1) Foam solution application shall be at the rate of 5 lpm/ sqm. for the liquid surface of the single largest cone roof tank;
(2) Foam solution application shall be at the rate of 12 lpm/ sqm. of seal area of the single largest floating roof tank;
(3) Floating roof sinking case also shall be considered for foam compound requirement and storage. Application @ 8.1 lpm/sq.m by required Nos. HVLR of installed capacity and minimum aggregate foam storage shall be total of (1) + (2) or (3), whichever is higher; and
(4) In case of Aviation Fuelling Stations, where aggregate product storage capacity is less than 1000 KL, foam quantity for spill fire protection of 30 minutes shall be made.

5.3.2.5 Foam compound storage:

[1][(1)Foam compound should be stored as explained in IS-4989 or equivalent standard. Type of foam compound to be used may be protein, fluro-protein or AFFF. Alcohol Resistant Foam shall be used for handling methanol or ethanol fires. Minimum 1000 litres of Alcohol

[1] Subs. by sub-cl (r) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

Resistant Foam compound shall be maintained at the installation to handle methanol or ethanol fire.]

(2) 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 shall be replaced. The deteriorated foam compound can be used for fire training purposes.

(3) Care shall be taken to avoid mixture of two or more different grades or batches of foam in a foam storage tank. In such cases foam shall be tested on yearly basis to check its efficacy and record shall be maintained thereof.

(4) For details of type of tests and their periodicity, IS 4989 or equivalent Standard shall be referred.

(5) Quantity of foam compound as per paragraph 5.3.2.4, should be stored in the Installation. At locations where cluster of OMC exists, foam requirement can be uniformly distributed at respective location. The stored quantity shall be made available to needy company in case of any emergency.

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

5.4 Control room and computer room protection:

(1) Control room and computer room should be protected by Clean Agent Fire Extinguishing System.

(2) In order to minimize the exposure to Clean Agent Fire Extinguishing System, persons should be evacuated from the areas before the system comes into operation.

(3) Clean agent fire extinguishing system as per NFPA-2001 shall be provided for the protection system. Each hazard area to be protected by the protection system shall have an independent system. The time needed to obtain the gas for replacement to restore the systems shall be considered as a governing factor in determining the reserve supply needed and 100% standby containers shall be considered for each protected hazard. Storage containers shall be located as near as possible to hazard area, but they shall not be exposed to fire. Storage containers shall be carefully located so that they are not subjected to mechanical, chemical or other damage.

(4) All the components of the system shall be capable of withstanding heat of fire and severe weather conditions.

5.5 First aid fire fighting equipment:

The fire extinguishers shall be provided as per the Table given below, namely: -

Sr. No.	Type of Area	Scale of Portable Fire Extinguishers
(i)	Lube Godown	1 No. 9 Kg DCP extinguisher for every 200 m^2 or min. 2 Nos. in each Godown, whichever is higher.
(ii)	Lube Filling Shed	1 No. 9 Kg DCP extinguisher for 200 m^2 or min. 2 Nos. in each Shed, whichever is higher
(iii)	Storage of (Class A or Class B)	1 No. 9 Kg DCP extinguisher for 100 m^2 or min. 2 Nos. in each Storage Area, whichever is higher.

	in packed containers and stored in open or closed area.	
(iv)	Pump House (Class A or Class B) Up to 50 HP (Class A and Class B) Above 50-100 HP . Beyond 100 HP	1 No. 9 Kg DCP for 2 pumps. 1 No. 9 Kg DCP for each pump. 2 Nos. of 9 kg or 1 no. of 25 kg DCP for each pump.
(v)	Pump House (Class C) Up to 50 HP Above 50 HP	 1 no. 9KgDCP for every 4 pumps up to 50 HP. 2 nos. 9 Kg DCP or 1x25 kg DCP for 4 pumps.
(vi)	Tank Truck loading and unloading gantry for POL or Special products	1 No. 9 Kg DCP extinguisher for each bay plus 1 No. 75 Kg DCP extinguisher for each gantry.
(vii)	Tank Wagon loading and unloading gantry or siding	1 No. 9 Kg DCP extinguisher for every 30 m of or siding plus 1 No. 75 Kg DCP extinguisher for each gantry or siding.
(viii)	A or G Tank Farm	2 Nos. 9 Kg DCP extinguishers for each tank plus 4 Nos. 25 Kg DCP extinguishers for each Tank Farm positioned at four corners. In case of adjoining tank farms, the no. of 25 Kg extinguishers may be reduced by 2 nos. per tank farm.
(ix)	U/G Tank Farm	2 Nos. 9 Kg DCP extinguisher for each Tank Farm
(x)	Other Pump Houses	1 No. 9 Kg DCP extinguisher for every two pumps or min 2 Nos. 9 Kg DCP extinguisher for each Pump House whichever is higher.
(xi)	Administration Building or Store House	1 No. 9 Kg DCP extinguisher for every 200 m^2 or min. 2 Nos. 9 Kg DCP extinguishers for each floor of Building or Store whichever is higher.
(xii)	DG Room	2 Nos. each 9 Kg DCP&4.5 Kg CO2 extinguishers for each DG room.
(xiii)	Main switch Room or Sub-Station	1 No. 4.5 Kg CO2 extinguisher for every 25 m^2 plus 1 No. 9 Liter sand bucket per transformer bay.
(xiv)	Computer Room or Cabin	2 Nos. of 2 Kg CO2 or 2 Nos. of 2.5 Kg Clean Agent extinguisher per Computer Room and 1 No. 2 Kg CO2 or 1 No. 1.0 Kg Clean Agent extinguisher per cabin.
(xv)	Security Cabin	1 No. 9 Kg DCP extinguisher per cabin.
(xvi)	Canteen	1 No. 9 Kg DCP extinguisher for 100 m^2 .
(xvii)	Workshop	1 No. 9 Kg DCP extinguisher and 1 No. 2 Kg CO2 extinguisher.
(xviii)	Laboratory	1 No. 9 Kg DCP extinguisher and 1 No. 4.5 Kg CO2 extinguisher.

(xix)	Oil Sample Storage Room	1 No. 9 Kg DCP extinguisher per 100 m^2 or min. 1 no. 9 Kg extinguisher per room, whichever is higher.
(xx)	Effluent Treatment Plant	1 No. 75 Kg. and 2 nos. 9 Kg. DCP Extinguisher
(xxi)	Transformer	1 No. 9 Kg. DCP extinguisher.
(xxii)	UPS or Charger Room	1 No. 2 Kg. CO2 extinguisher.

Notes:

(1) All fire extinguishers shall conform to respective BIS or equivalent codes, such as 9 Kg DCP Type (IS: 15683), 4.5/6, 8 Kg CO2 Type (IS: 2878) and 25/50/75 Kg DCP Type (IS: 10658) and bear ISI mark. BIS or Equivalent certificates of all extinguishers shall be maintained at the location;

(2) While selecting the Extinguisher, due consideration should be given to the factors like flow rate, discharge time and throw in line with IS: 2190 or equivalent;

(3) The Dry Chemical Powder used in extinguisher and carbon dioxide gas used as expelling agent shall be as per relevant BIS or Equivalent code;

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

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

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

(7) Portable fire extinguishers shall be located at convenient locations and are readily accessible and clearly visible at all times;

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

(9) Rain protection of suitable design should be provided for all extinguishers and sand buckets;

(10) The maximum running distance to locate an extinguisher shall not exceed 15 m; and

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

5.6 Emergency trolley and emergency kit:

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

(2) An emergency kit shall be provided consisting of safety items shall be readily available at the terminals. All the items of the kit shall be kept on a trolley specifically designed for the purpose.

5.7 Motorable arrangement for towing or carrying mobile fire fighting equipment such as Foam trolleys, Portable water-cum-foam monitors and like other monitors should be made and available on sharable basis.

5.8 Hydrocarbon detection and annunciation, dyke drain valve annunciation system and emergency shutdown logic:

5.8.1 Hydro carbon detection and annunciation system:

Hydrocarbon detectors shall be installed near all potential leak source of class-A that is to say tank dykes, tank manifolds, pump house manifold and like other manifolds and Hydrocarbon detector of proper type shall be selected and also shall be proof tested and shall be maintained in good condition. The other details are specified as below, namely:-

(1) General:

(i) The best method of prevention of explosion is to avoid basic build-up of Explosive Vapour concentration immediately on occurrence of leakage, and such method would require basically a reliable and continuous Hydro Carbon detection system with warning annunciation to alert the operating personnel to take timely corrective action;
(ii) The Hydro Carbon Detection System shall provide early warning on build-up of Vapour concentration below the LFL limits.

(2) Application:

(i) Hydrocarbon (HC) detectors shall be installed near all potential leak sources of Class-A Petroleum products such as tank dykes, tank manifolds and pump house manifold and such detectors shall be placed in a way that entire possible source of leaks and collection of products is continuously detected and alarm is set at 20% of lower explosive limit of Class-A petroleum products;
(ii) The detection control equipment should be provided in the control room and the field for continuous monitoring should be provided even during power failure.

(3) Power Supply:

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

(4) Architecture Components:

The main components shall be as specified below, namely: -

(i) Hydro Carbon Detectors;
(ii) Field Transmission units or Signal scanners;
(iii) Control system or PC;
(iv) Display;
(v) Annunciation System and like other system;
(vi) Cables, hooters, repeater, Power Supplies and like other devices; and
(vii) All the components installed in the hazardous area shall confirm to the Hazard Area Classification applicable and shall be certified by PESO or Authorized lab by the country of the origin.

(5) Annunciation System:

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

(ii) Hydro Carbon Detectors should be available as per requirement;

(iii) The detectors shall be able to detect the presence of Hydro Carbon Vapours well below the LEL level;

(iv) Any one or more in combination from the following types can be provided Namely: -

a. Catalytic detectors;
b. Infra-red detectors; and
c. Line or Path detectors;

(v) The system shall be available at all times;

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

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

(6) Inspection and Testing:

(i) Calibration of the detectors shall be done as per OEM recommendation or once in six month, whichever is earlier;

(ii) The drift in the sensitivity of the individual detectors shall be recorded in maintenance history log book during calibration and the detectors with abnormal or wide drift in sensitivity shall be rectified or replaced; and

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

5.8.2 Dyke Drain valve Annunciation system:

(1) All the dyke valves will be fitted with a proximity switch or sensor for indication of the position of the valve. The valves of the Dyke shall remain in closed position. In case any valve is open, then, Audio alarm and visual indication shall come at control panel for suitable corrective measures.

(2) In case of automated locations existing PLC can be used, but where the locations are not automated, a standalone system shall be provided.

5.8.2.1 Power Supply:

The supply to the system shall be through a reliable on line uninterrupted power supply/ (Online UPS). The main components in the Architecture Components shall be as below, namely: -

(i) Proximity Switches or Sensors;
(ii) Field transmitter unit or Signal Scanners;
(iii) Control System or PC or TAS;
(iv) Display;
(v) Annunciation System and like other systems; and
(vi) Cables, hooters, Mimic, Power Supplies and like other systems.

5.8.2.2 All the components installed in the hazardous area shall confirm to the Hazard Area Classification applicable and shall be certified by Central Institute of Mining and Fuel Research

(CIMFR) or Petroleum and Explosive Safety Organization (PESO) or Authorized lab by the country of the origin.

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

5.8.2.4 The control system shall be available at all times and the control equipment should have data logging facilities to provide print outs of the history of the events with date and time of open and close position of the valves.

5.8.2.5 Inspection and Testing:

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

5.8.3 Emergency shut Down (ESD) logic for Terminal Automation System (TAS):

The ESD for TAS enabled locations shall be provided in control room as well as at various strategic locations. ESD system shall be only through push buttons with wired connection. The other details are specified as below, namely: -

(1) Actuation or/ pressing of any ESD shall initiate following actions, namely: -

(a) Process Shutdown;
(b) Power Shutdown; and
(c) Process Shutdown shall include the following, namely: -

(i) To stop product loading pumps;
(ii) Barrier gates to open;
(iii) All ROSOVs and MOVs to close;
(iv) Tank lorry filling (TLF) or tank wagon filling (TWF) operations through the batch controllers to stop; and
(v) Fire siren to blow;

(2) Power Shutdown shall initiate the following, namely: -

(i) Trip all the panels other than Emergency panel. The Emergency panel should host fire siren, bore wells, jockey pumps, critical High Mast tower lights outside the licensed area, security cabin, fire pump house, Critical lights in TLF, Admin block, MCC room and power to the control room or Automation system;
(ii) There should be interlock between ESD for Process shut down and ESD for Power shut down so that full power shut down takes after a time lag required for closing the ROSOV or MOVs and full closure of valves shall be ensured. The time lag shall be location specific; and
(iii) At pipe line locations alarm signal shall be exchanged between the two control rooms so that necessary actions are taken by the operating personnel at both ends;

[1][(3)Inspection and Testing:

The system shall be checked during mock drill conducted with full system shut down once in six months and records shall be maintained.]

5.9 Mock drills and Mutual aid:

(1) Instructions on the action to be taken in the event of fire should be pasted at each siren point and familiarity with such instructions ensured and recorded.
(2) Monthly fire drills considering various scenarios shall be conducted regularly with full involvement of all employees of the installation. The mock drill shall include the full shut down system activation once in six months.
(3) The offsite disaster mock drills shall be conducted periodically as per local statutory requirements.
(4) The company should approach and coordinate with the district authority for conducting "Offsite Mock Drills".
(5) The post drill analysis should be carried out and discussed emphasizing areas of improvements.
(6) The record of such drills should be maintained at the location.
(7) Mock drill scenarios shall include all probable scenarios and the key areas like tank Farm, Rim seal fire, Gantry, Pump House, Tank Wagon gantry and like other key areas, shall be covered at least once in six months.
(8) Security staff should be trained as first responders for fire fighting and rescue operation along with plant operating personnel.
(9) Installation shall have a 'Mutual Aid' arrangement with nearby industries to pool in their resources during emergency.
(10) Mutual Aid agreements shall be prepared and signed by all Mutual Aid members. Fresh agreement shall be made on expiry of 2 years or whenever there is change in the signatories to the agreement. Quarterly meeting of Mutual Aid members shall be conducted and the minutes shall be recorded and the minutes shall be reviewed in the subsequent meetings.

5.10 ERDMP (Emergency Response and Disaster Management Plan):

(1) A comprehensive ERDMP shall be developed in accordance to the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010 and the copies of the ERDMP shall be available to all personnel in the installation.
(2) The key action points of the comprehensive ERDMP referred in sub-paragraph (1) shall be displayed at strategic locations in the installation for ready reference.

5.11 Fire Protection system: Inspection and Testing:

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

[1] Subs. by sub-cl (s) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(3) One officer shall be designated and made responsible for inspection, maintenance and testing of fire protection system.
(4) The responsibilities of each officer shall be clearly defined, explained and communicated to all concerned in writing for role clarity.

5.11.1 Fire water pumps:

(1) Every pump shall be test run for at least half an hour or as per OEM guidelines, whichever is higher twice a week at the rated head and flow.
(2) Each pump shall be checked, tested and its shut-off pressure observed once in a month.
(3) Each pump shall be checked and tested for its performance once in six months by opening required nos. of hydrants or monitors depending on the capacity of the pump to verify that the discharge pressure, flow and motor load are in conformity with the design parameters.
(4) Each pump shall be test run continuously for 4 hours at its rated head and flow using circulation line of fire water storage tanks and observations relating thereto shall be logged once a year.
(5) The testing of standby jockey pump, if provided shall be checked weekly. Frequent starts and stops of the pump indicate that there are water leaks in the system which should be attended to promptly.

5.11.2 Fire water ring mains:

(1) The ring main shall be checked for leaks once in a year by operating one or more pumps and keeping the hydrant points closed to get the maximum pressure.
(2) The ring mains, hydrant, monitor and water spray header valves shall be visually inspected for any missing accessories, defects, damage and corrosion every month and records thereof shall be maintained.
(3) All valves on the ring mains, hydrants, monitors and water spray headers shall be checked for leaks, smooth operation and lubricated once in a month.

5.11.3 Fire water spray system:

(1) Water spray system shall be tested for performance that is to say its effectiveness and coverage once in six months.
(2) Spray nozzles shall be inspected for proper orientation, corrosion and cleaned, if necessary at least once a year.
(3) The strainers provided in the water spray system shall be cleaned once in a quarter and records thereof shall be maintained.

5.11.4 Fixed and semi fixed foam system:

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

5.11.5 Clean agent system:

Clean agent fire extinguishing system should be checked as below, namely: -

(1) Agent quantity and pressure of refillable containers shall be checked once every six months; and
(2) The complete system should be inspected for proper operation once every year (refer latest NFPA 2001 for details of inspection of various systems).

5.11.6 Hoses:

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

5.11.7 Communication system:

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

5.11.8 Fire water tank or reservoir:

(1) Above ground fire water tanks should be inspected externally and internally.
(2) The water reservoir shall be emptied out and cleaned once in 3 years, but floating leaves, material or algae, if any, shall be removed once in 6 months or as and when required.

5.11.9 Fire extinguishers:

Inspection, testing frequency and procedure for **fire extinguishers** should be in line with design standard.

PART - F
(Maintenance and Inspection)

6.0 MAINTENANCE AND INSPECTION:

Each facility shall have a documented operating manual including operations, maintenance, training procedures, purging and record keeping based on experience and conditions under which the Petroleum Installation is operated, and a documented maintenance manual and such facility shall also have written operating, maintenance, and training procedures based on experience, knowledge of similar facilities, and conditions under which they will be operated.

6.1 Basic Requirements:

Each facility shall meet the following requirements, namely: -

(1) Have written procedures covering operation, maintenance, and training;
(2) Keep up-to-date drawings of plant equipment, showing all revisions made after installation;
(3) Revise the plans and procedures as operating conditions or facility equipment require;
(4) Establish a written emergency plan;
(5) Establish liaison with appropriate local authorities such as police, fire department, or hospitals and inform them of the emergency plans and their role in emergency situations;
(6) Analyze and document all safety-related malfunctions and incidents for the purpose of determining their causes and preventing the possibility of recurrence;
(7) As per maintenance philosophy, the activities should be identified that would be contracted to third party contractors for maintenance and support;
(8) The activity supervisors shall be identified according to the level of supervision required;
(9) The supervisors referred to in clause (8) shall be given safe supervisor training by designated staff and then they shall be put on the job;

(10) The contractors staff shall be engaged in toolbox talk given on relevant topics are held with the Contract holders and owners; and

(11) OEM service engineers are involved in critical overhauls for better quality assurance and for first time activities.

6.2 The operating manual for petroleum storage, handling and loading or unloading facilities shall include standard operating procedures which shall include procedures for the following, namely: -

(1) Handling, maintenance, inspection and fire protection facilities;
(2) Determining the existence of any abnormal conditions, and the response to such conditions in the plant;
(3) The safe transfer of petroleum including prevention of overfilling of vessels;
(4) For the proper startup and shutdown of all components;
(5) To ensure that each control system is adjusted to operate within its design limits;
(6) For monitoring operations; and
(7) Emergency preparedness and handling

6.3 The operating procedures manual shall be accessible to all plant personnel and shall be kept readily available in the operating control room. The operating manual shall be updated when there are changes in equipment or procedures. All petroleum plant components shall be operated in accordance with the standard operating procedures as per operating manual.

6.4 The periodic inspections and tests shall be carried out in accordance with generally accepted engineering practice or recommendations of Original Equipment Manufacturer to ensure that each component is in good operating condition.

6.5 Each facility operator shall ensure that when a component is served by a single safety device only and the safety device is taken out of service for maintenance or repair, the component is also taken out of service.

6.6 It shall be ensured that where the operation of a component that is taken out of service could cause a hazardous condition, a tag bearing the words “Do Not Operate,” or the equivalent thereto, is attached to the controls of the component, and wherever possible, the component shall be locked out.

6.7 Stop valves for isolating pressure shall be locked or sealed open and such stop valves shall not be operated except by an authorized person.

7.0 Maintenance Manual:

7.1 Each facility operator shall prepare a written manual that sets out an inspection and maintenance program for each component that is used in the facility.

7.2 The maintenance manual for facility components shall include the following, namely: -

(1) The manner of carrying out and the frequency of the inspections and tests as specified in this behalf;

(2) All procedures to be followed during repairs on a component that is operating while it is being repaired to ensure the safety of persons and property at the facility; and

(3) Each entity shall conduct its maintenance program in accordance with its written manual for facility components, and in addition, the history card of all critical equipments, instruments and systems shall be maintained.

7.3 Maintenance Work flow:

(1) The objective of the work flow is to provide an integrated proactive and reactive work plan so that repair work is minimized and reliability and availability are optimized. Maintenance execution begins with the receipt of a work request and concludes with the close out of the work order.

(2) Correct prioritization of work and proactively preparing activities through high quality work preparation, combined with accurate scheduling, will lead to a more stable work environment and reduce deferments and breakdowns, improve integrity and safety, and provide additional job satisfaction and ownership to technicians.

(3) The management and control of day-to-day maintenance on all process units and utilities of a site is to provide-

(a) support for a maintenance strategy based on doing programmed maintenance on time;
(b) safe, healthy and environmentally sound execution of maintenance work;
(c) availability of equipment; and
(d) business efficiency.

(4) The designated person for issue of work permit shall verify the execution of preparation activities before issue of the work permit.

(5) Maintenance work shall be undertaken in accordance with work permit requirements.

(6) Inspection personnel should be notified on time at which moment witnesses or hold points set.

(7) A verification of the HSE requirements should be carried as the maintenance execution includes HSE review and a toolbox talk as outlined in the work permit or work pack.

(8) The maintenance supervisor should ensure that a toolbox talk is held before work commences.

(9) Upon completion of the job, the job site should be left safe, clean and tidy and any excess materials should be returned to the stores and tools should be cleaned and returned to the workshop or put away in the correct storage place.

(10) On a daily basis, the progress of work should be reported. If the work is not completed, it should continue the next working day after taking requisite permission and approval from work permit issuing personnel.

(11) The work permit duly signed shall be returned to issuing authority on completion of job, removal of all material from site and handing over of facilities to user and like other events.

7.4 Maintenance Strategy:

(1) The facilities should be designed for minimum maintenance intervention.

(2) The maintenance requirements should be clearly defined and further optimized based on maintenance strategy reviews using tools such as reliability centred maintenance, Risk Based Inspection and Risk Assessment Matrix (RAM), after detailed equipment specifications are known.
(3) The criticality of the equipment shall be taken into account during the maintenance strategy selection.
(4) Appropriate diagnostic tools and staff competencies shall be provided to facilitate rapid fault finding and rectification and also to provide opportunistic maintenance during outages.
(5) Maintenance strategies shall maximize non-intrusive and on line data acquisition to support planning and analysis.
(6) Special Critical Equipment shall have OEM defined performance standards which shall be periodically tested and verified.
(7) Structural and pipeline survey and painting shall be done on a regular basis.

7.5 The entity shall prepare a written plan for preventive maintenance covering the scope, resources, periodicity and like other particulars. The corrective measures should include the preventive maintenance, scheduling, execution and closure.

7.6 Each facility should have well defined system for identification of spare part; rationalization and optimization to minimize any supply chain or logistics constraints and risks.

7.7 Well defined Roles and Responsibilities matrix should be available made for each machine as well as activity to be carried out in the workshop and the procedure for Audits and Review of the workshop shall be documented and adhered to.

8.0 Inspection:

(1) Each facility shall have written inspection, testing and commissioning program in place. Inspection shall include before commissioning during installation as well as during regular operation of the Petroleum Installation.
(2) All documents related to design, installation procedure of the respective vendors and the manufacturer's instruction for pre-commissioning and commissioning of the equipment, systems, instruments, control systems and like other devices shall be properly stored and followed.
(3) Inspection shall cover the review of test protocols and acceptance criteria that such procedures are in accordance with the protocols and acceptance criteria specified in line with OEM specific requirements
(4) Inspection shall cover that the equipment is installed in accordance with design, and any deviations documented and approved.
(5) All safety systems are installed inspected and tested as per design or OEM requirement.
(6) Inspection shall cover that all safety devices are installed and are in working condition as per the design or OEM requirements.
(7) Inspection shall cover the verification of various safety interlocks and ESD provided in the design.
(8) Inspection shall cover the adequacy of sealing systems.
(9) Inspection shall cover the electrical systems, check its integrity, earthing resistance, bonding and like other requirements.

(10) Inspection shall cover the integrity of mechanical and rotating equipment.
(11) The integrity and efficacy of gas detection, fire protection and fighting system and connected equipments shall be covered in the inspection.
(12) Inspection shall cover the efficacy of corrosion system.
(13) Inspection shall cover and review the mechanical completion records that the PSVs are of the correct type and sizing as per the P and IDs/data sheets.
(14) Inspection shall cover location of inlet pipe-work to relieving devices in relation to potential restrictions (such as above liquid levels, vessel internals, and like other potential restrictions).
(15) Inspection shall cover and review P and IDs to check the position of isolation valves for relieving devices, their capacities. Inspection to confirm by review of all vent locations (atmospheric vent from drums or equipment seals) that they vent to safe location and in the event of liquid carry over will not discharge to areas that may cause a hazard to personnel.
(16) Inspection shall review the area classification layouts and associated studies to confirm that all possible hazards have been appropriately considered (including possible migration) and the hazardous area drawings correctly account for the actual location of the sources of release the hazardous areas have been appropriately defined.
(17) Inspection shall cover that all ESD devices move to their safe condition on loss of system output, hydraulic power or instrument air. All ESD Valves and actuators shall remain functional following an explosion or under fire conditions for a sufficient time period to perform their intended function.
(18) The maximum allowable back pressure and minimum design temperature of the relief system shall be checked for suitability for the highest identified flow rate.
(19) Control System shall include all status monitoring and actions to and from the Control Rooms.
(20) Inspection shall cover the escape and evacuation passages.
(21) Inspection shall cover the emergency communication system for its effectiveness during emergency situations.

PART - G
(Competence Assurance and Assessment)

9.0 COMPETENCE ASSURANCE AND ASSESSMENT:

9.1 Every entity shall develop, implement, and maintain a written training plan to instruct all Petroleum installation personnel with respect to the following, namely: -

(1) Carrying out the emergency procedures that relate to their duties at the petroleum installation as set out in the procedure manual and providing first aid;
(2) Permanent maintenance, operating, and supervisory personnel with respect to the following, namely: -

(i) The basic operations carried out at the petroleum installation;
(ii) The characteristics and potential hazards of petroleum and other hazardous fluids involved in operating and maintaining the petroleum installation;

(iii) The methods of carrying out their duties of maintaining and operating the petroleum installation as set out in the manual of operating, maintenance and transfer procedures;
(iv) Fire prevention, including familiarization with the fire control plan, fire fighting, the potential causes of fire, the types, sizes, and likely consequences of a fire at petroleum installation; and
(v) Recognizing situations when it is necessary for the person to obtain assistance in order to maintain the security of the petroleum installation.

9.2 Each entity shall develop, implement, and maintain a written plan to keep its personnel up-to-date on the function of the systems, fire prevention, and security at the petroleum installation.

9.3 The Refresher programs for training of all personnel shall be conducted an interval not exceeding 3 years to keep personnel updated on the knowledge and skills.

9.4 Every entity shall maintain a record for each employee that sets out the training given to the employee under this Part.

9.5 Each entity shall ensure that petroleum installation personnel receive applicable training and have experience related to their assigned duties. Any person who has not completed the training or received experience shall work under the control of trained personnel.

9.6 For the design and fabrication of components, each entity shall use personnel who have demonstrated competence by training or experience in the design of comparable components and for fabrication who have demonstrated competence by training or experience in the fabrication of comparable components.

9.7 Supervisors and other personnel utilized for construction, installation, inspection, or testing shall have demonstrated their capability to perform satisfactorily the assigned function by appropriate training in the methods and equipment to be used or related experience and accomplishments and further their capability shall be assessed periodically.

9.8 Each entity shall utilize for operation or maintenance of components only such personnel who have demonstrated their capability to perform their assigned functions by successful completion of the training as specified in this behalf and possess experience related to the assigned operation or maintenance function.

9.9 Corrosion control procedures including those for the design, installation, operation, and maintenance of cathodic protection systems, shall be carried out by, or under the direction of, a person qualified by experience and training in corrosion control technology.

9.10 Personnel having security duties shall be qualified to perform their assigned duties by successful completion of the training as specified in this behalf.

9.11 There shall be a minimum level maintained with men apart from the security personnel for monitoring the facilities even during non operational hours.

9.11.1 During all operations even after the general shift, a dedicated fire fighting team should be present. Alternatively, the security personnel shall be trained and certified for operation of fire fighting and emergency handling.

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

9.12 Each entity shall follow a written plan to verify that personnel assigned operating, maintenance, security, or fire protection duties at the petroleum installation do not have any physical condition that would impair performance of their assigned duties. The plan shall be designed to detect both readily observable disorders, such as physical handicaps or injury, and conditions requiring professional examination for discovery.

9.13 Operations and Maintenance training:

Each entity shall provide and implement a written plan of initial training to instruct, the personnel as specified in succeeding paragraph 9.13.1 to 9.13.3.

9.13.1 All permanent maintenance, operating, and supervisory personnel;-

(1) about the characteristics and hazards flammable fluids used or handled at the facility, including, flammability of mixtures with air, odourless vapour, boil off characteristics, and reaction to water and water spray;
(2) about the potential hazards involved in operating and maintenance activities; and
(3) to carry out aspects of the operating and maintenance procedures that relate to their assigned functions.

9.13.2 All personnel of petroleum installation shall be trained to carry out the emergency procedures that relate to their assigned functions; and to give first-aid;

9.13.3 All operating and appropriate supervisory personnel of petroleum installation shall be trained to understand detailed instructions on the facility operations, including controls, functions, and operating procedure.

9.14 Security Training:

Personnel responsible for security at petroleum installation shall be trained in accordance with a written plan of initial instruction to-

(1) recognize breaches of security;
(2) carry out the security procedures that relate to their assigned duties;
(3) be familiar with basic plant operations and emergency procedures, as necessary to effectively perform their assigned duties; and
(4) recognize conditions where security assistance is needed.

9.15 Fire Protection and Fighting Training:

All personnel including officers, operators, security, T/T drivers and contract workmen, clericals who are likely to be present/working in the petroleum installation shall be trained in accordance with a written plan of initial instruction, including plant fire drills, to –

(1) know and follow the fire prevention procedures as specified in this behalf;
(2) know the potential causes and areas of fire determined;
(3) know the types, sizes, and predictable consequences of fire determined;
(4) know and be able to perform their assigned fire control duties according to the procedures and by proper use of equipment provided;
(5) each employee who undergo a refresher course once in every three years after initial training; and

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

9.16 Training Records;

Each entity shall maintain a system of records which-

(1) Shall provide evidence that the training programs required under this part have been implemented;
(2) Shall provide evidence that personnel have undergone and satisfactorily completed the required training programs; and
(3) Shall ensure that the records maintained for one year after personnel are no longer assigned duties at the petroleum installation.

PART - H

(Vehicle Management System)

10.0 Vehicle Management System:

The transportation management document shall describe the procedures for effective day-to-day management of Road Transport and such management shall include driver selection, recruitment and training, health screening, working hours and other terms and conditions relating thereto.

10.1 Driver Management:

The selection and training of drivers shall be in consonance with conditions as specified in succeeding paragraph 10.1.1 and 10.1.2.

10.1.1 Qualification of driver:

(1) The driver shall hold a valid driving license for type of vehicle to be driven and shall be authorized to drive vehicles carrying specific class of product under local Dangerous Goods regulations.
[1][****]
(3) The driver can demonstrate knowledge of local road or highway regulations.
(4) The driver can able to read and write in local language and comply with local legal regulations in terms of qualifications and requirements for him.
(5) Competence assessment of the driver should be carried out by a company-approved driving examiner with on-road test.

10.1.2 Training and communications:

The following shall be ensured, namely; -

[1] The words and expression mentioned are omitted by sub-cl (t) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(1) That the driver has completed induction training on company rules and emergency response procedures;
(2) That the driver has attended defensive driving course within last two years;
(3) That the driver has undergone training on first aid procedures;
(4) That the driver has completed necessary training as per hazardous good transportation procedures;
(5) That the driver should attend regular tool box meeting, safety meetings; and
(6) That the driver should attend daily/trip wise counselling on journey management.

10.2 Journey Management:

10.2.1 Journey management plans and controls shall have the following elements, namely: -

(1) Routes between supply point and major destination shall be drawn up using effective journey management system in order to avoid unsuitable roads and congested areas as far as practicable;
(2) Journey time shall be established for such routes and rest and reporting points designated on the long routes which exceed normal driver shift time;
(3) Resting points where suitable accommodation is available to be designated by management;
(4) Competent person supervise the journey management plan and procedures;
(5) System to be in place for deployment of emergency response procedures;
(6) Known en-route hazards, such as steep gradients, narrow bridges, poor road surface to be identified and recorded in the journey management plan;
(7) Route hazards maps to be produced and made available to drivers; and
(8) Trip time and other special route hazard information to be given to driver with customer invoice paperwork.

10.2.2 Driving and duty hours:

(1) Comply to legal requirements, if any, irrespective of any limits specified in the succeeding sub-paragraph and the drivers shall not drive or be requested to drive when feeling tired and effective fatigue management procedures should be in place.
(2) The continuous driving shall not exceed three hours and it should be followed by minimum 15 minutes rest. The rest shall be taken on continuous block and either away from vehicle or, if taken in a sleeper cab, while vehicle shall be stationary and alternatively, two drivers can be used with a monitoring system for rest after every three hours.
(3) Tachograph or in vehicle monitoring system to be fitted for vehicles.

10.3 Vehicle Management:

All vehicles shall comply with local legal requirements and respective company standards and the vehicles shall be designed and equipped for local environments and intended range of operation and the following shall be ensured, namely: -

(1) The tank truck shall be visually “well maintained “and capable of meeting basic safety inspection consistent with safe manoeuvering at low speeds within confines of loading or delivery location. The inspection includes brake operation and tyre inspection. (tie having a visible tread pattern and no obvious damage);
(2) Three-point inertia reel seat belts to be fitted for crew;
(3) The tank truck shall be fitted with an external engine cut-off device;
(4) The tank truck shall be fitted with audible reversing alarm;

(5) The tank truck should have product tank with an internal valve to prevent product leakage if an external outlet valve is damaged;
(6) The tank truck shall have an exhaust system adequately shielded from direct contact with fuel from overfilled tanks leaks;
(7) The tank truck [1][or the loading arm meant for filling the tankers] shall have overfill protection system (compatible with loading rack facilities);
(8) The tank trucks shall be loaded and operated within maximum permissible gross weight and in accordance with national regulation and approved limits by RTO for both rigid chasis and trailer body;
(9) Trailer tank to be fitted with overturn protection that gives effective protection to man lids in the event of vehicle roll-overs;
(10) Tank top safety rail or harness system to prevent driver from falling when or if working on tank top;
(11) Tank truck shall be provided with a spill kit capable of dealing with small spills < 10 ltrs."; and
[2][(12) In case of Dangerous Goods, Heavy Goods Vehicles (HGV) shall be fitted with at least One number of minimum 9 kg Dry Powder fire extinguisher on side of tank and 1 kg CO2 Fire extinguisher in Tank Truck cabin.]

PART - I

(Safety Management System)

11.0 Safety Management System:

The organization should establish a safety management system which shall be an integral part of the overall management system. Safety Management System (SMS) should be based on PDCA (Plan, Do, Check and Act) cycle which comprises of-

(1) Policy setting which includes policy, corporate acceptance of responsibility, objectives, requirements, strategies;
(2) Organization which includes structure, accountability and safety culture, involvement of the workforce, systems for performing risk assessment;
(3) Planning and execution which includes operational standards and procedures for controlling risks, permit to work, competence and training, selection and control over contractors, management of change, planning and control for emergencies and occupational health;
(4) Measuring and evaluating which includes active monitoring, recording and investigation of incidents or accidents, auditing and handling of non-conformities; and

[1] Ins. by sub-cl (u) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)
[2] Subs. by sub-cl (w) *ibid.* (w.e.f. 29.03.2023)

(5) Continuous improvement which includes review and application of the lessons learnt and Safety management system should not degenerate into a paper exercise only, conducted solely to meet regulatory requirements.

11.1 **Elements of Safety Management system:**

Safety management system should include at least the basic elements as specified in the succeeding paragraph 11.2 to 11.15.

11.2 **Safety Organization**:

Leadership and Management Commitment should be clearly visible in the SMS. Management should develop and endorse a written description of the company's safety and environmental policies and organizational structure that define responsibilities, authorities, and lines of communication required to implement the management program. Management should review the safety and environmental management program to determine if it continues to be suitable, adequate and effective at predetermined frequency. The management review should address the possible need for changes to policy, objectives, and other elements of the program in light of program audit results, changing circumstances and the commitment to continual improvement. Observations, conclusions and recommendations of management review should be documented.

11.3 **Safety Information**:

Comprehensive safety and environmental information for the facility, which includes documentation on process, mechanical and facility design, should be developed and maintained throughout the life of the facility.

11.4 **Process Hazard Analysis**:

The purpose of Process Hazard Analysis (PHA) is to minimise the likelihood of the occurrence and the consequences of a dangerous substance release by identifying, evaluating and controlling the events that could lead to the release. Process hazards analysis should be performed for any facility to identify, evaluate, and reduce the likelihood or minimize the consequences of uncontrolled releases and other safety or environmental incidents and human factors should also be considered in this analysis. The process hazard analysis should be updated and revalidated by a team, having requisite back ground, at least every 5 years after the completion of initial process hazard analysis. Recommendations resulting from the PHA should be completed before start-up for a new process or facility, or modification in existing facility.

11.5 **Operating Procedures**:

Written down operating procedures shall be available describing tasks to be performed, data to be recorded, operating conditions to be maintained, samples to be collected and safety and health precautions to be taken for safe operation. Operating procedures should be based on process safety information so that all known hazards are taken care of. The human factors

associated with format, content, and intended use should be considered to minimize the likelihood of procedural error.

11.6 **Safe Work Practices**:-

The entity shall maintain procedures that address safe work practices to ensure the safe conduct of operating, maintenance, and emergency response activities and the control of materials that impact safety and such safe work practices may apply to multiple locations and will normally be in written form (safety manual, safety standards, work rules, and like other written forms) but site-specific work practices shall be prepared and followed. In cases where an employee believes that following a procedure will cause an unsafe condition, he shall have authority to stop work and get permission from appropriate level to deviate and deviations should be documented for future analysis.

11.7 **Training:**

The training program shall establish and implement programs so that all personnel including contractors are trained to work safely and are aware of environmental considerations, in accordance with their duties and responsibilities. Training shall address the operating procedures, the safe work practices, and the emergency response and control measures and any change in facilities that requires new or modification of existing operating procedures may require training for the safe implementation of such procedures and the training should be provided by qualified instructors and documented.

11.8 **Management of Change (MOC)**:

There should be procedures to identify and control hazards associated with change and to maintain the accuracy of safety information and for each MOC, the operator shall identify the potential risks associated with the change and any required approvals prior to the introduction of such changes. The types of changes that a MOC procedure addresses shall include-

(i) technical;
(ii) physical;
(iii) procedural; and
(iv) organizational,

and such procedure shall consider permanent or temporary changes and the process shall incorporate planning for the effects of the change for each situations relating thereto and the procedures should cover the following, namely: -

(i) The process and mechanical design basis for the proposed change;
(ii) An analysis of the safety, health, and environmental considerations involved in the proposed change, including, as appropriate, a hazards analysis;
(iii) The necessary revisions of the operating procedures, safe work practices, and training program;

(iv) Communication of the proposed change and the consequences of that change to appropriate personnel and the necessary revisions of the safety and environmental information;
(v) The duration of the change, if temporary; and.
(vi) Required authorizations to effect the change.

11.9 **Contractors:**

When selecting contractors, operators should obtain and evaluate information regarding a contractor's safety and environmental management policies and practices, and performance there under, and the contractor's procedures for selecting subcontractors. The entities shall communicate their safety and environmental management system expectations to contractors and identify any specific safety or environmental management requirements which they have for contractors. Interfacing of SMS of various entities (operator, contractor or service provider, subcontractor and third-party) should be ensured through a well written bridging document. Entity shall document the clear roles and responsibilities with its contractors.

11.10 **Assurance of quality and mechanical integrity of critical equipment**:

Procedures should be in place and be implemented so that critical equipment for any facility is designed, fabricated, installed, tested, inspected, monitored, and maintained in a manner consistent with appropriate service requirements, manufacturer's recommendations, or industry standards. Entity shall maintain inspection and testing procedures for safety-related equipment. Human factors should be considered, particularly regarding equipment accessibility for operation, maintenance and testing.

11.11 **Pre-startup Safety Review:**

Before a new or modified unit is started, a systematic check should be made to ensure that the construction and equipment are in accordance with specifications; operating procedures have been reviewed; hazards analysis recommendations have been considered, addressed and implemented; and personnel have been trained. It should be ensured that programs to address management of change are in place.

11.12 **Permit to Work (PTW) System:**

PTW system is a formal written system [1][(online or offline)] used to control certain types of work which are identified as potentially hazardous. Essential features of permit-to-work systems are as specified below, namely: -

(i) Clear identification of who may authorize particular jobs (and any limits to their authority) and who is responsible for specifying the necessary precautions;
(ii) Training and instruction in the issue, use and closure of permits;
(iii) Monitoring and auditing to ensure that the system works as intended;

[1] Ins. by sub-cl (v) of cl. (vi) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(iv) Clear identification of the types of work considered hazardous; and
(v) Clear and standardized identification of tasks, risk assessments, permitted task duration and supplemental or simultaneous activity and control measures.

11.13 **Emergency Planning and Response:**

A comprehensive Emergency Response and Disaster Management Plan (ERDMP) shall be developed in accordance with the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010. The copies of the ERDMP shall be maintained at each petroleum installation. The emergency response planning shall have clear written procedures for expected actions during anticipated emergencies and emergency response plan shall include operational and procedural requirements for various emergency scenarios that are relevant for the installation and the emergency procedures shall contain inter alia as specified below, namely: -

(i) The emergency procedures shall include, at a minimum, emergencies that are anticipated from an operating malfunction of any component of the petroleum storage, handling and transportation facilities, personnel error, forces of nature, and activities carried on adjacent to the facilities;

(ii) The emergency procedures shall include but not be limited to procedures for responding to controllable emergencies, including the following, namely: -

(a) The notifying of personnel;
(b) The use of equipment that is appropriate for handling of the emergency;
(c) The shutdown or isolation of various portions of the equipment; and
(d) Other steps to ensure that the escape of gas or liquid is promptly cut off or reduced as much as possible;

(iii) The emergency procedures shall include procedures for recognizing an uncontrollable emergency and for taking action to achieve the following, namely: -

(a) Minimize harm to the personnel at the petroleum storage, handling and loading or unloading facilities and to the public;
(b) Provide prompt notification of the emergency to the appropriate local officials, including the possible need to evacuate persons from the vicinity of petroleum installation;
(c) The emergency procedures shall include procedures for coordinating with local officials in the preparation of an emergency evacuation plan that sets forth the steps necessary to protect the public in the event of an emergency, including the following, namely: -

(i) Quantity and location of fire equipment throughout the petroleum installation;
(ii) Potential hazards at the petroleum installation; and
(iii) Communication and emergency-control capabilities at the petroleum installation.

11.14 **Incident Investigation and Analysis**:

Procedures for investigation of all incidents as per the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010 shall be developed. Incident investigations should be initiated as promptly as possible, considering the necessity of securing the incident scene and protecting people and the environment. The intent of the investigation should be to learn from the incident and help to prevent similar incidents. A corrective action program should be established based on the findings of the investigation to prevent recurrence.

11.15 **Compliance Audit**:

Safety Audits are the periodic examination of the functioning of safety system and it gives an idea about how effectively the safety system is implemented and how they are being accomplished and it is the feedback mechanism that provides management with the status and measurement of effectiveness of the various safety system elements and activities and leads to the appropriate control over such efforts. The audit program and procedure should cover the following, namely: -

(i) The activities and areas to be considered in audits;
(ii) The frequency of audits
a. Internal Audit : Every year (including those years in which External Audit is undertaken);
b. External Audit : Once in three year;

(iii) The audit team;
(iv) How audits will be conducted; and
(v) Audit Reporting;

and the findings and conclusions of the audit should be provided to the management and the management should establish a system to determine and document the appropriate response to the findings and to assure satisfactory resolution. The audit report should be retained at least until the completion of the next audit.

11.15.1 Internal and External Safety Audits:

Audit conducted by Internal Audit teams of the organization shall be categorized as Internal Safety Audit. Internal Safety Audits shall be coordinated by local management under the overall direction from the respective Corporate Offices. External Safety Audits shall be carried out through PNGRB empanelled third party agency or multidisciplinary team constituted by PNGRB.

[1][PART J:

[Aviation Fueling Station (AFS]

12.0 Applicability:

For Aviation Fuel Stations across the country falling under the scope of these regulation; Part A, Part B, Part C, Part E and paragraph 10.1.1 of Part H (that is to say Qualification of Driver) shall be superseded by Part J and remaining parts that is to say Part D, Part F, Part G, Part H, Part I shall hold good except Clause 10.1.1 of Part H.

The paragraphs of this Part are applicable for such Aviation Fuel Station or installation, where aggregate above ground storage capacity is equal to or more than 1000 KL.

12.1Scope:

This Part lays down minimum safety requirements in layout, design, fire protection system, hydrant refueling system and supply and handling of aviation product in barrels or packed conditions, keeping in view specific requirements for AFS and availability of a reliable fire fighting support from the airport operator.

12.2Installation layout:

12.3Layout Philosophy:

Following philosophy should be adopted in layout of an Aviation Fuel Station, namely: -

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

(b) **Physical segregation or demarcation of hazardous and non-hazardous areas shall be provided. Layout indicating hazardous and non-hazardous area segregation or demarcation shall be available. Hazardous area segregation or demarcation shall be as per latest IS 5572.**

(c) **AFS facilities should be located based on the following, namely:-**

(i) De-licensed area consisting of admin building, security cabin and utilities should be nearer to the entry or exit gates to minimise movement of personnel in licensed premise.

(ii) TT unloading, refuellers loading area and refuellers parking shall be located in such a way that vehicular movement is minimised; and

(iii) Facilities should be laid such that length of drain leading to OWS is minimal.

(d) ***Risk Analysis or 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 or mitigation measures shall be given due credit. The outcome of risk assessment shall guide in preparation of onsite and off-site emergency plan. Quantitative Risk Assessment (QRA) shall be done whenever major additions in facilities or major changes in the surrounding areas, operating parameters, product grade takes place or once in every five years ,whichever is earlier.***

(e) **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.**

[1] Ins. by cl. (vii) of reg (2) the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Amendment Regulations, 2023 (w.e.f. 29.03.2023)

(f) **Roads inside the hazardous area of an AFS shall be restricted to vehicles required for operational, maintenance and safety or security reasons and are to be allowed only with proper safety fittings and authorization from location in-charge or designated safety officer or Shift In-charge.**
(g) **Road widths, gradient and turning radii at road junctions shall be designed to facilitate movement of the fire-fighting vehicle envisaged in the event of emergency.**
(h) **The access of facility should be available from two approaches.**
(i) **Layout should consider the space requirements for the following, namely:-**
    (i) Maintenance and inspection of each equipment or facility;
    (ii) Dedicated area for construction activities;
    (iii) Future expansion for addition of facilities;
    (iv) Parking of refuellers or hydrant dispensers and other vehicles; and
    (v) TT Parking area based on expected fleet size.
(j) **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 arrestor fitted on the vehicle.**
(k) **The maximum height of structure at the AFS shall not exceed the maximum permissible height specified by the local airport authority or operator.**

12.3.2 Layout of facilities:

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

(a) **Storage tanks, utility requirements**
(b) **Product receipt or dispatch and mode of transport (by Road and 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 or disposal facilities.**
(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 or 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.**

12.3.3 General Considerations:

While locating the various facilities the following should be considered, namely: -

(a) **Tank farm, loading or unloading gantry, utilities, and approach roads should be suitably constructed to prevent flooding.**
(b) **Operations Control Room, SCADA and server 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 or server room for the AFS.**
(d) **Utility blocks 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-stations shall be terminated or located outside the hazardous area.**

(g) **Tank truck or refuellers movement inside the AFS shall be kept to minimum. The truck or refuellers loading or 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 or refuellers in the gantry shall be in drive out position for easy escape in case of emergency.**

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

(i) **Roads should be provided in a 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 and 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.**

(l) **The provision should be made to receive the water from other sources including mutual aid or sharing of water into fire water storage tanks.**

(m) **All buildings which are not related to AFS operation should be located at upwind of hydrocarbon storage and handling facilities and they shall be located outside the hazardous area, and such areas include administration, canteen with a separate entry and special care should be taken for canteen location where any spark or open flame is likely to exist.**

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

(o) **Room for storing hydro carbon samples shall be provided with bottom exhaust for release of flammable vapours. Electrical fittings as well as electrical equipment shall be flame proof. Adequate number of fire extinguishers should be placed, wherever required.**

(p) **Electrical equipment or 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 shall be of approved type.**

(q) **The additives shall be stored at the designated or segregated area as per respective Material Safety Data Sheet.**

(r) **Unlicensed area shall be suitably demarcated by fencing.**

12.3.4 Layout of Storage Tanks:

12.3.4.1 Dyked Enclosures:

(a) **Above ground ATF storage tanks shall be located in dyked enclosures. Facility shall be accessible from atleast two sides. 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 or 10% of calculated dyke capacity, whichever is higher, shall be provided for fixing the height and capacity of the dyke.**

(c) **Enclosure capacity shall be calculated after deducting the following volumes, namely:-**

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

(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.**

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

(f) **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 or polyethylene sheet**

to prevent the ground water contamination in addition to brick or stone pitching or PCC. For existing facilities, imperviousness of dyke enclosure should be ensured using any suitable technology.

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

(h) **Pump stations and piping manifold should be located outside dyke areas.**

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

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

(k) **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.**

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

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

(n) **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 shall be ensured ,namely:-**

(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 storage tanks; and

(iv) Suitable railing for fall protection to be provided at cross over in case of dyke height is more than 1.5 metre.

(o) **In case of buried tanks - Under Ground (UG or buried) and Semi-buried (SB) tanks:**

(i) Semi-buried tanks are treated as underground storage tanks for calculation of inter-distance between the facilities;

(ii) Kerb wall of minimum 300 mm height should be provided in the UG or SB tank Farm Area to contain accidental overflow.;

(iii) A minimum of 1.5 m clear distance from the tank shell shall be maintained from structures or boundary;

(iv) Vents shall be located or terminated at a distance of 4 m from hazards and shall be at minimum 4 m height from the ground level;

(v) The open end of vent pipe shall be covered with non-corrodible metal wire gauge preferably SS having 60 meshes and shall be further protected from rain by hood or by suitably bending it downward;

(vi) Aviation fuels shall enter a tank through closed piping system or coupled electrically continuous and sound hose; and

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

(p) **Corrosion control measures such as wrapping- coating for buried pipelines and tanks, Internal epoxy lining of tanks and hydrant pipelines, provision of Cathodic protection for hydrant pipelines shall be undertaken.**

12.3.4.2 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.**

12.3.4.3 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 600 mm shall be provided to prevent spills from one tank endangering any other tank in the same enclosure.**

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

12.3.4.4 General:

(a) **For aboveground vertical storage tanks, the tank height shall not exceed one and half times the diameter of the tank or maximum 20 m, whichever is less.**

(b) **All Piping from or to any tank including connected sprinkler or foam line shall comply with the following, namely:-:**

(i) They shall not pass through any other dyked enclosure;

(ii) They shall run directly to outside of dyke to minimise piping within the enclosures; and

(iii) They should not pass-through other tank areas or fire walls.

(c) **Piping design inside tank dyke area should ensure easy accessibility for any operations in the tank farm and wherever necessary well-designed cross-overs shall be provided to cross the pipelines running within the dyke area. Elevated catwalks above the height of the dyke wall shall be provided for safe access and exit in case of normal or emergency situations. The catwalks shall run at the same level and terminate directly outside the dyke.**

(d) **No part of the dyked enclosure should be below the level of surrounding ground immediately around the outside of dyke area.**

(e) **Minimum distance between a tank shell and the inside toe of the dyke shall not be less than half the height of the tank**

12.3.5 Protection of Facilities:

12.3.5.1 Proper approach towards various facilities should be provided within the AFS for smooth access of fire tenders in case of emergency, for AFSs storing more than 1000 KL in above ground tanks.

12.3.5.2 For AFSs located outside airport or defence premises, the boundary wall should be constructed as per the directives of the Government of India, in the Ministry of Home Affairs or any other Central Government directive. In any case the boundary wall shall be of minimum 3m height with V or Y or X shaped barbed wire fencing on the wall with 600 mm diameter concertina coil on top.

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

12.3.5.4 CCTV shall be installed in AFSs, other than defence, with aggregate above ground storage tank capacity more than 5,000 KL. The CCTV shall cover entry and exit gate, periphery of installation and all critical operating areas such as tank farm, loading or unloading area, which should be monitored continuously. The CCTV monitoring station should be provided in SCADA, or SHIFT room, security cabin and Location In-charge room.

12.3.6 Separation Distances:

12.3.6.1 Minimum separation distances between various facilities described above shall be as per Tables-1, 2 and 3 of these part . Every table of these part shall be read in conjunction with the notes specified with the table.

12.3.6.2 The layout shall also take into account findings and recommendations of HAZOP or Quantitative Risk Assessment study, which shall be carried out at all the stages of facility development process.

12.3.6.3 For large AFS, 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.

12.3.6.4 For medium sized AFS, minimum separation distances shall be as specified in Table-2. This table is applicable where total above ground storage capacity for ATF is above 1000 KL but less than or equal to 5000 KL.

12.3.6.5 For other category AFSs, minimum separation distances shall be as specified in Table-3. This table is applicable where total above ground storage capacity is equal to 1000 KL or where AFSs are having buried or semi-buried tanks irrespective of storage capacity.

12.3.6.6 In case of an existing AFS where inter-distances between various facilities are not conforming to the Table- 1 or 2 or 3 of these part (as applicable), then QRA or HAZOP study shall be conducted and suggested mitigation measures shall be implemented.

TABLE – 1

Separation Distances Between Facilities for Large AFSs with Above Ground Tankage > 5000 Kl

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

General Notes to Table-1:

All distances are in metre and the table specified the minimum requirement.

(a) "D" indicates the diameter of the larger tank.

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

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

(d) "X" means any distance suitable for constructional or operational convenience.

(e) 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.

(f) Pig launcher or receiver at liquid hydrocarbon handling pipeline installations should be located at least 5 m from boundary.

Specific notes to Table-1:

1. OWS or Pits shall be minimum 1.5 m from boundary wall. However, OWS or Pits 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 or source of ignition.

TABLE – 2

Separation distances between tank/ offsite facilities for AFSs with Above Ground Tankage >1000KL and ≤5000KL

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

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 also applicable for Table- 2.

TABLE – 3

Separation Distances between tank for AFS with Above Ground tankage =1000KL or buried/semi-buried tanks irrespective of capacity

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

General notes to Table –3:

(a) All distances are in metre and the table specifies the minimum requirement.
(b) Distance norms between buried or semi buried tanks will not be applicable. The distance between buried or semi buried tanks and 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 or unloading area where the distance shall be from the centre of each bay.
(h) Pig launcher or receiver should be located at least 5 m from boundary.
(i) Safety distances between tanks and other facilities (other than boundary are not applicable for double walled above ground storage tanks. No dykes are required for such tanks.

For Aviation Fuel Stations:

1. For underground and 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 or source of ignition.

12.4 Design Considerations:

12.4.1 Design of storage tanks

12.4.1.1 Tank design:

(a) **All horizontal tanks ,above ground, underground and semi buried, shall be as per IS 10987 or any equivalent industry standard. Semi-buried tanks are considered as underground storage tanks for all purposes.**

(b) **atmospheric pressure tanks shall be designed as per, API 650 or IS 803 or any other equivalent standard.**

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

(d) **Tank bottoms should be cone down with a continuous slope towards centre sump for vertical tanks as per relevant standards and horizontal tank should be installed with a continuous slope of 1:60 minimum.**

12.4.1.2 Tank Appurentences:

(a) **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.**

(b) **Stairs should be made of grating. All staircases shall have resting or landing platform for a height not exceeding 5m.**

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

(d) **Walkway with hand rail on the roof of the tank should be provided to facilitate inspection or checking of vents, so that movement of personnel on roof is safer. Anti-slippery path on the roof should be provided for this purpose.**

(e) **All ATF 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.**

(f) **Sampling sump shall be provided in all types of Aviation tanks.**

(g) **For vertical tanks minimum one no. sampling draw off line or one water draw off line should be provided.**

(h) **Flash Back Arrester (Flame arrester) vents where fitted should be as per IS 11006 or adequately sized free vents should be provided for ATF tanks as API 2000 and also considering the following , namely :-**

(i) Maximum and minimum ambient temperatures;

(ii) Vapour pressure of the product at operating or design temperature;

(iii) Maximum pumping in and out rates.

(i) Free Vents shall be provided with Screens made of stainless steel to prevent the ingress of foreign bodies and shall have a coarse mesh with approximately 60 mesh size or finer.

12.4.2 Tank farms and manifolds:

12.4.2.1 Tank Farm Drains for AFS with storage capacity more than 1000 KL:

(a) **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.**

(b) **The outlet from dyke shall have the provision to divert to the OWS or Pits or to main storm water drain.**

(c) **In case of 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.**

(d)

12.4.2.2 Tank Manifold:

(a) **The number of inlet or outlet connections to the tank shell should be kept minimum.**

(b) **Tank body valve of above ground tanks shall be manually operated valve or motor operated or remote operated shut off valve type.**

(c) **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 where HRS system is not installed, in place of MOV, manual operated valve may be provided. This second valve should be located outside the dyke area.**

(d) **All AFSs with above ground storage capacity more than 5000 KL shall have over-fill protection system.**

(e) **Hammer blind valves of any type shall not be used in AFSs.**

(f) **MOV should have open and close remote operation from SCADA or shift room and at field outside of dyke. ROSOV wherever provided shall be fail safe and fire safe (shall close in case of signal failure) and the actuator shall be failsafe. The cables leading to the control room shall be fire resistant. ROSOV shall have only close operation from control room or at a strategic remote location.**

(g) **In addition, open, close and stop feature should be available for local operations, close to the valve.**

(h) **Tank manifold, 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 or Pits.**

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

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

(k) **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 through 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 or cleaning.**

(l) **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.**

12.4.2.3 Tank Settlement:

(a) **Tank Settlement should be effectively made up with proper slope to avoid rain water accumulation and subsequent corrosion of the bottom plate.**

(b) **Where large settlement is anticipated, supporting arrangement for the connected piping shall be suitably designed to take care of the settlement.**

12.4.3 Drain or sampling point:

12.4.3.1 Drain or sampling point in Above Ground tanks:

(a) **Arrangement should be provided in all above ground tanks for product sampling and water draw off from tanks. Number and details of the drains shall be as per the applicable tank design standard.**

(b) **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 or capping arrangement.**

12.4.3.2 Drain or sampling point in Buried or Semi Buried tanks

(a) **Arrangement should be provided in all buried and semi buried tanks for product sampling and water draw off from tank.**

12.4.4 Vent:

12.4.4.1 Open Vents: For sizing the vents API 2000,it shall be referred. Following basic guidelines should be followed while designing vent, namely:-

(a) **Maximum and minimum ambient temperatures;**
(b) **Vapour pressure of the product at operating or design temperature; and**
(c) **Maximum pumping in and out rates.**

12.4.5 Dip Hatch or Sampling:

(a) **Dip hatch or gauge hatch, used for gauging the height of the liquid in an above ground tank as well as to take out samples for testing, shall be provided. In underground and semi buried tanks, separate sampling hatch should be 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 or strips with bottom plate of the tank.**

12.4.6 Instrumentation:

12.4.6.1 Level controls on Tanks shall be as follows, namely:-

(a) **High Level (H): Between normal fill level and safe fill level;**
(b) **High High Level (HH): At safe fill level ;**
(c) **"H" and "HH" level switches shall have provision of audio and visual alarms on auto-actuation in the control room;**
(d) **"HH" level switch shall have audio alarm on auto-actuation in the control room and auto actuation of shut off valve;**
(e) **"L" alarm may be interfaced with pump for dry run protection ;**
(f) **The above alarms shall be provided as given below in the table, namely:-**

AFS with total storage equal to 1000 KL above ground.	NIL requirement.
AFS with total storage 5000 KL and more (above ground tanks)	Hi, Hi-Hi alarm and ESD or ESB System.
AFSs with above ground storage tank of capacity 1000 KL and above but less than 5000 KL	Hi level alarm.

The above shall be applicable to all locations;

(g) **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.**
(h) **Adequate measures should 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 or pump tripping should be provided.**

12.4.7 Piping or valves or flanges:

12.4.7.1 Piping:

(a) **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.**
(b) **Pipe joints should be welded as far as practicable with full penetration weld. Number of flanged or threaded joint should be kept to a minimum.**
(c) **In case sampling point is provided on receipt line for operational requirement, the same should be provided outside of dyke in the manifold.**
(d) **Sectionalizing of the pipe lines with isolation valves and arrangements for injection or draining of water shall be provided for facilitating hydro-testing of the pipe lines.**
(e) **The product hydrant pipelines should be provided with low point and high point drains to facilitate emptying, sampling or hydro-testing. Ends of each drain point should have provision of blind flange or capping arrangement.**
(f) **Buried piping shall be protected against physical damage and corrosion with suitable protective coating.**

12.4.7.2 Valves:

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

12.4.7.3 Fittings:

(a) **Steel flanges and flanged fittings shall conform to relevant ASME or ASTM or ANSI or equivalent. Slip on or weld neck flanges should be used. Screwed flanges for sizes 50 mm or smaller may be used.**
(b) **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.**
(c) **All flanges shall be connected for bonding for electrical continuity.**

12.4.8 Bulk Loading or unloading operations:

12.3.8.1 Loading or 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 or screw capped.**
(c) **Pumps shall be located in an exclusive paved area with drainage facilities routed to OWS or Pits for AFSs with above ground storage tank of capacity more than 1000 KL.**
(d) **Pump house shall be positioned at an elevated platform and shall be well ventilated on all four sides. In case site condition does not allow for pump house at elevated level, suitable arrangement to be provided to ensure disposal of accumulated product.**
(e) **Pump-motors shall be provided with suitable IP protection.**
(f) **Unloading or loading pumps shall also be provided with additional flame proof switch located at the strategic location near the loading-unloading bays to switch off the pump in case of emergency such as over flow, fire or any other abnormal situation.**
(g) **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. 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.**

(h) **In addition to above, locations having automation shall be provided ESD (Emergency shutdown) feature through automation system.**

12.4.8.2 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 that is to say, Cast steel Plug or Ball Valves.**
(c) **Automated locations may provide suitable overfill protection system to prevent any overflow and hazards arising out of that.**
(d) **Loading hoses for Tank Trucks and refuellers shall be as per relevant API or EI or EN or 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 or unloading during night is required to be done.**
(f) **Operating personnel of large size AFSs (storage more than 5000 KL) should be provided with intrinsically safe walkie-talkie sets.**
(g) **AFSs with Tank Truck unloading or 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 and 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. Alternatively, Swing type hydraulic loading platforms without counter weight can also be provided.**
(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.**
(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 or refuellers, if not exempted by PESO, entering AFS shall be provided with PESO approved spark or flame arrestor at the exhaust. Vehicle confirming to BS IV and above are exempted for fitment of spark arrestor.**
(n) **Oil and water collected from loading or unloading areas shall be routed to OWS or Pits for AFSs with above ground storage tank of capacity more than 1000 KL. 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.**

12.4.9 Design Layout for Handling of Slop

12.4.9.1 Drainage and Collection:

(a) **A network of drainage system shall be provided to collect oil drains from various equipment, loading or unloading areas, pump houses and like other areas.. The drainage shall lead to OWS or Pits.**

12.4.9.2 OWS or Pits:

(a) **The receiving sump of the OWS or Pits shall have suitable arrangement for skimming off upper layer of accumulated oil.**

12.4.10 Electrical Equipment:

12.4.10.1 Selection:

(a) **Selection Electrical equipment including the lighting system shall conform to hazardous area classification. The hazardous area shall be classified as per IS: 5572 and Petroleum Rules, 2002.**

(b) **The electrical fittings or equipment in the respective classified area or zone shall be of a type suitable for the particular area or zone as per classification in line with IS: 5571.**

(c) **Electrical equipment shall be selected, sized and installed so as to ensure adequacy of performance, safety, reliability and shall conform to relevant Indian Standards.**

12.4.10.2 Protection:

(a) **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 and lightning surges. Relays and protective devices shall be suitably selected and installed.**

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

12.4.10.3 Cables:

(a) **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.**

(b) **All power and control cables in hazardous area shall have extruded inner and outer sheaths. Cables should be Aluminium or Copper Conductor PVC insulated, PVC sheathed and armoured type.**

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

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

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

(a) **Emergency Feeder shall host equipments such as fire water jockey pump, critical lighting, fire siren, bore well, gate barrier, safety instrumentation and interlocks, CCTV, UPS of automation and supply to essential firefighting equipment.**

12.4.12 Installation Earthing:

12.4.12.1 AFS earthing design shall be carried out in accordance with the requirements of Central Electricity Authority (CEA) safety Regulations, 2010 and IS 3043 or equivalent system recognized by statutory authorities under the law in force relating petroleum and electricity and all earth connections should be visible for inspection for extent possible.

12.4.12.2 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, namely: -

(a) **System neutral earthing;**

(b) **Protective Equipment Earthing for personnel safety;**
(c) **Protection against Static discharges;**
(d) **Lightening Protection; and**
(e) **Earthing for Data Processing system.**

12.4.12.3 Measurement of earth resistance:

(a) **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 should be used for this purpose.**
(b) **Removable link shall be provided to allow measurement of an earth electrode-resistance.**

12.4.12.4 Allowable Earth-Resistance values:

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

(a) **4 Ohms for electrical systems and metallic structures;**
(b) **7 Ohms for storage tanks;**
(c) **1 Ohm for main earth grid, and bonding connections between joints in pipelines and associated facilities; and**
(d) **2 Ohms for each electrode to the general mass of the earth.**

12.4.12.5 Electrically independent earth electrodes:

(a) **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.**
(b) **The Lightning Arrestor (LA) to be provided for Di Pole or Four Pole structures and shall be connected to two distinct earth pits. The strips shall run on insulators or 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.**
(c) **The Di Pole or Four Pole structure shall be earthed with two distinct earth connections. The Gang Operated Switch shall also be earthed.**
(d) **Fencing of Di or Four Pole, Transformer yard shall be earthed and also electrical continuity between various structures, the fencing shall be ensured.**
(e) **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.**
(f) **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.**
(g) **The transformer body shall be earthed at two points separately leading to earthing system.**
(h) **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.**
(i) **All the electrical equipment operating above 250 volts shall have two separate connections to the earth. (such as Sub Station Panels, Motors, FLP JBs).**

(j) **All Steel structures, loading platform or gantries and like other devises,. shall have two separate and distinct connections. Connections shall be made to the pit directly and then, pits shall be connected to each other to form a grid.**
(k) **Storage Tanks shall have minimum two separate and distinct connections. Each connection will be made to the respective earth pit directly. Thereafter 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 or connections should be increased for large tanks so that the distance between the connections shall not exceed 30 metre on the tank perimeter.**

12.4.12.6 Bonding:

(a) **All flanged connections shall be effectively bonded by strips of suitable material.**
(b) **Inside AFS, for the tank truck or Refueler Loading or Unloading bays minimum 6 mm Sq. braided copper wire with one end firmly bolted to the Loading Unloading Arm or hoses and the other end provided with G.I or Copper or Non corrodible metal crocodile clips are to be used, the crocodile clips being attached to the tank-truck or refuellers under loading or discharging. (For External Bonding of Loading unloading arms or hose with the Tank Truck).**
(c) **For sampling devices to be inserted into product tanks, SS chain shall be used.**

12.4.12.7 Static Earthing:

(a) **Static Earthing shall be provided at Tank Lorry or Refuellers loading or Decantation Gantries, to prevent building up of Static Charges.**
(b) **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.**

12.4.12.8 Lightning Protective System:

(a) **Lighting protection shall be provided for the equipment, structures and buildings which are higher than 20 metre or as per the risk index analysis worked out as per IS 2309.**
(b) **Self-conducting structures (having min thickness 4.8 mm) do not require lightning protection with aerial rod and down conductors. They shall be connected to the earthing system at two points of the base.**
(c) **If lightening arrester is provided, an independent earthing network shall be provided for lighting protection.**

12.4.12.9 Earthing for Data Processing System:

(a) **Low noise Earthing shall be provided for critical data processing equipment and shall be independent of any other Earthing of the Building.**
(b) **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.**

12.4.12.10 Number of earth pits:

(a) **The minimum requirement of earth pits and additional earth pits shall be made as per paragraph 2.12.8 of Part B of this Schedule.**
(b) **This is minimum requirement and additional earth pits shall be made such as to maintain Grid Values below 1 Ohm.**

12.4.12.11 General:

(a) **Insulation mats as per IS-15652 standard shall be provided in the Sub Station, control panels.**
(b) **Relays or Cables shall be tested once in a year and records maintained.**
(c) **Transformer oil shall be tested once in a year and records maintained.**
(d) **Size of conductor shall be selected based on the fault current that is required to be dissipated during emergency.**
(e) **Fail safe interlock or changeover switch shall be provided between grid power and the DG power to ensure that equipment gets supply from one source only.**

12.4.13 Installation lighting:

(a) **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.**
(b) **Normal lighting system shall be on 415V or 240V AC supply, whereas critical emergency lighting will be DC based in critical areas like Sub-Station, D G Room, SCADA or Shift Room, Security cabin.**
(c) **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.**
(d) **Critical Emergency lighting (D.C. supply or UPS based) shall be normally kept 'ON'. During power failure, battery bank or UPS shall be used to provide power.**
(e) **Lighting shall be provided for the various facilities in the AFS. The illumination levels in different areas shall be as per good engineering practice.**
(f) **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.**
(g) **Depending on the nature of job activities carried out, the minimum required illumination levels for various areas shall be ensured for safe movement or operations or emergency handling, as per the table given under Clause (10) of paragraph 2.13of Part B of this Schedule.**
(h) **The lighting fixtures on various circuits shall be suitably designed so that failures of any one circuit do not result in complete darkness.**
(i) **Switches controlling the lighting fixtures and exhaust fan shall be installed outside the battery room.**
(j) **Switches of lighting panels installed in hazardous area, shall have a pole to break the neutral, in addition to the poles for phases.**

12.4.14 Design of Hydrant Refuelling System (HRS):

12.4.14.1 Safety in Design of HRS:

(a) **No electrical connection between the fuelling vehicle and the hydrant pit should be made. 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 EI1584 specifications and they shall 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) or Emergency Shut Down (ESD) shall be located close (maximum 80 metre) to fueling 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.**
(i) **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.**
(j) **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).**
(k) **All color 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 or discharge hoses, shall be properly color coded to the grade of fuel to which they are dedicated.**
(l) **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. Hydrant system shall be designed in conjunction with site levels, the products) to be handled, the operating temperature range and the design characteristics of all items affecting pressure and flow, including-**

(i) Tanks;
(ii) Pumping sets;
(iii) Automatic control systems;
(iv) Filtration equipment;
(v) Hydrant pit valves;
(vi) Shock alleviators;
(vii) Hydrant servicers (pipe systems and components), flexible hoses; and
(viii) Aircraft fuel systems (pressure and flow rate limitations).

(m) **Cathodic protection:**
(n) **Cathodic protection meeting local or national standards should be installed to prevent the corrosion of underground pipeline systems feeding fuel to hydrants.**

12.4.14.2 External coating of pipeline:

(a) **When CS pipes are installed below ground, they should be appropriately protected against corrosion.**
(b) **Joints made during installation should be protected by an appropriate wrapping system.**
(c) **The integrity of the external coating and wrapping of buried pipes should be verified, and any defects should be rectified before the trenches are backfilled..**

12.4.14.3 Hydrant Pits:

Hydrant pits are positioned in the areas where aircraft are parked and they should embody the features described as below, namely:-

(a) **Pits should be capable of accommodating the equipment.**
(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 or tethered or permanently connected to pits to prevent them being carried away by jet blast or propeller vortex. Each hydrant pit box should be designed to effectively isolate from its hydrant riser by means of a sealing arrangement that can accommodate both lateral and vertical differential movement, in case transmission of any loadings to hydrant risers (to which the hydrant pit valve is fitted) from aircraft wheels, tugs, other service vehicles or from settlement or movement of adjacent aprons.**
(c) **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 30 and 50 to the top of pits.**
(d) **Isolating valve should be installed between the riser flange and the hydrant pit valve.**

12.4.14.4 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 and 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 and an emergency should 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 or EI 1584).**
(e) **A self-sealing male adaptor with tethered or permanently connected 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 or EI 1584.**

12.4.14.5 Emergency Shut Down (ESD) Controls for HRS System:

*(a) **Wired or Wireless system shall be installed for shutting down the hydrant refueling system (HRS). Emergency Stop Buttons (ESBs) or Emergency Shut Down (ESD) shall be located close to fueling bays and shall be clearly identified and easily accessible.***

(b) ***High visibility identification signs and emergency instructions should be displayed at prominent locations.***

12.5 Safe Operating Practices:

12.5.1 General:

(a) **AFS SCADA room where ever provided shall be manned on continuous basis during operations and in emergency.**

(b) **Site Specific, Standard Operating Procedures (SOPs) shall be developed. Such procedures shall be periodically reviewed, updated and records maintained especially whenever any changes or modifications to the facilities are made as per Management of Change procedure (MOC).**

(c) **The critical operating steps based on "SOPs" shall be displayed on the board near the location where applicable.**

(d) **VHF handsets provided to operating personnel shall be of intrinsically safe type.**

(e) **All operations shall be carried out under supervision of a responsible operating personnel.**

(f) **The pipeline transfer should preferably be commenced during day light. Due to urgency if operation requires to be carried out or extended in night time, the same to be carried out under supervision of trained and experienced staff.**

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

(h) **For locations with above ground storage tanks having aggregate capacity more than 5000 KL, the tank farm management system should be integrated with electronic data services repository. Provision of recording of TFMS inventory levels should be made on electronic data services repository.**

(i) **For locations with above ground storage tanks having aggregate capacity more than 5000 KL, suitable interlocks shall be provided for tripping or alarm or MOV operation based on the events high level, high high level and likewise.**

(j) **The contents of the dyke drain generated from draining of tanks and any other spillage or effluent containing oil shall be diverted to Oil Water separator (OWS) for safe disposal.**

(k) **Personnel protective equipment such as safety shoes, hand gloves, apron, safety goggles, safety belt, helmet, ear muff, bump caps, self-contained breathing apparatus (SCBA), resuscitator. 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, during normal and emergency operations.**

(l)

(m) **Bulk Handling for movement by Road:**

(n) **For movement of refuellers, sampling or pit cleaning vehicles and hydrant dispensers, inside airport premises, the relevant Motor vehicle Rules, local airport operator's requirement and Civil Aviation Requirements shall be followed.**

(o)

12.5.2 Safety Precautions during Tank Truck or Refuelers Loading or Unloading in Aviation Fuel Station:

Following precaution shall be taken due to associated hazards during transfer of Petroleum products to or from a tank truck, namely:-

(a) **Open source of ignition shall not be allowed in the area where product transfer operations are carried out.**
(b) **Vapour space shall not be less than 3% in each tank truck and refuellers in respect of Class Aand Class B petroleum products.**
(c) **Fire extinguishers shall be placed near the tank trucks during operations in a designated marked place.**
(d) **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.**
(e) **The first operation after positioning the truck or refuellers shall be to provide proper earthing or bonding. Earthing or bonding shall be disconnected just before the release of the truck.**
(f) **All Refueling Hoses shall conform to EI-1529 or IS 1825 or equivalent standard and shall be handled with care and hydrostatically tested once in 6 months.**
(g) **No repairs shall be made on the truck or refuellers while it is in the loading or unloading area.**
(h) **Personnel shall wear applicable Personal Protective equipment.**
(i)
(j) **Filling or transfer operations should be suspended immediately in the event of –**

(i) Uncontrolled leakage occurring;
(ii) A fire occurring in the vicinity; and
(iii) Lightning and thunderstorm

12.5.3 Procedure for Loading or Topping up of Refuelers:

12.5.3.1 Following checks shall be done in a tank truck or Refuellers before accepting it for loading or unloading, namely: -

(a) **Presence of PV vent, emergency vent valve, master valve, spark arrestor and other safety fittings.**
(b) **Fire screen between cabin and tank shall be provided. For this purpose, cabins with metallic back cover 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 or 9 kg DCP and 1 no. 1 kg CO2 or 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 or 9 kg DCP and 1 no. 1 kg CO2 or 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 registration certificate is available.**
(h) **Availability of brazed copper strips for earthing and bonding connection.**

12.5.3.2 Move vehicle to the loading or topping up bay.

12.5.3.3 Place the truck or refuellers on loading or topping up bay and place wheel chokes at front and rear wheels. Keep the truck or refuellers in neutral mode with hand brakes "ON".

12.5.3.4 Stop the engine and switch off all electrical equipment.

12.5.3.5 All persons should leave the driver's cabin.

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

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

12.5.3.8 Start the loading or topping up operations.

12.5.3.9 The quantity loaded into the truck or refuellers can be assessed by -Liquid recorded through manual dipping or dial gauge reading.

12.5.4 Procedure for Unloading of Refuelers:

(a) **Necessary steps described under clause B should be carried out.**
(b) **Test the connections for leaks**
(c) **Start the Unloading operations**
(d) **Before releasing the trucks, it shall be ensured that valves are closed and ends are capped.**
(e) **An authorized person of the company shall supervise the unloading operation and respond immediately in the event of an emergency.**

12.5.5 Tank Farm Operations:

(a) **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.**
(b) **All electrical fittings shall be maintained to ensure its integrity and type of protection.**
(c) **The tank farm shall be kept clean and free from vegetation.**
(d) **Tanks shall be periodically checked for leakages or sweating and repairs must be immediately carried out whenever scaling or pitting are observed.**
(e) **Proper earthing and bonding shall be maintained and ensured at all times for the tank body.**
(f) **Dyke drain valve shall be in closed condition and shall be operated only under supervision of an authorized person and log book maintained.**
(g) **Isolation Valves on expansion linesor TSV vent lines shall be always kept open except under requirement during location specific operations to take care thermal expansion.**
(h) **No gauging or sampling of tanks shall be undertaken during thunder or hail storms.**
(i) **Flow velocity at tank inlet shall not exceed 1 m/s until the inlet is completely submerged. For easy reference, permissible flow rate for initial filling are given below, namely: -**

Size (in mm) of Inlet pipe	Max. Flow Rate (Kl/Hr)
300	246
250	168
200	109
150	59
100	27
80	25.5

(j) **Safety shoes and PPEs shall be worn by the operating staff in the operational area.**
(k) **Tank dip pipes shall be extending to tank bottom. If dip pipes are not provided, give a relaxation time of 30 minutes before sampling or gauging.**
(l) **Synthetic fibre cord shall not be used for sampling or gauging. If the sampling orgauging, equipment is a conductor, the cord must be conductive, that is to say., a metal wire or chain. Proper bonding to be provided in this case.**
(m) **While cleaning the tanks, care shall be taken to avoid generation of static electricity.**
    (i) Cleaning of tanks by gas oil spray shall not be permitted.
    (ii) Cleaning of tanks by steaming shall not be permitted for Class A and Class B products.
(n) **Earthing and bonding connections shall be ensured during the entire operating process.**

12.5.6 Pipeline Transfer Operations:

12.5.6.1 A mass flow meter or flow meter with integrator shall be installed on receipt pipeline in AFS, if applicable. Signals shall be provided in the control rooms of both dispatching and receiving companies for monitoring.

12.5.6.2 The following safe practices to be followed, namely:

(a) **Gauging procedure shall be completed and line shall be made through.**
(b) **Physical inspection shall be carried out up to the exchange manifold for any leakage or damage.**
(c) **Line up shall be started from the exchange pit end.**
(d) **Pressure relief lines of receipt nozzles of product tanks connected to the same common receipt header shall be sealed.**
(e) **After ensuring that there are no leaks, pumping shall be commenced.**
(f) **Pumping shall be commenced initially at low flow rate and only after stabilizing of flow, the flow rate may be increased.**
(g) **Product shall not be pumped beyond safe filling height of the tank.**
(h) **After completion of the receipt, pumps shall be stopped.**
(i) **In case of Emergency Shutdown, care shall be taken so that back pressure is not developed in the pipelines and pump head.**
(j) **Sampling shall be carried out as per provisions of DGCA approved Quality Control Manual.**
(k) **Pipe Line transfer (PLT) from a pipeline shall not be taken simultaneously in more than one tank.**
(l) **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.**
(m)

12.5.7 Methanol Handling at AFS:

(a) **Containers used for storage of De-ionized Water shall be of high-density polythene (HDPE) or stainless steel and shall be flushed clean before use.**
(b) **High density Polythene (HDPE) pipes shall be used for transferring De-ionized Water from one container to another.**
(c) **The HDPE container shall be handled with due care to avoid damage.**
(d) **The container shall always be kept closed and in a clean condition.**

(e) **DP Shed of required dimensions duly approved by PESO shall be provided for storage of Power Boost Methanol (PBM).**
(f) **Blending of PBM and Methanol Water Mixture shall be carried out in blending unit kept in a ventilated area.**
(g) **Only polythene pipes and stainless-steel pipes shall be used for suction of PBM and De-ionized Water.**
(h) **All sampling procedures and tests shall be carried out as per Quality Control Manual.**
(i) **All precautions taken during normal refueling shall be ensured for MWM refueling also.**

12.5.8 Safety in Barrel Operations:

12.5.8.1 Receipt of Aviation Fuel in barrels:

(a) **The loading location shall comply with the quality control and safety requirements, while loading and transporting the stocks in drums.**
(b) **Adequate measures should be taken, to ensure that the drums are not damaged during unloading.**
(c) **The drums should be unloaded using an unloading ramp.**

(d) **The drums should be stacked in the place earmarked for this purpose. All drums carrying "DP" products shall be stacked in DP shed.**
(e) **It shall be ensured that the license of the DP shed is valid and the storage does not exceed the authorised capacity.**

12.5.8.2 Storage:

(a) **For each consignment, placard indicating the grade of product, Batch Number and date of Test Report shall be exhibited.**
(b) **Each consignment shall be stacked separately to facilitate delivery of stocks on first in first out basis.**
(c) **All the barrels when stored shall be kept only in sealed condition.**
(d) **The barrels shall be visually inspected at least once in a day for any leaks and the observations recorded in the shift log.**
(e) **During monsoon, adequate precautions shall be taken to prevent ingress of water into the drums. When drums are stored in the open over dunnage with a tarpaulin cover, the water stagnated over the tarpaulin cover shall be removed on priority.**
(f) **Barrels shall be stored in 3 o'clock – 9 o'clock position on a thick wooden plank of minimum thickness 2".**

12.5.8.3 Loading of Barrels:

Following procedures shall be followed, namely: -

(a) The barrels shall be selected in the following order of priority, **namely: -:**
    (i) New Barrels.
    (ii) Barrels having stored similar aviation fuel previously Once used .
    (iii) PBM barrels.
(b) **Lube oil or Black oil drums shall not be selected for filling Aviation Turbine fuel. The drum-filling operations shall be taken up only in the licensed area.**
(c) **Before flushing, it should be ensured, that each drum is clean and dry.**

(d) **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.**
(e) **The electrical bonding connection shall be established between the filling nozzle and the barrel. In 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.**
(f) **While filling, it shall be ensured that adequate space to be left in the barrel depending upon the class of petroleum product. For 'A'class minimum 5% space to be left and for'B' Class minimum 3% space to be left as vapour space for safety reasons.**
(g) **The barrels shall be sealed tight, using bungs with washers.**
(h) **It shall be ensured that the barrels are stacked in a vertical position in a single tier in the truck properly covered with tarpaulin.**
(i) **Fire extinguishers of adequate capacity shall be carried along with the drums.**
(j)
(k) **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.**
(l) **The Explosives License authorising the customer to transport and store the fuel shall also be produced before requesting for fuel.**
(m) **The filling of container shall be taken up only after satisfying conditions mentioned above.**
(n) **The quantity to be delivered shall not exceed the quantity indicated in the license.**
(o) **All the precautions and procedures given above shall be adhered to. Containers not fit for Aviation use shall be rejected.**
(p) **The flushed quantities shall be collected in a drum and downgraded to a similar non-aviation grade. However, this downgraded product shall not be handed over to the customer.**

12.6Fire Protection and Prevention Facilities:

12.6.1 Fire Protection:

12.6.1.1 Depending on the nature of risk, following fire protection facilities shall be provided, in AFSs with aggregate above Ground storage tank capacity more than 1000 KL, namely:-

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

12.6.1.2 For AFSs storing 1000 KL aggregate product, the following fire protection facilities shall be provided, namely:-:

(a) **First Aid Fire Fighting Equipment .**
(b) **CO2 extinguishers for electrical fire .**
(c) **Dry Chemical Extinguishers .**
(d) **Fire Siren .**

12.6.2 Design Criteria for Fire Protection System for AFSs with Above Ground Storage Tank Capacity more than1000 KL :

(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. Fire water storage shall be sufficient for minimum 4 hours aggregate rated capacity of fire water main pumps. 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 and monitors.**
(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) **In case of an existing AFS where inter-distance between various facilities are not conforming to the Table -1 or Table-2 or Table-3 specified in the Part –A of this Schedule (as applicable), then QRA or HAZOP study shall be conducted and suggested mitigation measures shall be implemented.**
(i) **Tank Truck (TT) or Refuellers or 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 and 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.**
(j)
(k) **The high-volume long range (HVLR) water cum foam monitors (variable type) shall be provided as under, namely:**

(i) AFSs with above ground storage tank of capacity more than 1000 KL and meeting the safety distance norms as per these regulations, 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 tank of capacity more than 1000 KL and not meeting the safety distance norms as per this regulation, 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.

(iii) Provision for connecting or 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 shall be directed on the inner upper surface of the tank and not in the middle of the tank to prevent splash over.

(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 or tank or reliable replenishment for foam induction system shall be provided near the hook up points of mobile HVLRs with the hydrant system.

12.6.3 Fire Water System Design (applicable for AFSs with aggregate above ground storage tank of capacity more than 1000 KL):

(a) **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.**

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

(c) **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.**

(d) **For AFSs located in areas where ambient temperature is subzero during the year, the firefighting lines should be emptied. Alternatively, a suitably designed mechanism should be provided to prevent freezing of fire water.**

(e)

12.6.3.1 Fire Water Design Flow Rate:

(a) **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 of capacity more than 1000 KL and up to 30,000 KL.**
(b) **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**
(c)
(d) **For water flow calculations, all tanks' farms having class B petroleum storage (above ground) of capacity more than 1000 KL shall be considered irrespective of diameter of tanks and whether fixed water spray system is provided or not.**
(e) **Fire water flow rate for a tank farm shall be aggregate of the following, namely: -**
    (i) Water flow calculated for cooling a tank on fire at a rate of 3 lpm/sqm of tank shell area.;
    (ii) 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/m^2 of tank shell area;
    (iii) 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/m^2 of tank shell area;
    (iv) Water flow required for applying foam on a single largest tank by way of fixed foam system, where provided, or by use of water or foam monitors whichever is higher;
    (v) Foam solution applicable rate for cone roof tanks shall be taken as 5 lpm/ m^2;
    (vi) Various combinations which shall be considered in the tank farm for arriving at different fire water flow rate and the largest rate to be considered for design;
    (vii) Design flow rate which shall be based on the combination of the above; and
    (viii) Supplementary water: Fire water flow rate for supplementary streams which 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/cm^2. The supplementary water stream requirement shall be in addition to the design flow rates.

12.6.3.2 Fire Water Storage:

(a) **Water for the firefighting shall be stored in easily accessible surface or underground or above ground tanks of steel, concrete or masonry.**
(b) **The effective capacity of the reservoir or tank above the level of suction point shall be minimum 4 hours aggregate rated capacity of pumps.**
(c) **Fresh water should be used for firefighting purposes. In case sea water or treated effluent water is used for firefighting purposes, the material of the pipe selected shall be suitable for the service.**
(d) **Storage 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 or depth to prevent any migration or overflow due to difference in height or depth. During maintenance of water tanks, availability of at least 50% of the water capacity shall be ensured.**
(e) **Large natural reservoirs having water capacity exceeding 10 times the aggregate fire water requirement can be left unlined.**
(f) **In case existing land area is insufficient to have additional water tanks as per requirement andwater replenishment rate from the local airport operator or AAI may be added to existing water storage capacity to fulfil the net requirement.**

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

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

(d) **The fire water pumps including the standby pumps 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 and storage shall be located far away from the potential leak sources or 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 or line pressurized at all times. The capacity of the pump shall be sufficient to maintain system pressure in the event of leakages from valves, Besides the main jockey pump, the stand by pump of same capacity and type shall be provided.**

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

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

12.6.3.4 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;

(iii) for pipeline size less than 150 mm, support interval shall not exceed 3 metre;

(iv) pipe line size 150mm and above support interval shall not exceed 6 metre or design approved;

(v) the system for above ground portion shall be analysed for flexibility against thermal expansion and necessary expansion loops were called for shall be provided;

(c) **Fire hydrant ring main may be laid underground at the following places, namely: -**

(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 metre below the ground level should be provided. Alternatively, in such cases for above ground pipelines, water circulation should be carried out.

(d) **Fire water ring main laid underground shall ensure the following, namely: -**

(i) Pipes made of composite material shall be laid underground.

(ii) The Ring main shall have at least one metre 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 or 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 or wrapping with or without cathodic protection.

(iv) In case of poor soil conditions, it may be necessary to provide concrete or masonry supports under the pipe line.

(e) **Size of Hydrant Pipeline**

(i) The hydraulic analysis of network shall be done at the design time. Also, whenever fire water demand increases due to addition of facilities or extensive extension of network, fresh hydraulic analysis shall be carried out.

(ii) The velocity of water shall not exceed 5 metre per second in fire water ring main.

(iii) Fire water ring main shall be sized for 120% of the design water flow rate. Design flow rates shall be distributed at nodal points to give the most realistic way of water requirements in an emergency. It may be necessary to assume several combinations of flow requirement for design of network.

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

(f) **General:**

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

(ii) Associated Sprinkler, foam riser or 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.

(g) **Hydrant or Monitors:**

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

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

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

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

(v) Hydrant or Monitors shall be located along road side berms for easy accessibility.

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

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

(viii) 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.

(ix) 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 or within dykes are not meeting the requirements).

(x) TT or Refuellers loading and unloading facilities shall be provided with alternate hydrant or 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.

(xi) The hydrants and monitors shall be located at a minimum distance of 15 M from the hazard (that is to say the TT loading or unloading facilities) to be protected.

12.6.3.5 Material Specifications

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

(a) **Pipes: Carbon Steel as per IS: 3589 or IS: 1239 or 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 be used may be as per API 15LR or API 15HR or IS:12709. 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 or close indication shall be used. Other materials such as cupro-nickel for saline or 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 or Aluminum or Stainless or Steel or Al-Zn Alloy

(d) **Monitors or High Velocity Long Range Water cum Foam Monitors (HVLR):**

(i) Approved or listed by international certifying agencies like UL or FM or VdS or LPC or equivalent Indian certifying agencies.

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

(e) **Fire Hoses:**

(i) Reinforced Rubber Lined Hose shall be as per IS 636 (Type A) or Non-percolating Synthetic Hose (Type B) or UL or Equivalent Standard.

(f) **Painting:**

(i) Fire water mains, hydrant and monitor stand posts, risers of water spray system shall be painted with “Fire Red” paint as per of IS: 5.

(ii) Hose boxes, water monitors and hydrant outlets shall be painted with “Luminous Yellow” paint as per IS: 5.

(iii) Corrosion resistant paint shall be used in corrosion prone areas.

(g) **Fixed Water Spray System**

(i) In case the system is manually actuated, the isolation valve shall be located outside the dyke for ease of access and operation.

(ii) Spray nozzles shall be directed radially to the tank at a distance not exceeding 0.6 m from the tank surface.

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

12.6.4 FOAM SYSTEMS:

12.6.4.1 Foam 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, namely:-

(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 or pourers as indicated below, namely: -

Tank Diameter in (Metre)	**Requirement of Foam Pourer (Minimum Nos.)**
Above 18 and up to 20	2
Above 20 and up to 25	3
Above 25 and up to 30	4
Above 30 and up to 35	5
Above 35 and up to 40	6
Above 40 and up to 45	8
Above 45 and up to 50	10

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

(vi) 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.

(b) Protection for Dyke area Spill Fire:

(i) Portable monitors or foam hose streams shall be provided for fighting fires in dyked area and spills.

(ii) In addition to above, medium expansion foam generators shall be provided to arrest vapour cloud formation. Two nos. portable foam generator shall be provided for each AFS.

12.6.4.2 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, namely:-

(i) 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.

(ii) 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, namely:-

(i) Tanks (fixed roof) containing Class 'B' product: minimum duration shall be 65 minutes, and;

(ii) Where the system's primary purpose is for spill fire protection such as dyked area and non dyked area (such as TT or refuellers,): the minimum duration shall be 30 minutes.

(c) **Water for Foam Making:**

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

(d) **Foam Quantity Requirement:**

Foam quantity requirement shall be calculated as given below, namely:-

(i) For locations aggregate capacity upto 30,000 kl (Single contingency):
Foam solution application at the rate of 5 lpm/ sqm for the liquid surface of the single largest cone roof tank.

(ii) 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);

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

B. Two hose streams of foam each with a capacity of 1140 lpm of foam solution.

(e) **Foam Compound Storage:**

(i) Foam compound should be stored as explained in IS-4989 or 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.

(ii) 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.

(iii) Care shall be taken to avoid mixture of two or more different grades or 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.

(iv) For details of type of tests and their periodicity, refer IS 4989 or UL-162 or Equivalent Standard.

(v) Quantity of foam compound equal to 100% of requirement as calculated as per method applicable should be stored in an AFS.

12.6.5 SCADA or SERVER Room Protection:

(a) **SCADA or server room provided for location having pipeline receipt should be protected by Clean Agent Fire Extinguishing System.**

(b) **Persons should be evacuated from the areas before the clean agent fire extinguishing system comes into operation.**

(c) **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.**

(d) **All the components of the system shall be capable of withstanding heat of fire and severe weather conditions.**

12.6.6 First Aid and Fire Fighting Equipment :

12.6.6.1 Emergency Trolley and Emergency kit:

(a) **A trolley containing Fire Proximity Suit, BA 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.**

(b) **The aforesaid emergency trolley and emergency kit- emergency shall be readily available at AFSs at the Aviation Fuel Station. All the items of the kit shall be kept on a trolley specifically designed for the purpose.**

(c) **For all other AFSs, Fire Proximity Suit, Water Gel Blanket, Resuscitator, First Aid Box, 2 nos. 10 or 9 kg DCP fire extinguishers, Safety helmets, Fire buckets, shall be placed at an easily accessible location inside the AFS.**

12.6.6.2 Portable Fire Extinguisher Specification:

(a) **All fire extinguishers shall conform to respective IS or UL or equivalent codes, that is to say10 or 9 Kg DCP Type (IS: 15683 or UL 299), 4.5, 6 or 8 Kg CO2 Type (IS: 2878 or UL 154) and 25, 50 or 75 Kg DCP Type (IS: 10658 or UL 299) and bear ISI or UL mark. BIS or UL or Equivalent certificates of all extinguishers shall be maintained at the location.**
(b) **Extinguisher should be selected, based on factors like flow rate, discharge time and throw in line with IS: 2190.**
(c) **The Dry Chemical Powder used in extinguisher and carbon dioxide gas used as expelling agent shall be as per relevant IS or UL or equivalent code.**
(d) **Dry chemical powder, should be selected based on the typical properties such as Apparent Density (0.65 ±0.05), Fire Rating (144B), Thermal Gravimetric Analysis (with decomposition at around 250°C) and foam compatibility.**
(e) **Spare CO2 cartridges and DCP refills or buffer stocks of stored pressure vessel type fire extinguishers 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.**
(f) **Portable fire extinguishers shall be located at convenient locations and are readily accessible and clearly visible at all times.**
(g) **The sand buckets shall have round bottom with bottom handle having 9-liter water capacity conforming to IS: 2546 or equivalent specifications. The sand stored in bucket shall be fine and free from oil, water and rubbish.**
(h) **Rain protection of suitable design should be provided for all extinguishers and sand buckets.**
(i) **The maximum running distance to locate an extinguisher shall not exceed 15 m.**
(j) **The extinguisher shall be installed in such a way that its top surface is not more than 1.5m above the floor or ground level.**
(k) **The number of extinguishers at various locations shall be provided as per paragraph 5.5 of Part E of this Schedule..**

12.6.6.3 Wheeled Fire Fighting Equipment

For AFSs having above ground product storage tanks of diameter larger than 9 m, following firefighting equipment shall be provided, namely: -

Size of AFS (In KL)	**Water or Foam Monitor (Nos.)**
Having aggregate capacity of 1000 KL	NIL
Having aggregate capacity up to 10,000 KL	Minimum 2 Number of suitable capacity
Having aggregate capacity more than 10,000 KL	More than 2 Numbers of suitable capacity

12.6.6.4 Foam compound trolley 200 or 210 liters shall be provided as under, namely: -

Tank diameter (In m)	**Water or Foam Monitor (Nos.)**
Up to 24 m	1 no.
24 m - 30 m	2 nos.
Above 30 m	3 nos.

12.6.6.5 Other Safety and PPE Gadgets required for the locations:

Minimum fire accessories to be provided in a location without fire hydrant system are as follows, namely:-

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	: 1 No.
Water jel blanket	: 1 No.
Red & Green flag-fire drill	: 2 Nos. in each colour.
Self-Carrying Breathing Apparatus Set (30 minute capacity): 2 set with spare cylinder.	

12.6.7 Emergency shut Down (ESD)or Emergency Shutdown Button (ESB) system :

12.6.7.1 The ESD or ESB shall be provided in SCADA room as well as at strategic location. ESD or ESB system shall be operated through push buttons or wireless connection. While ESD will actuate overall shutdown for location having Hydrant Refueling system and ESBs shall actuate shutting down of Product pumps and compressors.

12.6.7.2 Actuation or pressing of any ESD shall initiate following actions, namely:-

(a) **Shutdown of all operations.**
(b) **Power Shutdown.**
(c) **Process Shutdown shall include the following, namely:-**

(i) To stop all unloading and delivery pumps;
(ii) Barrier gates and access control system to open; and
(iii) All MOVs to close.

12.6.7.3 Power Shutdown shall initiate the following, namely:-

(a) **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 unloading or Refuellers loading area, Admin block, MCC room and power to the control room or Automation system.**
(b) **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.**

(c) **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.**

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

12.6.8 Fire Protection system: Inspection and Testing:

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

12.6.8.1 Fire water pumps:

(a) **Every pump shall be test run for at least half an hour or as per OEM guidelines, whichever is higher twice a week at the rated head and flow.**
(b) **Each pump shall be checked, tested and its shut-off pressure shall be observed once in a month.**
(c) **Each pump shall be checked and tested for its performance once in six months by opening required numbers of hydrants or monitors depending on the capacity of the pump to verify that the discharge pressure, flow and motor load are in conformity with the design parameters.**
(d)
(e) **Each pump shall be test run continuously for 4 hours at its rated head and flow using circulation line of fire water storage tanks and observations relating thereto shall be logged once a year.**
(f) **The testing of standby jockey pump, if provided shall be checked weekly. Frequent starts and stops of the pump indicate that there are water leaks in the system which should be attended to promptly.**

12.6.8.2 Fire water ring mains:

(a) **The ring main shall be checked for leaks once in a year by operating one or more pumps and keeping the hydrant points closed to get the maximum pressure.**
(b) **The ring mains, hydrant, monitor and water spray header valves shall be visually inspected for any missing accessories, defects, damage and corrosion every month and records thereof shall be maintained.**
(c) **All valves on the ring mains, hydrants, monitors and water spray headers shall be checked for leaks, smooth operation and lubricated once in a month.**

12.6.8.3 Fire water spray system:

(a) **Water spray system shall be tested for performance that is to say its effectiveness and coverage once in six months.**
(b) **Spray nozzles shall be inspected for proper orientation, corrosion and cleaned, if necessary, at least once a year.**

(c) **The strainers provided in the water spray system shall be cleaned once in a quarter and records thereof shall be maintained.**

12.6.8.4 Fixed and semi fixed foam system:

(a) **Fixed or Semi fixed foam system on storage tanks should be tested once in six months and such testing shall include the testing of foam maker or chamber.**
(b) **The foam maker or chamber should be designed suitably to facilitate discharge of foam outside the cone roof tank and after testing foam system, piping should be flushed with water.**

12.6.8.5 Clean agent system:

Clean agent fire extinguishing system should be checked as below, namely: -

(a) **Agent quantity and pressure of refillable containers shall be checked once every six months; and**
(b) **The complete system should be inspected for proper operation once every year (refer latest NFPA for details of inspection of various systems).**

12.6.8.6 Hoses:

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

12.6.8.7 Communication system:

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

12.6.8.8 Fire water tank or reservoir:

(a) **Above ground fire water tanks should be inspected externally and internally.**
(b) **The water reservoir shall be emptied out and cleaned once in 3 years, but floating leaves, material or algae, if any, shall be removed once in 6 months or as and when required.**

12.6.8.9 Fire extinguishers:

Inspection, testing frequency and procedure for fire extinguishers should be in line with design standard.

12.6.9 ERDMP (Emergency Response and Disaster Management Plan):

12.6.9.1 A comprehensive ERDMP shall be developed in accordance to the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010 (PNGRB ERDMP Regulations, 2010) and the copies of the ERDMP shall be available to all personnel in the installation.

12.6.9.2 Mock drills and Mutual aid:

(a) **Written mutual aid arrangements shall be worked out by locations to facilitate additional help in the event of Level-II and level-III emergencies by way of rendering manpower, medical aid or fire fighting equipments, as per Petroleum and Natural**

Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan) (ERDMP) Regulations, 2010 as amended from time to time.

(b) **The mutual aid arrangement shall be such that the incident controller of the affected installation shall be supported by neighboring industries on call basis for the support services materials and equipment already agreed. Further, all such services deputed by member industry shall work under the command of the site incident controller of the affected installation.**

(c) **Mutual aid associations shall conduct regular meetings, develop written plans and test the effectiveness of their plans by holding drills.**

(d) **Fresh agreement shall be made on expiry of 2 years or whenever there is change in the signatories to the agreement.**

(e) **Quarterly meeting of Mutual Aid members shall be conducted and the minutes shall be recorded and the minutes shall be reviewed in the subsequent meetings.**

(f) **Arrangement of mutual aid scheme with the local airport operator or authority and sharing of firefighting with neighboring agencies should be ensured.**

12.6.10 Combined AFS With LPG or POL Facilities or Retail Outlets in the same premises:

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

(a) **AFS located within POL or LPG facility shall meet the design, layout and fire protection system requirements of combined facilities and have common boundary wall and ownership of both the facilities under same company.**

(b) **In case AFS is an integral part of the LPG installation, then the fire-fighting facilities shall be adequate to meet the respective fire-fighting requirements of LPG and AFS regulations.**

(c) **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 or LPG or Retail Outlet with whom AFS will be located facility.**

(d) **For AFSs located adjacent to an existing LPG bottling plant, POL terminal or depot or retail outlet requirement of fire-fighting facilities, safety distances shall be guided as per details given in these regulations. The common water storage facility for firefighting purpose may be shared between AFS and LPG bottling plant.**

(e) **The fire pump house may be common or separate.**

12.7Vehicle Management System:

12.7.1 Qualification of Driver:

(a) **The drivers shall hold a valid driving license for type of vehicle to be driven and they shall be authorized to drive vehicle carrying specific class of product under local dangerous goods regulations.**

(b) **The regulations of airport with regard to qualification and experience of driver shall prevail.**

"PART K:

(Lube manufacturing and filling plants)

13.0 Applicability:

For Lube manufacturing and filling plants across the country falling under the scope of these regulations: Part A (Design and Layout), Part B (Design Considerations), Part C (Safe Operating Practices), Part E (Fire Protection and Prevention Facilities) and Part F (Maintenance and inspection) of this schedule shall be superseded by this Part and remaining parts that is to say, Part D (Commissioning or De-commissioning of facilities), Part G (Competence Assurance and Assessment), Part H (Vehicle Management System) and Part I (Safety Management System) shall hold good.

13.1 Scope:

This part lays down minimum safety requirements in design, layout, automation, storage, loading or unloading, packaging, inspection and maintenance, fire protection of lube manufacturing and filling plants including standalone packing and fillings units with or without blending facilities.

13.2 Installation Layout:

13.2.1 Layout Philosophy:

Following philosophy should be adopted in layout of a Lube manufacturing and filling Plant, namely:-

(a) **Quantitative Risk Assessment should be carried out at the layout stage with an objective to arrive at any specific mitigation measures required for Hazards identification. Risk reduction or mitigation measures should be given due credit.**
(b) **Risk assessment should include societal risk (if any). The outcome should guide in preparation of onsite or off-site emergency plan. Further, emergency response disaster management plan (ERDMP) should be made in line with requirement of PNGRB ERDMP Regulations, 2010 and its latest amendments.**
(c) **Quantitative Risk Assessment (QRA) should be done whenever major additions in facilities (such as addition of major storage facility, new process unit block) or major demographic changes in the surrounding of plant areas takes place.**
(d) **Two approaches from the highway or major road should be provided, one for normal movement and other for emergency exit. Both these approaches should be available for receipt of assistance in emergency. Minimum road width should be 3.5 m for one-way vehicular movement.**
(e) **Alternative access should be provided for each block so that it can be approached for firefighting in the event of blockage on one route.**
(f) **Road widths, gradient and turning radius at road junctions should be designed to facilitate movement of the largest fire-fighting vehicle envisaged in the event of emergency.**
(g) **Physical segregation should be provided between operating and non-operating area. Segregation should be minimum 1 m height either in the form of chain link fence or brick wall or combination of both. Entry to operating area should be through security access control only, that may be either manual or using technology.**
(h) **Various additives should be stored within the blocks in separate demarcated area with required fire protection as per MSDS.**

13.2.2 Layout of Facilities:

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

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

13.2.3 General Consideration

While locating the va:rious facilities, the following should be considered, namely:-

(a) **Layout of blocks or facilities should be in sequential order of process flow.**
(b) **The process operations like blending, and packaging operation should be carried out under the common block or shed. Separate block for boiler or heating unit should be provided. Refer Table -1 in Part J of this Schedule- for separation distance between blocks and between units within the block.**
(c) **Plant elevation should be higher than the outside boundary surroundings and approach roads inside the plant area should be on higher ground to avoid flooding.**
(d) **Process units, tank farm, bulk loading or unloading gantry or platform, filling, boiler unit or other heating unit, solid storage, additive storages, Effluent Treatment Plant (ETP) or OWS and utilities should be located on high ground to avoid flooding.**
(e) **Fire control room should be earmarked or located in non-operating area, upwind (Majority of the year) of lube oil storage, handling, blending, filling or storage area and at a distance (refer table) from potential leak sources. It should not be located on a lower level than surrounding plant area and tank farms. Fire control room may be in the security room or administrative building.**
(f) **Utility facilities should be located in separate blocks. However, air compressor can be installed in the boiler house in same block.**
(g) **Overhead power transmission lines should not pass over the plant processing and operating areas including the truck parking areas. In case, the power transmission lines are passing through non- operating areas, horizontal and vertical clearance should be in line with the Central Electricity Authority.**
(h) **High Tension (HT) line and HT sub-stations should be terminated or located outside the operating area.**

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

(j) **A designated platform should be provided suitably at the main entrance exit gate, inside the location, for the purpose of checking road taker safety fittings or documents to avoid any obstruction for other vehicular movement in normal or emergency situation.**

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

(l) **Effluent Treatment Plant should be located at a distance as per Table -2 in Part -J of this Schedule-. This should be closer to disposal point (to outside storm drain) by the side of the boundary and at lower grade to facilitate gravity flow of effluent from other operating facilities.**

(m) **Roads should be provided in a symmetric manner to serve all areas requiring access for the operation, maintenance, and firefighting. At least two approaches should be provided for each operating area.**

(n) **Smoking booths shall not be allowed inside the plant area.**

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

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

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

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

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

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

(ii) Effective ventilation that is to say, forced ventilation or air turbo ventilation and single pass once through type shall be considered with about 10-12 changes of whole air per hr. Emergency exits shall be provided at strategic locations. Each laboratory shall have two easily accessible, hindrance free exits. Doors shall open in the direction of the exit.

(t) **Turbo or forced ventilation shall be considered for enclosed or confined process or utility blocks.**

(u) **Various additives (non-bulk), within blocks, shall be stored at the**

demarcated area based on requirement of fire protection system and application as per respective Material Safety Data Sheet. Additives falling under Class A or Class B shall be stored separately (duly marked) with suitable fire protection.

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

(w) **All electrical cables shall be laid through conduit or cable trench. The designated cable route should be having route markers as per applicable Rules.**

(x) **Storage of sludge inside the plant or its disposal strictly should be as per concerned State Pollution Control Board's norms.**

13.2.4 Layout of Storage Tanks:

13.2.4.1 Dyke Enclosure:

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

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

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

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

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

(f) **Dyke enclosure (entire area of the dyke) should have impervious layer of suitable material such as EPDM (ethylene propylene di-monomer) liner or polyethylene sheet or PCC or RCC to prevent the ground water contamination.**

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

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

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

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

diagram of each facility should be displayed near the facility for ease of understanding.

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

(j) **Horizontal above ground tanks, irrespective of product class, mounted on pedestals shall meet the following, namely: -**

(i) Dyked enclosure shall contain the largest tank capacity.

(ii) Separation distance between adjacent tanks shall be (D+d)/4 or minimum 3 m whichever is higher.

(iii) Separation distance from adjacent facility or boundary shall be minimum 15 m.

(iv) Minimum two manholes having minimum size of 600 mm.

(v) All tanks shall have either individual or common stairs with toe guards and hand railing. Emergency exit or stair should be considered.

(vi) Drain from dyked enclosure shall be routed to ETP or OWS.

(vii) Vents shall be located or terminated at a minimum height of 4 m from the ground level.

(viii) The open end of free vent pipe shall be covered with two layers of non-corrodible metal wire gauze having not less than 11 meshes per liner centimetre and shall be further protected from rain by hood or by suitably bending it downward.

(ix) The petroleum product shall enter a tank through closed piping system or coupled electrically continuous and sound hose.

(k) **Under Ground Tanks, irrespective of product class, shall meet the following, namely: -**

(i) Inter tank distance for UG tanks shall be (D+d)/4 or minimum 1.5 m, whichever is higher.

(ii) A minimum of 3 m clear distance around the tank shall be maintained (from structures or boundary wall).

(iii) Minimum burial depth under the earth should be 300 mm and the manholes or gauge pipe should be 300 mm above the ground level.

(iv) Minimum two manholes having minimum size of 600 mm.

(v) Embankment wall of minimum 300 mm height shall be provided in the UG tank farm area to contain accidental overflow or spillage and area shall be paved.

(vi) Drain from UG tank farm shall be routed to ETP or OWS.

(vii) Vents shall be located or terminated at a minimum height of 4 m from the ground level.

(viii) The open end of free vent pipe shall be covered with two layers of non-corrodible metal wire gauze having not less than 11 meshes per liner centimeter and shall be further protected from rain by hood or by suitably bending it downward.

(ix) The petroleum product shall enter a tank through closed piping system or coupled electrically continuous and sound hose.

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

13.2.4.2 Grouping of Tanks:

(a) **Grouping of tanks in a dyke: Storage tanks should be grouped in a dedicated dyke according to their respective classification of petroleum product. For example,**

excluded product and other than excluded products should be stored in separate dyked enclosure.

(b) **In case, different class of products are stored in any combination of product classification, then, when excluded petroleum is stored with other class of product in same dyke, applicable fire protection shall be considered based on flash point of different class of products and fire protection for lower flash point product shall be applicable for all other tanks in that dyked enclosure**

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

(d) **To meet the objective, the peripheral drain of the plant shall be provided with sluice gates at the exit point where from drain goes outside of boundary. Pipelines if any entering or exiting the plant boundary shall be sealed properly.**

13.2.4.3 Fire Break Walls Inside Dyke Enclosure:

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

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

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

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

13.2.4.4 General:

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

(b) **All Piping from or to any tank shall run directly to outside of dyke to minimize piping within the enclosures.**

(c) **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 or emergency situations. The catwalks shall run at the same level and terminate directly outside the dyke.**

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

(e) **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.**

(f) **Properly laid out road shall be provided for easy access on all four sides of each dyke for normal and emergency use.**

13.2.5 Layout of Sub-station:

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

(b) **exits. These exits shall be located at opposite ends of the building, to prevent the possibility of operating personnel being trapped in case of fire. The doors should open outward and be equipped with exit signs. For existing plants, all effort shall be made to meet the guidelines, provided in this paragraph 13.2.5.**

(c) **The roof shall be given adequate water proofing treatment to ensure that rainwater does not seep into the sub-station.**

13.2.6 Protection of Facilities:

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

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

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

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

(f) **Truck parking area based on fleet size shall be provided adjacent to the plant gate with following facilities, namely:-**

(i) Segregation of parking area through chain link fence or boundary wall.

(ii) Separate entry and exit gate with security control.

(iii) Parking lane demarcation or slotting to ensure independent drive out position parking for quick evacuation in the event of emergency.

(iv) Suitable fire protection facility through hydrant or monitors shall be considered at least from two sides of the parking lot.

13.2.7 Separation Distances :

13.2.7.1 Between Storage Tanks and Offsite Facilities

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

(b) **For Class–C petroleum, if stored in separate dyke or along with excluded product, in lube manufacturing and filling plant, Table–1 of this part shall be applicable for the purpose of separation distances between various facilities.**

(c) **Separation distances between the nearest tanks located in separate dykes shall not be less than the diameter of the larger of the two tanks or 30 metre, whichever is more.**

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

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

13.2.7.2 Between Other Blocks or Equipment:

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

Table-1

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

#	From / To	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Process Block	30 (Note4)	15	15	30	30	20	30	15	30	15	15	30	15 or 6(Note -5)
2	Storage tanks in tank farm area (Excluded/ Class C)	15	x	15	30	15* 30* *	0.5 D or min 20	20 * 30 **	15	30	15	15	30	15
3	Bulk loading, unloading gantry (excluded, class C)	15	15	X	30	15* 30* *	20	20 * 30 **	15	30	15	15	30	15
4	Fire Engines, water tanks	30	30	30	X	30	6	6	6	30	X	6	X	15
5	Boiler house	30	15* 30* *	15* 30* *	30	X	15	15	6	30	6	15	30	X
6	Boundary wall	20	0.5 D or min 20	20	6	15	X	X	6	15	X	X	X	15

#	From / To	1	2	3	4	5	6	7	8	9	10	11	12	13
7	Admin Building, Fire Control Room, Canteen	30	20* 30**	20* 30**	6	15	X	X	15	15	X	X	X	15
8	Cooling Tower DM, RWTP	15	15	15	6	6	6	15	X	6	6	15	6	15
9	OWS, API separator or Sludge pit	30	30	30	30	30	15	15	6	X	15	15	15	15
10	Electrical sub station	15	15	15	X	6	X	X	6	15	X	X	X	15
11	Warehouse	15	15	15	6	15	X	X	15	15	X	X	6	15
12	Fire Station (Fire tender, Ambulance and like other devices)	30	30	30	X	30	X	X	6	15	X	6	X	15
13	Thermic Fluid Heater	15 or 6(Note-5)	15	15	15	X	15	15	15	15	15	15	15	X
* Indicates inter distance for excluded Class. ** Indicates inter distance for Class- C.														

Table-2

Inter-distances between various facilities within the Process Block:

#	From / To	1	2	3	4	5	6	7	8	9
1	Process control room	X	X	6	6	3.5	3.5	6	6	6
2	QC Lab	X	X	6	6	3.5	3.5	6	6	6
3	Blending Kettles	6	6	3	3.5	3.5	3.5	6	6	6

				(Note -3)						
4	Intermediate or Finished Product storage	6	6	3.5	X	3.5	3.5	6	3.5	6
5	Filling Nozzle	3.5	3.5	3.5	3.5	X	3.5	3.5	3.5	6
6	Drum Empty Unit	3.5	3.5	3.5	3.5	3.5	X	3.5	3.5	3.5
7	Packaging Material	6	6	6	6	3.5	3.5	3.5 (Note-3)	3.5	6
8	Packed Material Storage	6	6	6	3.5	3.5	3.5	3.5	X	6
9	Package Container Loading	6	6	6	6	6	3.5	6	6	X

NOTE:

General Note to Tables -1 and 2

1. All distances are in metre. "X" indicates any suitable distance for constructional, operational and maintenance requirement as per good engineering practice.
2. All distances shall be measured between the nearest points on the perimeter of each facility except (i) in case of tank vehicle loading or unloading area where the distance shall be from the Centre of nearest bay. (ii) The distances given in case of storage tanks are from the shell of the tank.
3. The distance specified is between two sub-units or facilities in the same Process Block.
4. Separation distances between two Process Blocks shall not be less than 30 m. In case of space constraints, the distance can be reduced, provided hydrants are placed at a minimum distance of 20m from the respective process Blocks on both sides.
5. Thermic fluid unit within the process block shall have clear distance of 6 m from other facilities in the same process unit. Thermal fluid heater unit and Boiler unit can be in the same block.

Specific note to Tables – 1 and 2:

1. For a process control room attached to single process unit like lube blending unit, the minimum separation distance shall be 6 m from the nearest vessel. Each process control room shall have separate emergency exit.
2. The distance specified in Tables above is minimum.
3. Building within the blocks for operational or maintenance requirements shall not be considered as administrative building for the purpose of inter-distances.
4. Mezzanine floor is provided for storage of input packaging material and to feed the same to filling nozzles. The Mezzanine floor, if required can be constructed above the can filling machine or nozzles. In such cases, electrical fittings inside the cellar above the Mezzanine floor should be flame proof type. Necessary fall arresting protection such as railings or guards, shall be in place to avoid any accidental fall of personnel while working inside the cellar above the Mezzanine floor.

13.3 **Design Considerations**:

13.3.1 Design of Storage Tanks:

13.3.1.1 Tank Design:

(a) **Selection of type of tank generally depends on ambient conditions and the product handled.**
(b) **For designing of storage tanks API STD 650 or API 620 or IS 803 or IS 10987 shall be followed based on the type of the tank.**
(c) **Tank bottoms should be of cone up or cone down ("Apex down") based on requirement and product handled.**

13.3.1.2 Tank Appurtenances:

(a) **Handrails and toe guards shall be provided around the roof for safe movement of personnel for tank dipping, inspection, maintenance.**
(b) **Above ground or horizontal tanks shall have access to their roofs by means of a ladder or staircase constructed and attached to the outer tank shell. An alternate, emergency access or escape ladder or staircase may be constructed based on site specific or user requirement.**
(c) **Stairs should be made of grating. All staircases shall have resting or landing platform for every 5 m height. The landing platform as well as individual stairs or ladders shall be provided with toe guard. The stairs or ladders shall have suitable hand railings on both sides.**
(d) **Number of manholes shall depend on diameter of the tank and code followed for construction of tanks. Each manhole shall be of suitable sized and provided with hold down handle for ease of handling for maintenance.**
(e) **Two isolation valves shall be installed on each product or water draw off lines.**

13.3.2 Tank Farms or Manifolds:

13.3.2.1 Tank Farm Drains:

(a) **The dyke drain shall be provided along the inside periphery of the dyke enclosure wall. In case circular drain around tank pad is provided, the same needs to be connected to the peripheral drain. The outlet from dyke shall have the provision to either divert to the effluent Treatment plant or OWS or to main storm water drain.**

(b) **Dyke drain Valves shall be provided with position indicator. Audio alarm and visual indication should be provided in the control room to monitor open or close status of dyke valve.**

13.3.2.2 Tank Manifold:

(a) **The number of inlet or outlet connections to the tank shell should be kept minimum. Each product line nozzle connected to tank, shell shall have minimum two valves. 1st tank body valve on inlet or outlet lines should be motor operated valve (MOV) or Pneumatic operated valve (POV) and 2nd valve can be hand operated valve or MOV or POV as decided by the user. This clause is applicable for above ground tanks having capacity above 500 kl (nominal capacity). Water or product drain lines or recirculation line shall be provided with at least two manual operated isolation valves. The above stipulation is not applicable for utilities or instrumentation lines entering the tanks.**

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

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

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

(e) **Thermal safety valve (TSV) or Expansion line should be provided for blocked portion of pipe linesto take care of the thermal expansion of product due to rise of temperature.**

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

13.3.2.3 Tank Settlement:

Tank Settlement 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.

13.3.3 Tank Heaters or Mixers:

13.3.3.1 Heaters:

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

13.3.3.2 Design Criteria:

Tank heaters shall be designed to hold the product at the specified storage temperature when tank is filled up to safe filling height.

13.3.3.3 Steam Heating (low pressure steam):

(a) **Man way heater should be designed so that its removal can be done without the requirement of person entering in the tank.**
(b) **Steam coils should have no flange connections inside the tank.**
(c) **Provision should exist in condensate outlet lines to check for oil leak.**
(d) **Gradient of the coil bundle inside the tank should be such that condensate accumulation is avoided.**
(e) **The Inlet and outlet nozzle height of steam coil should be such that the same should always be immersed in the dead level of storage tank during normal operations.**
(f) **Due to operational reason, if product level is brought down below the steam coils, the steam input thru coils should be avoided or restricted and monitored for maximum temperature limit.**

13.3.3.4 Hot Oil system:

(a) **Necessary remote temperature indicators and control valves are required for the system.**
(b) **Isolation and sampling facilities are to be provided at each tank to check leaks.**
(c) **Heating oil tank level should be monitored with indicators and alarms.**

13.3.3.5 Electric Heating:

The classification and thermal rating of electric heat tracing should be verified before application. The electric conduits and cabling should conform to Classification of Areas for Electrical Installations.

13.3.4 Drains From the Tanks:

13.3.4.1 Bottom Drains:

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

13.3.4.2 Drain line:

Each drain line shall have minimum two isolation valves and pipe extended beyond tank pad up-to drain point. One of these valves shall be of quick

closing type. Ends of each drain point should have provision of blind flange or capping arrangement.

13.3.5 Vents:

Number of vents shall be provided as per applicable standard. For sizing the vents API STD 2000 is to be referred. However, following are the basic guidelines need to be considered, namely:-

(a) **Maximum and minimum ambient temperatures.**
(b) **Vapour pressure of the product at operating or design temperature.**
(c) **Maximum pumping in and out rates.**
(d) **Blending components likely to be handled in the tank.**

13.3.6 Dip Hatch:

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

13.3.7 Instrumentation:

13.3.7.1 Level instrument for storage tanks:

(a) **This paragraph 13.3.7.1 is applicable for above ground tanks having nominal capacity above 500 kl. Level instrument on the tank should be provided as under, namely:-**

(i) Minimum one reliable level instrument shall be provided in each above ground tank.

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

(iii) Level for "H" alarm shall be decided based on site specific operating parameter that is to say, diameter of tank, flow rate and operator's response time for corrective measures to stop product level reaching curb angel. However, this level shall be below the level corresponding to tank safe filling capacity.

(iv) An independent level switch shall be provided at the "HH" level which in any case shall not be above the level corresponding to safe filling capacity of the tank. This level switch shall enable initiation of action for closure of the respective tank inlet line MOV or POVs that is to say , 1st tank body valve so that the entire receipt operation closes on safe mode and the product does not overflow.

13.3.7.2 Adequate measures should be taken for tanks receiving product from ships at high flow rates for surge pressures due to sudden closures of valves and accordingly wherever required, suitably designed surge relief system to be provided. Timely closure of transfer operations to be ensured through effective communication system. Closure of pump should be based on pressure development philosophy in the outlet line in case of transfer from other locations.

13.3.7.3 Temperature and Insulation:

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

(b)

(c) **Suitable insulation shall be provided for heat conservation. The storage tanks or process tanks having higher surface temperature shall have insulation up-to minimum 2 m high for personal protection. Also, patch insulation should be provided on the shell along with spiral stairway or ladders.**

13.3.8 Piping or Valves or Flanges:

13.3.8.1 Pipping:

(a) **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 terminal) or API 5L or equivalent as applicable. Piggable pipelines shall be as per DIN standard or as per manufacturer's recommendations so as to meet the operational requirements of pigging operations.**

(b) **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.**

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

(d) **Sectionalizing of the pipelines with isolation valves and arrangements for injection or draining of water shall be provided for facilitating hydro-testing of the pipelines.**

(e) **Buried piping shall be protected against physical damage and corrosion with suitable protective coating.**

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

(g) **The pipelines should be provided with low point's drains and high point vents to facilitate emptying or hydro-testing. Ends of each drain point shall have provision of blind flange or capping arrangement.**

13.3.8.2 Valves:

Steel valves conforming to relevant API standards shall be used. Cast iron valves shall not be used for class C or excluded Petroleum products.

13.3.8.3 Flanges or Fittings:

(a) **Steel flanges and flanged fittings shall conform to relevant ASME or ASTM or ANSI or equivalent standards.**

(b) **Slip on or weld neck flanges should be used.**

(c) **Screwed flanges for sizes 50 mm or smaller may be used**

(d) **Steel flanges should conform to the applicable provisions of ASME B 16.5 or equivalent.**

(e) **Steel screwed fittings and couplings shall conform to ASME B 16.11 or equivalent.**

(f) **Steel unions shall have ground metal to metal seats. Gasket type unions shall not be used.**
(g) **Plugs should be of steel. Cast iron or brass plugs shall not be used.**
(h) **All flanges shall be connected for bonding for electrical continuity.**

13.3.9 Bulk Loading or Unloading Facility:

13.3.9.1 Loading or Unloading Pumps:

(a) **Pumps conforming to relevant API standards or equivalents shall be used.**
(b) **Product pumps shall be provided with suitable sized strainers on suction and NRVs on discharge lines. All drain points of strainers shall be provided with double isolation valve and ends having provision for blind flange or screw capped.**
(c) **Pumps shall be installed on paved area above the ground level with drainage facilities routed to OWS or ETP.**
(d) **Pump house shall be well ventilated.**
(e) **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.**
(f) **Loading pumps should also be provided with additional remote stop switches at the strategic point close to loading area to switch off the pump in case of emergency such as overflow, fire, or any other abnormal situation.**
(g) **Automated plants alternately, can install ESD at strategic points for total shutdown.**
(h) **Suction and discharge lines should be provided with thermal safety relief device to relieve pressure due to ambient temperature rise. Thermal Safety relief device may vent into a tank or piped to OWS located in safe area. When connected to tank, it (TSV) shall be provided with isolation valves. One isolation valve shall be installed close to the tank shell to the maximum extent possible.**
(i) **Pump delivery shall have bypass to facilitate loading operations in peak and lean periods.**

13.3.9.2 Tank truck loading Gantry:

(a) **Loading points shall have quick shut-off valves such as Cast steel or Ball Valve.**
(b) **In case of loading hoses, only neoprene impregnated hoses having electrical continuity between nozzle and flange shall be used.**
(c) **Proper lighting shall be provided.**
(d) **Loading gantry shall be provided with at least one suitable telephone or walkie talkies for effective communication with pump house in normal and emergency operations.**
(e) **Tank truck loading gantry shall be suitable for all weather conditions.**
(f) **Tank Truck loading gantry shall be provided with safety harness to protect the operating crew against fall from height.**
(g) **Swing type loading platforms with counterweight and hand railing shall be provided and should be light in construction.**
(h) **Proper handrail arrangement shall be provided on platforms and stairs for safe movement of personnel. Stairs and platforms shall be constructed of gratings. Minimum width of stair shall be 610 mm.**
(i) **At one emergency escape ladder shall be provided at rear middle of 8 bays gantry for emergency use. Minimum width of emergency ladder stairs should be 610 mm. Escape ladders shall be prominently identified from distant view. A safety cage shall be provided around top portion of the escape ladder.**

(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 shall be considered as per the site conditions and overall automation system in the installation. Isolation valves shall be located at least 15 m away from the gantry and easy accessible location.**
(k) **Drain in front and rear side of the loading or unloading gantry shall be provided. Open drains along gantry shall be covered with gratings so as not to endanger movement of personnel.**
(l) **Loading gantry area shall be paved for smooth draining. Oil and water collected from loading or unloading areas shall be routed to Oil water separator system or Effluent Treatment Plant or similar facility.**
(m) **The tank truck gantry shall be so designed that all the compartments of the tank truck are filled at one bay only. The layout shall ensure that all operations are planned in a manner so that no zigzag movement of the tank truck around the gantry should take place.**
(n) **All trucks entering the plant shall have safety fittings as required.**

13.3.10 Blending Vessel Pumps:

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

13.3.11 Pipeline Pigging system and pigging Manifold:

(a) **Interconnecting the large number of source tanks with different possible destinations (such as blending, filling and bulk loading has always been a major challenge of Lube blending plants.**
(b) **Pipeline Pigging system should be provided where a large variety of products are transferred primarily for optimization of installation cost by reducing the number of pipelines.**
(c) **The pigging system or manifold must be a closed system to ensure safe interconnection without cross-contamination and product loss.**

13.3.12 Design Layout for Handling of Slop:

(a) **Collection and Drainage:**

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

(b) **ETP or OWS:**

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

(ii) Final effluent discharge should be tested periodically to check the PPM content in order to meet the prescribed limit by Pollution Control Board (PCB).

13.3.13 Handling of Sick or Leaky Tank Trucks or Tank Wagon

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

(a) **Arresting of leaks using suitable method as a first aid measure till the sick or leaky tank truck or tank wagon is unloaded safely at designated place. In no case such tank truck or tank wagon shall be used for transportation;**
(b) **A drain header should be provided to drain out the content to an underground tank or sump from where it can be pumped out to storage tank or to the loading header; and**
(c) **Either permanent facility or portable pump motor arrangements with suitable fittings to be used for quick disposal. Such products to be handled further as per IQCM (Industry Quality Control Manual).**

13.3.14 Electrical Equipment:

13.3.14.1 Selection:

(a) **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.**
(b) **Protection:**
(c) **The protective system shall be designed to ensure Protection of Personnel and plant equipment against damage which can occur due to internal or external short circuits, overloading, abnormal operating conditions, switching, lightning surges and like other reasons accordingly, relays and protective devices shall be suitably selected and installed.**
(d) **All enclosure for electrical equipment or panels or JBs or double entry glands for cable entries in process blocks, finished product and empty storage area should have Ingress Protection (IP 54 or IP 55).**
(e) **All the protective relays for the Generator, Transformer, Motors and Switchgears shall be tested at least once in a year and test records maintained.**

13.3.14.2 Cables

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

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(b) **All power and control cables shall have extruded inner and outer sheaths. Cables should be Aluminium or Copper Conductor PVC insulated, PVC sheathed and armoured type.**
(c) **Instrument signal communication cables shall not be laid in the same trench or tray along with electrical cables. The overall cable layouts shall be designed for minimum interference between signal and power cables.**

(d) **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.**

13.3.15 Installation Earthing :

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

(a) **System neutral earthing.**
(b) **Protective Equipment Earthing for personnel safety.**
(c) **Protection against Static discharges.**
(d) **Lightening Protection.**
(e) **Earthing for Data Processing system.**

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

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

13.3.15.3 Measurement of earth resistance:

(a) **The testing of the Earth Pits shall be done half yearly basis, once in dry and once in wet weather and records shall be maintained in this regard.**
(b) **Removable link shall be provided to allow measurement of an earth electrode-resistance independently.**

13.3.15.4 Allowable earth-Resistance Values:

The resistance value of an earthing system to general mass of the earth should not exceed, the following namely:-.

(a) **4 ohm for electrical systems and metallic structures**
(b) **7 ohm for storage tanks**
(c) **1 ohm for main earth grid, and bonding connections between joints in pipelines and associated facilities.**
(d) **2 Ohm for each electrode to the general mass of the earth (read in conjunction with note in succeeding clause).**
(e) **Note: In areas with high soil resistivity (that is to say, Granite or rocky area), allowable resistance for individual electrode to the general mass of the earth is acceptable up-to 5 ohm, but grid resistance value shall no way exceed 1 ohm.**

13.3.15.5 Electrically independent earth electrodes:

(a) **Earth electrodes should 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.**
(b) **The Lightning Arrestor (LA) of the Two Pole or Four Pole structure shall be connected to two distinct earth pits. The strips shall run on insulators or isolators so as not to come in contact with the Pole structure. Connections shall be made to the pit directly and, then, pits shall be connected to each other to form an independent earthing network. This independent earthing network or grid shall be connected with main earthing grid below the ground (at a depth of minimum 500 mm), minimum at two points.**
(c) **The use of rod or pipe or strip electrodes is permissible. Their choice will depend upon site conditions, soil resistivity and economic considerations. The material of earth electrodes shall be galvanized iron.**
(d) **The whole of lightning protective system including any earth ring shall have a combined resistance to earth not exceeding 10 ohm without taking account of any bonding.**
(e) **The Two Pole or Four Pole structure shall be earthed with two separate earth connections from grid. The Gang Operated Switch shall also be earthed.**
(f) **Fencing of two Pole or four Pole, Transformer yard shall be earthed and also electrical continuity between various structures, the fencing shall be ensured.**
(g) **The Neutral of the Transformers shall be earthed with two distinct earth pits separately. Connections shall be made to the pit directly and, then, pits shall be connected to each other to form a grid. This independent earthing network or grid should be connected with main earthing grid below the ground (at a depth of min. 500 mm), minimum at two points.**
(h) **The Neutral of the Diesel Generatorsshall 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 independent earthing network or grid should be connected with main earthing grid below the ground (at a depth of minimum 500 mm), minimum at two points.**
(i) **The transformer body shall be earthed at two points separately leading to earthing system.**
(j) **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.**
(k) **All the electrical equipment operating above 250 volts shall have two separate and distinct connections to the earth grid.**
(l) **All Steel structures, loading platform or gantry and like other devices, shall be earthed with two separate connections from main earthing grid.**
(m) **Each Product Storage tank shall have one separate earth connection at every 30 m of the tank perimeter from main earthing grid. However, minimum two connections shall be provided for smaller tanks.**

13.3.15.6 Bonding:

(a) **Flanges: All joints in pipelines, valves, storage tanks and associated facilities and equipment for petroleum shall be made electrically continuous by bonding. The resistance value between joints shall not exceed 1 ohm.**
(b) **Tank Truck Loading and Unloading Gantry: For the gantry 6 mm Sq. braided copper wire with one end firmly bolted to the Loading or Unloading Arm or hoses and the other end provided with G.I or Copper or Non corrodible metal crocodile**

clips should be used, the crocodile clips being attached to the tank-truck under loading or unloading. (For External Bonding of Loading or unloading arms or hose with the Tank Truck).

13.3.15.7 Static earthing:

(a) **Static Earthing (earthing for static charge dissipation) shall be provided at Tank Lorry filling or decantation Gantries, to prevent building up of Static Charges.**

(b) **The earthing for static dissipation, electrical system and automation system shall be separate and can be taken from main grid below the ground.**

13.3.15.8 Lightning protection for structure and building:

(a) **Lighting protection shall be provided for the structures and buildings which are higher than 20 metre or as per the risk index analysis worked out as per IS 2309.**
(b) **Self-conducting structures having metal thickness of more than 4.8 mm may not require lightning protection with aerial rod and down conductors. They shall, however, be connected to the earthing system, at least, at two points at the base.**
(c) **Non-conducting chimneys or stacks whose overall width or diameter at top is up-to 1.5 m shall be provided with one aerial rod and down conductor and chimneys with overall width of diameter at top more than 1.5 m shall be provided with 2 Nos. aerial and down conductors.**
(d) **In case, lightening arrester is provided for any structure or building or stack, an independent earthing network shall be provided for grounding the lighting protection system. This independent earthing network or grid shall be connected with main earthing grid below the ground (at a depth of minimum 500 mm), minimum at two points.**

13.3.15.9 Earthing for data processing system:

(a) **Low noise Earthing shall be provided for critical data processing equipment which shall be independent of any other Earthing of the Building.**
(b) **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.**

13.3.15.10 Minimum Permissible Sizes of the Earthing Conductors:

(a) **Size of the conductor shall be selected based on the fault current that is required to be dissipated during emergencies, as specified below, namely:-**

Equipment	Size of the conductor
Main Earthing Grid	50 mm x 6 mm GI strip.
Lightening Arrester of the 2 or 4 Pole Structure	50 mm x 6 mm GI strip.
2 or 4 Pole structure, Sub-Station equipment's, VCB and like other devices	50 mm x 6 mm GI strip.
Fence of the 2or 4 pole structure, transformer yard	25 mm x 3 mm GI strip.
Power Transformer Neutral	50 mm x 6 mm GI strip.
Power Transformer Body	40 mm x 5 mm GI strip.
Fire Water Pump House	25 mm x 3 mm GI strip.
Building or Structure Columns	50 mm X 6 mm GI Strip.
Storage Tanks	50 mm X 6 mm GI Strip.
Push Button Stations	No. 8 SWG Solid GI Wire.
Street Light Poles	10 mm (3 or 8") GI Wire Rope.
Small Equipment and Instruments	No. 8 SWG Solid GI Wire.
Bonding of Pipes	25 mm square copper strip / braided flexible cable.
Motors up to 3.7 Kw	No. 8 SWG Solid GI Wire.
Motors above 3.7 Kw up to 30Kw	10 mm (3 or 8") GI Wire Rope.
Static Earth at Tanker, Wagon loading or Unloading gantry	50 mm x 6 mm GI strip..
Flexible cable for Static Earth	10 Sq mm Copper flexible cables with lugs at one end and crocodile clip at other end.

(b) **Facility or equipment wise recommended minimum Nos. of earth pits or connections which should be bonded in main earthing grid.**

The minimum requirement of earth pits and additional earth pits shall be made as per paragraph 2.12.8 of Part B of this Schedule.

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

13.3.15.11 Electrical safety for laboratories:

(a) **Hazardous are classification within laboratory building, which should be carried out in line with IS: 5572. Accordingly, the electrical equipment or fittings should be selected in line with IS:5571.**
(b) **Following aspects should be considered for electrical equipment or fittings in the laboratory, namely:-**
    (i) Layout of electrical switch room shall have spacing as per Indian electricity rules.
    (ii) Plugs, having multiple outlets, should not be used. Industrial type closed or tight metal clad fittings for plug and socket assembly should be used.
    (iii) ELCB or MCB shall be installed in the main power switchboard.

13.3.15.12 General:

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

13.3.16 Plant Lighting:

(a) **Sufficient lighting shall be provided so as to enable Plant operators to move safely within the accessible areas of installation and to perform routine operations. In the event of normal power failure, emergency lighting shall be provided in critical areas.**
(b) **Normal lighting system shall be on 415 or 240V AC supply, whereas critical emergency lighting will be DC based in critical areas like Sub-Station, D. G. Room, Control Room and Security cabins.**

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

(d) **Critical Emergency lighting (D.C. supply based) shall be normally kept 'ON'. during power failure, battery bank shall be used to provide power.**

(e) **Lighting shall be provided for the various facilities in the Lube manufacturing and filling plants. The illumination levels in different areas should be as per good engineering practice.**

(f) **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.**

(g) **Lighting requirements provided during the failure of power supply is intended broadly to-**

(i) facilitate carrying out of specified operations, for safe shutdown of the installation.

(ii) gain access and permit ready identification of firefighting facilities such as fire water pumps, fire alarm stations and like other devices .

(iii) to gain access to escape route for safe evacuation of operating personnel.

(h) **Depending on the nature of job activities carried out, the minimum illumination levels for various areas be ensured for safe movement or operations or emergency handling as per clause(10) of paragraph 2.13 of Part B of this Schedule. Following shall also be ensured, namely: -**

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

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

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

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

(v) Minimum One number calibrated lux meter shall be kept in the location.

(i) **Emergency lighting panel:**

(i) Emergency lighting panel shall have provision of power input both from normal supply and DG supply independently with a provision of failsafe interlock. In the event of failure of normal supply or emergency or maintenance, emergency panel shall be receiving alternate supply from DG set. Emergency lighting panel shall host the equipment specified in the succeeding clause(ii)

(ii) Jockey Pump, Critical lighting (one or two high mast, minimum lighting for fire pump house, security room, control room, administrative building, operating facilities and like other devices), Fire Siren, Electrical pumps for fire water replenishment, Gate Barrier, safety instrumentation and interlocks such as CCTV, smoke or heat detectors, Dyke drain valve system, UPS of automation and supply to essential firefighting equipment.

13.3.17 Air Turbo Ventilation System in Lube Manufacturing And Filling Plants:

13.3.17.1 The ventilation not only provides pleasant, healthy working atmosphere in workplaces but also maintains hygienic condition. In emergency like fire, it also extracts smokes or fumes which enables easy escape of personnel working there and fire fighters to reach the fire site. Construction material should be weatherproof.

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

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

13.3.17.4 Salient features of the ventilation system should be -

(a) **7 x 24 hrs. availability.**
(b) **Noiseless operation.**
(c) **Cost effective.**
(d) **Capable of extracting heat, humidity, smoke, fumes , dust and like other requirements.**
(e) **Maintains hygienic condition.**

13.3.17.5 Flooring:

(a) **Flooring of blocks shall be non-skid type and having proper slope for necessary drainage.**
(b) **Any level difference on floor in account of operational requirement or equipment layout should be clearly demarcated so as to ensure safe movement of persons.**

13.3.17.6 Stairs And Platforms:

(a) **All platforms or stairs shall be of non-skid type surface preferably made of gratings.**
(b) **Toe guards and suitable railing shall be provided all around the elevated platform.**
(c) **Alternate access or emergency escape shall be considered for each elevated platform.**

13.3.17.7 Ladders:

(A) Material construction of ladder

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

(B) General requirements:

(i) All ladders shall be constructed to carry their intended loads safely.

(ii) Side rails of metal ladders should be of sufficient cross-section to prevent excessive deflection in use.

(iii) Ladders which are to remain as a part of the permanent structure should conform to any local, state or municipal bye laws which may be applicable.

(iv) Top and bottom of each built up ladder should be securely fastened.

(v) All surfaces of the ladder should be planed, free of splinters and edge of handrails used should be beveled.

(vi) Rung spacing should be uniform and not over 300 mm on centers. Rungs should be recessed at least 12 mm into rails.

(vii) Safety shoes, lashing or other effective means shall be used to avoid danger of slipping

13.3.17.8 Stacking of Drums or Packed Products:

(a) **Stacking of drums or packed lubes should be on racks or pallets or reapers and above the grade levels.**
(b) **Stacking should be max in 4 rows, 5 tier height and 25 m length. A minimum access path should be provided which should be minimum of forklift turning radius plus 0.5 m between two groups of stacks.**
(c) **Light fittings on the ceiling should be fixed in between two stack lines. Suitable cage type protection should be provided so as to avoid external damage.**
(d) **The drum or packed storage space should be properly marked or painted on the flooring.**

13.3.17.9 Boiler:

(a) **The steam boilers intended for use in lube manufacturing and filling plants shall be governed by the regulation of Indian Boilers Act, 1923 and latest amended Rules.**
(b) **The design and drawings of the boiler or boiler component, as the case may be, and the materials, mountings and fittings used in the repair of such boiler or boiler component shall conform to the applicable regulations.**

13.3.17.10 Steam Trap:

(a) **Suitable stream traps shall be provided at outlet of steam lines.**

13.3.17.11Thermal or Steam Insulation:

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

13.3.17.12Compressor:

Compressed air:

(a) **The quality of instrument air shall conform to the requirements as recommended by the manufacturers of instruments or equipment.**
(b) **If one compressor is envisaged to run normally, another standby compressor of 100% capacity shall be provided. When more than one compressor running is envisaged, 50% standby capacity shall be provided.**

13.3.17.13Service Water for Plant Operations:

(a) **Service water is required for the plant operations such as, Boiler use, cooling tower, compressor cooling and in hose stations for washing and like other activities, water may be provided at a pressure of about 3 Kg/sq.cm. g. If one pump is envisaged to run normally, another pump with 100% capacity shall be provided as a standby. Where more than one pump running is envisaged, 50% capacity as standby shall be provided.**
(b) **Water Quality should be of potable quality conforming to IS: 10500 - Specification for Drinking Water.**

13.3.17.14Cooling Tower:

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

13.3.17.15 Induction Sealing System:

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

13.3.17.16 Storage Space for Empty Packages, Packed Additives, and Packed Finished Product:

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

13.3.17.17 SRV for Vessels or Kettles in Confirmity to ASME Section Viii Div. 1:

Pressure vessels or kettles with internal coils or limpet coils or jackets shall have SRVs, set at 110% of the maximum operating or working pressure.

13.3.17.18 Pressure Regulation for Low Pressure Steam:

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

13.3.17.19 Transfer or Filling Hoses:

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

13.3.17.20 Auto Cut-Off Facility:

Lube filling machines preferably should have automatic features like auto filling, auto cutoff, auto pick up and like other features.

13.4 Safe Operating and Handling Practices in Lube Manufacturing and Filling Plant Operations:

13.4.1 General:

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

(b) **Plant process control room wherever provided shall be manned on continuous basis during operations and in emergency.**

(c) **Site specific Standard Operating Procedures (SOPs) shall be developed.**

(d) **These must be made with the involvement of users and approved by the competent authority. Such procedures shall be periodically reviewed, updated and records maintained in this regard especially whenever any changes or modifications to the facilities are made as per Management of Change (MOC) procedure.**

(e) **The critical operating steps based on "SOPs" shall be displayed on the board near the location where applicable.**

(f) **POV shall be in fail safe mode (that is to say, with loss of pressure, the valve shall shut off). After end of operations, all operating valves shall be in closed position.**

(g) **VHF or UHF handsets of appropriate type shall be provided to all operating personnel working in critical areas.**

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

(i) **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.**

(j) **The pipeline transfer should preferably be commenced during day light. Due to urgency if operation requires to be carried out or extended in night time, the same to be carried out under supervision of adequately trained and experienced staff.**
(k) **Manning level in the shift shall be adequate to ensure coverage for normal and emergency operations.**
(l) **Suitable interlocks shall be provided for tripping or alarm of MOV operation based on the events that is to say , low level, high level, high high level, high pressure, low pressure and like other events.**
(m) **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) or Effluent Treatment Plant (ETP) for safe disposal.**
(n) **Personnel protective equipment such as safety shoes, hand gloves, apron, safety goggles, safety belt, helmet, earmuff, dust respirator, self-contained breathing apparatus (SCBA), fire proximity suit, resuscitator and like other equipments as applicable shall be worn while carrying out operations in normal and emergency situations.**

13.4.2 Bulk Handling for Movement By Road:

(a) **Transportation of petroleum products by road is regulated by the Motor Vehicle Act, 1988.**
(b) **Containers and tank trucks should be fabricated in accordance with applicable statutory requirement.**
(c) **All TTs to be fitted with Antilock Braking System (ABS) as per RTO regulations.**

13.4.3 Safety Precautions During Tank Vehicle Loading Or Unloading In Bulk:

Following precaution shall be taken due to associated hazards during transfer of Petroleum products to or from a tank truck, namely:-

(a) **Open source of ignition shall not be allowed in the area where product transfer operations are carried out.**
(b) **Similarly, minimum 3% vapour space shall be kept in containers and 2% vapour space in tank trucks in respect of petroleum Class C or excluded product.**
(c) **Fire extinguishers shall be placed near the tank trucks during operations in a designated marked place.**
(d) **The Double pole master switch shall be put off immediately after parking the truck in position. No electrical switch on the truck shall be turned "on" or "off" during the transfer operation.**
(e) **The first operation after positioning the truck shall be providing wedge or stopper and earthing. They shall be removed or disconnected just before the release of the truck.**
(f) **Hoses shall be handled with care and inspected periodically.**
(g) **No repairs shall be made on the truck while it is in the loading or unloading area.**
(h) **Personnel shall wear applicable Personal Protective equipment.**
(i) **Filling or transfer operations shall be suspended immediately in the event of –**

(i) Uncontrolled leakage occurring;

(ii) A fire occurring in the vicinity; and

(iii) Lightning and thunder storm.

13.4.4 Safe Procedures During Operation:

13.4.4.1 Loading operations:

(a) **Check for following in a tank truck as per statutory regulations before accepting it for filling, namely:-**

(i) Provision of PV vent, emergency vent, Master valve and other safety fittings.

(ii) Fire screen between cabin and tank is provided. For this purpose, cabins with metallic back cover without any opening will be considered as fire screen.

(iii) Provision of 2 nos. of Fire Extinguishers of ISI mark (1 no. of 9 kg DCP and 1 no. of 1 kg CO2 or DCP or equivalent approved fire extinguisher).

(iv) Spark arrestors should be properly bolted or welded on the exhaust.

(v) No leakage in exhaust silencer pipe.

(vi) Availability of valid RTO certificate.

(vii) Availability of brazed copper strip for Earthing or bonding connection.

(b) **Drive the truck at stipulated speed to the loading bay.**

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

(d) **Stop the engine and switch off all electrical equipment.**

(e) **All persons should leave the driver's cabin.**

(f) **Provide earthing connections of the vehicle at specified point to the fixed grounding system.**

(g) **Start the loading operations.**

(h) **The quantity loaded into the truck can be assessed by –**

(i) Liquid level through manual dipping; and

(ii) Filling through Flow meter.

13.4.4.2 Unloading operations:

(a) **Operations described under clause 6.4(A) should be selectively carried out.**

(b) **Test the connections for leaks.**

(c) **Start the unloading operations.**

(d) **Before realizing the trucks ensure that valves are closed or ends are capped.**

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

(f) **Checklist for bulk or packed lube or additive trucks at loading or unloading locations is given at Annexure-1 to this Part.**

13.4.5 Handling of Sick Bulk Truck or Tank Wagon:

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

13.4.6 Pipeline Transfer Operations:

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

13.4.6.2 Wherever pipeline transfer is envisaged between various companies, a mass flow meter with integrator shall be installed on receipt line at both ends that is to say dispatch and receipt ends. Signal should be provided in the control rooms of both dispatching and receiving companies or plants for monitoring delivered quantity.

13.4.6.3 The following safe practices shall be followed, namely:-

(a) **Gauging procedure shall be completed, and line shall be made through.**
(b) **Physical inspection shall be carried out up to the exchange manifold for any leakage or damage and like other losses.**
(c) **Line up shall be started from the exchange pit end.**
(d) **Seal the pressure relief lines of receipt nozzles of product tanks connected to the same common receipt header.**
(e) **After ensuring that there are no leaks, pumping should be commenced.**
(f) **Pumping shall be commenced initially at low flow rate and only after stabilizing of flow, the flow rate may be increased.**
(g) **Product shall not be pumped beyond safe filling height of the tank.**
(h) **After completion of the receipt, pumps must be stopped.**
(i) **In case of Emergency Shutdown, care shall be taken so that back pressure is not developed in the pipelines and pump head.**
(j) **Sampling shall be carried out as per provisions of Industry Quality Control Manual (IQCM).**
(k) **Pipeline transfer (PLT) shall not be taken simultaneously in more than one tank.**
(l) **In case product is required to be taken into more than one tank, tank should be switched over after completion of operation in first tank, close all valves to the first tank, make line through for the second tank as per procedure. For flying switch over from one tank to another, a written down procedure to be in place and followed.**

13.4.7 Safety Precautions in Tank Farm Area Operations:

(a) **At the end of day operations, 100% closure of all the operating valves must be ensured and they shall not be left in partial open condition.**
(b) **All electrical fittings shall be maintained to ensure its integrity and type of protection.**
(c) **The tank farm shall be kept clean and free from vegetation.**
(d) **Tanks and tank aprons shall be periodically checked for damage, leakages, sweating and repairs.**
(e) **Proper earthing and bonding shall be maintained for storage tanks and across the flange joints.**
(f) **Dyke drain valve shall be positioned outside of dyke and kept normally in closed condition and shall be operated only under supervision of authorized person and log book maintained.**
(g) **Isolation Valves on expansion lines or TSV vent lines shall be always kept open except under requirement during location specific operations to take care thermal expansion.**
(h) **No gauging or sampling of tanks should be undertaken during thunder or hailstorms.**
(i) **Flow velocity at tank inlet should not exceed 1 m/s until the inlet is completely submerged.**
(j) **Safety shoes (Conductive type) shall be worn while gauging, sampling or taking temperatures.**

(k) **Ensure that gauge tapes with earthing provision are used for gauging.**
(l) **Tank dip pipes shall be extending to tank bottom. If dip pipes are not provided, give a relaxation time of 30 minutes before sampling or gauging.**
(m) **Synthetic fiber cord shall not be used for sampling, dipping, gauging and like other process .If the sampling, gauging, dipping, and like other process equipment is a conductor, the cord must be conductive, that is to say a metal wire. Metal chains should not be used instead.**
(n) **Natural fibers such as sisal and manila have sufficient conductivity to prevent the operator from becoming charged by handling it, hence can also be used.**
(o) **In case of large tank farms effective communication is essential. Apart from VHF, Pagers with loud hooters should be provided on roadside at various locations. This can also be utilized for communication during emergency like fire.**
(p) **While cleaning the tanks, care should be taken to avoid generation of static electricity. Cleaning of tanks by gas oil spray shall not be permitted. Cleaning of tanks by steaming shall be permitted for Class C or excluded products, but not permitted for class-B products. Water washing is preferred.**
(q) **If the tank has internal heating coils, steam to the coils should not be charged until the coils are fully submerged and condensate from these coils must be monitored for Oil content.**
(r) **Side entry mixtures should be operated only when liquid level is above the blades.**

13.4.8 Safety Instruction Regarding usage of Portable Ladders:

(a) **Before use, all ladders shall be tested for load test. For load test, a test load of 1.5 times the mass of worker plus the mass of 16 bricks shall be hung from each rung. The rung and ladder should not show any distress or noticeable bending. The lower rungs may be tested by reversing the ladder. Unless otherwise specified, the mass of worker should be taken as 68 kgs. Load testing shall be done when ladders are brought to the construction site and when damage to ladders is anticipated or observed on visual inspection.**
(b) **No ladder having a missing or defective rung shall be used. Defective ladders shall be promptly and properly repaired or replaced.**
(c) **Ladders leading to landing shall extend at least one metre above the landing and shall be secured at the upper end.**
(d) **To prevent slipping, a ladder shall be secured at the bottom end, otherwise, a person shall be stationed at the base wherever it is used.**
(e) **The pitch at which a lean-to-ladder is used shall be such that the horizontal distance of its foot from the vertical plane of its top shall be not more than one quarter of its length.**
(f) **If the surface of the floor on which the ladder rests is smooth or sloping, the ladder shall be provided with non-slip bases.**
(g) **If the use of ladder is essential during strong winds, it shall be securely latched in position.**
(h) **No ladder shall be placed or leant against window panes, sashes or such other unsafe or yielding objects, nor placed in front of doors opening towards it. If set up in driveways, passage ways or public walkways, it shall be protected by suitable barricades.**
(i) **When ascending or descending, the user shall face the ladder, use both his hands and place his feet near the ends of the rungs rather than near middle.**
(j) **It is dangerous to lean more than 300 mm to side in order to reach a larger area from a single setting of the ladder. Instead, the user should get down and shift the ladder to the required position.**
(k) **Metal ladders shall not be used around the electrical equipment or circuits of any kind where there is a possibility of coming in contact with the current. Metal ladders shall be marked with signs reading "CAUTION: DO NOT USE NEAR ELECTRICAL EQUIPMENT"**

13.4.9 Precautions for Boiler Operations:

13.4.9.1 Before starting the fires in a boiler, the attendant should-

(a) **check that there is sufficient water in the boiler, and that the gauge cocks are working freely;**

(b)

(c) **ease safety valves, or open cock on top of boiler to allow air to escape;**

(d) **check that the blow-off cock is fully closed and tight;**

(e) **check that the safety valves and feed check valve are free and workable;**

(f) **check that water is not leaking from any part of the boiler; and**

(g) **check that the feed pump is in working order.**

13.4.9.2 Keep the gauge cocks perfectly tight and clean blowing through the test cocks frequently.

13.4.9.3 Pressure gauge should have a plain mark on it showing the highest pressure allowed for the boiler, and the dial should be kept clean so that the figures may easily be read.

13.4.9.4 Safety valve should be moved by hand every day so as to prevent them from sticking.

It should never be opened by a sudden knock or pull. Safety valves must never be overloaded, and spring valves should have ferrules or other provisions against the valves being screwed down too far.

13.4.9.5 Steam pressure: Ordinarily the safety valve will prevent steam from raising much above the working pressure, but if the steam gauge shows so rapid an increase of pressure as to indicate danger of exceeding the highest limit, water should be immediately fed into the boiler and the dampers partially closed in order to diminish the effect of the fire. If, however, the water has fallen so low that there is danger of an accident from this cause, the fires should be withdrawn before feeding in water, the safety valves eased and if the engine is at rest, it should be started so as to reduce the pressure.

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

13.4.9.7 Re-ignition boiler: Before re-ignition of boiler, sufficient degassing should be done as per SOP to ensure nil hydrocarbon vapour presence.

13.4.10 Forklift Operations:

(a) **Load bearing test for the forklifts shall be done at a frequency in line with requirement of concerned Government Inspector of Factories and record maintained.**

(b) **Vision test or eye test for the forklift operators shall be done at a frequency in line with requirement of concerned Government Inspector of Factories and record shall maintained in this regard.**

(c) **Neither forklift nor the operator shall be engaged, if above statutory requirements are expired.**

13.4.11 Weigh Bridge:

(a) **Calibration of Weigh Bridge shall be carried out as per concerned State Government Legal Metrology requirement.**

(b) **Required quantity of weight should be kept at site as per requirement of Legal Metrology.**

13.5Fire Protection and Prevention Facilities:

13.5.1 Fire Protection :

Depending on the nature of risk, required fire protection facilities shall be provided from the following, namely:-

(a) **Fire Water System - (storage, pumps, distribution piping network with hydrant, monitors, elevated monitors).**
(b) **First Aid Fire Fighting Equipment.**
(c) **Trolley mounted Fire Fighting Equipment.**
(d) **Carbon Dioxide System.**
(e) **Dry Chemical Extinguishing System.**
(f) **Clean Agent Protection System.**
(g) **Detection and alarm systems.**
(h) **Communication System.**

13.5.2 Design Criteria For Fire Protection System:

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

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

13.5.2.3 *For lube manufacturing and filling plant storing mainly Class C or excluded products, the water requirement shall be based on 1 monitor of 144 kl/hr and 4 hose streams of 36 kl/hr that is to say, a total of 288 kl per hr for four hrs.*

13.5.2.4 *If Class –A or Class B products are stored in above ground tanks in the lube manufacturing and filling plants, applicable fire protection system in line with PNGRB T4S Petroleum installation regulation shall be provided. Class –A and or Class B storage tanks should be in separate dyke. If stored in common dyke with class –C or excluded storage in above ground tanks, the applicable fixed type spray system shall also be provided on all tanks as applicable in PNGRB T4S Petroleum installation regulation. However, this paragraph should not be applicable in case the class A, Class B or Class C product is stored in UG tanks. In such cases, fire protection facility as per Petroleum Rules shall be applicable.*

13.5.2.5 *The operating or hazardous areas shall be protected by a well laid combination of hydrants and monitors. The following plants are exempted from this provision, namely: -*

(a) **The plants having aggregate above ground storage capacity of less than 1500 KL, irrespective of class.**
(b) **Plants storing products in UG tanks, irrespective of class.**

13.5.2.6 Installations where inter distances between tanks (class C and above) in a dyke or within dykes are not conforming to the extant provisions of the standard, additional remedial measures (if any) need to be taken based on QRA report and recommendations.

13.5.2.7 The empty package storage area within blocks which stores flammable materials such as cans or small containers or cartons or labels or pails or buckets or HDPE barrels and like other storages , shall be covered by manually operated medium velocity fixed type spray system with application @ 10 lpm / sq.m area. Isolation valves on fixed type spray riser lines shall be provided at sufficient distance from the hazard that is to say, 15 m (minimum), preferably outside of shed. Alternate isolation valves should be considered from opposite side. However, for existing plants or plants under construction, in case it is not practically feasible to provide the fixed spray system due to space constraints or structural stability of the sheds, the double hydrant points should be provided outside the shed at nearest location of the empty package storage area so that any exigency can be mitigated.

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

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

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

13.5.2.11 Hydrant facility should not be laid inside the process blocks for example the blending process blocks. However, hydrant system should be laid all around the process blocks.

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

13.5.2.13 Portable monitors or foam hose streams shall be provided for fighting fires in dyke area and other plant area.

13.5.2.14 At least two Nos. trolley mounted water cum foam monitor of capacity 2400 lpm each shall be provided at lube manufacturing and filling plant.

13.5.3 Fire Water System Design:

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

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

(a) **a fire water ring main shall be provided all around perimeter of the plant facilities with hydrants or monitors spaced at intervals not exceeding 30 m when measured aerially. Fire hydrants and monitors shall not be installed within 15 metre from the facilities or equipment to be protected.**

(b) **the water replenishment arrangement either from bore well or natural or artificial reservoir should be at least 12.5 % of per hour design flow rate. Availability of fire water from above source should be 7 x 24 Hrs.**

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

13.5.4 Fire Water Design Flow Rate:

13.5.4.1 The design flow rate shall be any one of the maximum requirements of the following cases for four (4) hrs, namely:-

(a) **For lube manufacturing and filling plant storing exclusively Class C or excluded products, the water requirement shall be based on 1 monitor of 144 kl / hr and 4 hose streams of 36 kl/hr that is to say, a total of 288 kl per hr.**

(b) **For Class-A or Class - B petroleum, if stored in the same plant, the water requirement should be based on requirement as stipulated in PNGRB T4S Regulation for Petroleum Installation, whether the fixed fire protection facilities are provided or not. Storage of class A or class -B product in non-bulk category shall comply Petroleum Rules.**

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

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

13.5.4.2 Design flow rate shall be the maximum among as provided in preceding clauses (a), (b), (c) and (d) above.

13.5.5 Fire Water Storage:

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

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

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

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

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

(f)

13.5.6 Fire Water Pumps:

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

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

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

(d) **The fire water pumps including the standby pumps shall be of diesel engine driven type. Where electric supply is reliable, 50% of the pumps can be electric driven. The diesel engines shall be quick starting type with the help of push buttons located on or near the pumps or located at a remote location. Each engine shall have an independent fuel tank adequately sized for 6 hours continuous running of the pump. Fuel tank should be installed outside of fire pump house and shall have provision for venting. If tanks are installed inside the pump house, a safe distance from engine (3 m) to be maintained and the vent shall have provision for venting outside the pump**

house. Installation of fuel tank shall be such that tank bottom is at least 200 mm above the suction valve of the fuel injection pump or as specified by OEM.

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

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

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

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

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

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

(i) The main fire pumps shall start automatically in set sequence in response to a low-pressure condition in the hydrant system.

(ii) Stand by fire water pumps shall start automatically, if the main pumps do not start or fail to build up the required pressure within 20 seconds.

(iii) Provision shall be made for manual starting of each pump at the pump house and from control room also. However, manual stop of each pump unit shall be only at pump house.

13.5.7 Fire Hydrant Network:

13.5.7.1 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.

13.5.7.2 Fire hydrant ring main shall be laid above ground ensuring that-

(a) **the Pipeline shall be laid at a height of 300 mm to 400mm above finished ground level.**

(b) **the pipe support shall have only point contact. The mains shall be supported at regular intervals,-**

(i) for pipeline size less than 150 mm, support interval should not exceed 3 m.

(ii) for pipeline size 150mm and above, support interval should not exceed 6 m or design approved.

13.5.7.3 The system for above ground portion shall be analyzed for flexibility against thermal expansion and necessary expansion loops where called for shall be provided.

13.5.7.4 Fire hydrant ring main may be laid underground at the following places, namely:-

(a) **At road crossings.**

(b) **Places where above ground piping is likely to cause obstruction to operation and vehicle movement.**

(c) **Places where above ground piping is likely to get damaged mechanically.**

(d) **Where frost conditions warrant, and ambient temperature is likely to fall below zero deg. Centigrade, underground piping should be provided at least 1 metre below the ground level. Alternatively, in such cases water circulation to be carried out for above ground pipelines.**

13.5.7.5 Fire water ring main laid underground shall ensure the following, namely:-

(a) **Pipes made of composite material shall be laid underground**

(b) **The Ring main shall have at least one metre 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 or steel encasement as per design requirement and in case of rail crossing, provisions stipulated by Indian Railways shall be complied.**

(c) **The Ring main shall be suitably protected against soil corrosion by suitable coating or wrapping with or without cathodic protection.**

(d) **In case of poor soil conditions, it may be necessary to provide concrete or masonry supports under the pipeline.**

13.5.7.6 Size of hydrant pipeline shall be as specified below, namely:-

(a) **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.**

(b) **The velocity of water shall not exceed 5 metre per second in fire water ring main.**

(c) **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.**

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

13.5.7.7 General:

(a) **Fire water mains shall not pass-through buildings or dyke areas. In case of underground mains, the isolation valves shall be located in RCC or brick masonry chamber of suitable size to facilitate operation during emergency and maintenance.**

(b) **Associated fixed spray or foam riser or 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.**

(c) **The riser connections shall be taken directly from the mains and provided with separate isolation valve outside of dyke. Suitable strainer should be provided on fixed spray riser connection and shall be located outside of dyke.**

13.5.8 Hydrant or Monitors:

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

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

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

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

(e) **Hydrant or Monitors shall be located along roadside berms for easy accessibility.**

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

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

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

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

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

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

13.5.9 Material Specifications

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

(a) **Pipes: Carbon Steel as per IS: 3589 or IS: 1239 or IS: 1978 or Composite Material or its equivalent for freshwater service. In case saline, brackish or treated effluent water is used, the fire water ring main of steel pipes, internally cement mortar lines or glass reinforced epoxy coated or pipes made of material suitable for the quality of water able to withstand the temperature and pressure shall be used. Alternately, pipes made of composite materials shall be used. The composite material to be used may be as per API 15LR or API 15HR or IS: 12709. 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 or close indication should be used. Other materials such as cupronickel for saline or brackish water can be used. The material of the valve shall be suitable for the service.**

(c) **Hydrants post:**

(i) Stand post - Carbon Steel

(ii) Outlet valves – Gunmetal or Aluminium or Stainless or Steel or Al-Zn Alloy

(d) **Monitors or Water cum foam monitors:**

(i) Approved or listed by any of the international certifying agencies like UL, FM, VdS or LPC.

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

(e) **Fire Hoses:**

(i) Reinforced Rubber Lined Hose as per IS 636 (Type A) or Non-percolating Synthetic Hose (Type B) or UL or Equivalent Standard.

(f) **Painting:**

(i) Fire water mains, hydrant and monitor stand posts, risers of water spray system shall be painted with “Fire Red” paint as per of IS: 5.

(ii) Hose boxes, water monitors and hydrant outlets shall be painted with “Luminous Yellow” paint as per IS: 5.

(iii) Corrosion resistant paint shall be used in corrosion prone areas.

13.5.10 Process Control Room (Having Console Or Monitor, Rack, Ups, Battery And Computers) Protection:

13.5.10.1 Smoke or heat detectors shall be installed in the process control room with alarm facility in control room and repeater panel in fire control room.

13.5.10.2 Control room should be protected by portable type Clean Agent Fire Extinguishers in addition to portable CO2 fire extinguishers.

13.5.10.3 Clean agent shall conform to the NFPA-2001 (Latest edition).

13.5.11 First Aid Firefighting Equipment:

Portable Fire Extinguishers

(a) **All fire extinguishers shall conform to respective IS or UL or Equivalent codes, for example 1, 2,3,4,6 and 9 Kg DCP portable type (IS: 15683 or UL 299) and 2, 3, 4.5 and 6 Kg CO2 portable type (IS:15683 or UL 154) and 25, 50, or 75 Kg DCP trolley mounted type (IS: 10658or UL 299) and bear ISI or UL mark. BIS or UL or Equivalent certificates of all extinguishers shall be maintained at the location.**
(b) **While selecting the Extinguisher, due consideration should be given to the factors like flow rate, discharge time and throw in line with IS: 2190 or UL 711.**
(c) **The Dry Chemical Powder used in extinguisher and carbon dioxide gas used as expelling agent shall be as per relevant IS or UL or Equivalent code.**
(d) **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.**
(e) **Siliconised Potassium bicarbonate DCP powder (IS 4308:2003) or Mono-ammonium phosphate based DCP powder (IS: 14609) can also be used for recharging DCP fire extinguishers.**
(f) **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.**
(g) **Portable fire extinguishers shall be located at convenient locations and are readily accessible and clearly visible at all times.**
(h) **The sand buckets shall have round bottom with bottom handle having 9-litre water capacity conforming to IS: 2546. The sand stored in bucket shall be fine and free from oil, water or rubbish.**
(i) **Suitable weather protection shall be provided wherever the fire extinguishers or sand buckets are positioned outdoor.**
(j) **The maximum running distance to locate an extinguisher shall not exceed 15 m.**
(k) **The extinguisher shall be installed in such a way that its top surface is not more than 1.5m above the floor or ground level.**
(l) **The minimum deployment of portable firefighting equipment at Lube manufacturing and filling plants shall be as per paragraph 5.5 of Part E of this Schedule.**
(m) **Wheeled Fire Fighting Equipment inclusive of quantity specified elsewhere in these regulations shall be provided as under, namely: -**
(n)
(o)

S. No	Type of equipment	Minimum Quantity
1	2400 lpm water cum foam monitor	Two.
2	250 litre foam compound trolley	Two.
3	75 kgs DCP	Three.
4	25 Kgs DCP	As per requirement of these regulations

13.5.12 Hoses, Nozzles And Accessories:

13.5.12.1 Hoses:

(a) **Reinforced rubber lined canvas or non-percolating synthetic fire hoses conforming to IS- 636 or UL 19 (Type A or Type B) should be provided.**

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

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

(d) **The hoses shall be stored at convenient and easily accessible location in the lube manufacturing and filling plant.**

13.5.12.2 Nozzles:

In addition to one jet nozzle provided in each hose box, there shall be at least two nozzles in each *category as per relevant IS or UL Codes and maintained in the plant as per following table, namely:-*

S. No.	Item Description	Minimum Requirement
1	Jet Nozzle	2 Nos.
2	Fog Nozzle	2 Nos.
3	Universal branch pipe with nozzle	2 Nos.
4	Foam branch Pipe 1140 lpm	2 Nos.
5	Water curtain	2 Nos.

13.5.12.3 Accessories:

The following minimum no. of safety Instrument shall be provided as indicated against each item, namely:-.

S. o	Item Description	Minimum Requirement
1	Sand drum with scoop	4 Nos.
2	Electrical Siren (3 km range)	1 No.
3	Hand operated siren or MCP one each at strategic operating unit	No. at each operating area.
4	Multi gas detector with provision of uring % of Oxygen and HC detectors	1 No.
5	Red and Green flag for fire drill	2 Nos. in each color.

6	PA system	1 No.
7	Wind socks	1 No.

13.5.12.4 Hose box and accessories:

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

13.5.12.5 Personnel protective equipment:

The following minimum no. of Personal Protective Equipment and First Aid Equipment shall be provided as indicated below against each item, namely:-

S.No.	**Item description**	**Minimum requirement**
1	Safety helmet	1 No. per person.
2	Safety shoe meant for use in plant and handling black oil or bitumen	As per plant requirement.
3	Plash goggles	As per plant requirement.
4	Rubber hand glove	2 Pairs.
5	Fire proximity suit	1 Suit.
6	SCBA Set (45-minute capacity) with spare cylinder	1 set.
7	Ear muff	As per plant requirement.
8	Suitable electrical hand gloves	As per plant requirement.
9	Resuscitator	1 No.
10	Safety shower and eye wash facility	1 set each.
11	Water jell blanket	1 No.
12	Stretcher with blanket	2 Nos.
13	Multipurpose detector (HC and Oxygen)	1 No.
14	Boiler suit	As per plant requirement.

S.No.	Item description	Minimum requirement
15	Apron at lab	As per lab requirement.
16	First Aid box	1 No.

Note:

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

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

(c) Explosive meter and P. A. System shall be readily available at the plant and positioned to have easy access to it during emergency situation.

(d) In addition, an emergency kit shall be provided consisting of safety items as per the item list given below and shall be readily available at the terminals.

13.5.12.6 Emergency kit items:

(a) **Emergency Kit consists of listed emergency equipment required for rescue and control or arresting leakage in case of emergency in lube manufacturing and filling plant. The equipment should be mounted on a compact light weight trolley. Emergency Kit should be consisting of the following emergency equipment, namely:-**

S. No	Item	Quantity	Remarks
1	Fire proximity suit	1 set	
2	Breathing apparatus set (45-minute duration)	2 sets	
3	Flame proof search light	2 nos.	Rechargeable type suitable for Explosive Environment.
4	Hand siren with stand	1 no	Approx. range of 1.6 kms.

S. No	Item	Quantity	Remarks
5	Fireman axe	1no	
6	First aid box	1 no.	
7	Manual resuscitator	1 no	Manually operated for artificial respirators consisting of adult size nose, mouth, face plate, air bulb with oxygen inlet connection, non-return, non-breathing human valves and first aid charge packed in a plastic bag.
8	Folding stretcher	1 no	Size 6 feet X 3 feet with tying belts and blanket.
9	Mechanical tool kit	1 set	
10	Cold or low temperature hand gloves	2 Pairs	
11	Electrical rubber hand gloves	2 pair	Suitable for Electrical jobs up-to 33000 Volts.
12	Electrical tester	1 no	
13	Chemical or oil splash proof goggles	2 nos.	ANSI or CE marked

(b) **All the items of the kit shall be kept on a trolley specifically designed for the purpose. List of PPE's as mentioned in other elsewhere in these regulations should be merged with this list. Any item featuring more than in one list should be considered for one time only.**

13.5.13 Use of Foam and Storage:

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

13.5.14 Smoke or Heat Detection and Annunciation, Dyke Drain Valve Annunciation System and Emergency Shut Down Logic:

13.5.14.1 Smoke or Heat Detection and Annunciation System:

(a) **Combined or separate smoke or heat detection system should be installed near carton storage area, process control room, warehouse and laboratory. Smoke or heat detectors of proper type should be selected and maintained in sound working condition.**

(b) **General:**

A reliable and continuous smoke detection system with alarm annunciation shall be installed to alert the operating personnel to take timely corrective action.

(c) **Application:**

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

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

(d) **Power Supply:**

The supply to the system shall be through a reliable online Uninterrupted Power Supply (online UPS).

(e) **Architecture Components:**

The main components of Smoke or heat detection and annunciation system shall be-

(i) Smoke or heat detectors;
(ii) Field Transmission units or Signal scanners;
(iii) Control system or PC;
(iv) Display;
(v) Annunciation System; and
(vi) Cables, hooters, repeater, Power Supplies.

(f) **Smoke or Heat Detectors:**

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

(g) **Annunciation System:**

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

(h) **Inspection and Testing:**

(i) The system shall be checked by the safety officer on a daily basis.

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

13.5.14.2 Dyke Drain Valve Annunciation System:

(a) **All the tank dyke drain exit valves shall be fitted with a limit switch or sensor for indication of the position of the valve. The valves of the Dyke shall remain in closed position. In case any valve is open, then, Audio Visual alarms shall come at local and remote-control panel for suitable corrective measures.**

(b) **In case of automated locations, existing PLC can be used. However, where the locations are not automated a standalone system should be provided.**

(c) **Power Supply:**

The supply to the system shall be through a reliable online Uninterrupted Power Supply. (Online UPS).

(d) **Architecture Components:**

(i) The main components of Dyke Drain valve Annunciation system shall be-

(A) Proximity Switches or Sensors;

(B) Field transmitter unit or Signal Scanners;

(C) Control System or PC or TAS;

(D) Display;

(E) Annunciation System; and

(F) Cables, hooters, Mimic and Power Supplies.

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

(e) **Annunciation System:**

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

(f) **Control system:**

(i) The system shall be available at all times.

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

(g) **Inspection and Testing:**

(i) The system shall be checked by the safety officer on a daily basis.

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

13.5.14.3 Emergency Shut Down (ESD) And Manual Call Point (MCP) Logic For Plant Shutdown:

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

(b) **Annunciation of ESD or MCP shall initiate following actions , namely:-**

(i) Process Shutdown:

(A) To stop loading pumps;

(B) Barrier gates to open;

(C) Tank lorry filling (TLF) operations through the batch controllers to stop; and

(D) All MOVs or POVs to close.

(ii) Power Shutdown :

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

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

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

(d) **Inspection and Testing:**

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

13.5.15 Fire Alarm and Communication System:

(a) **Hand operated sirens: alternately fire call points shall be provided at strategic locations and clearly marked in the plant. Fire call points shall have combination of audio or visual alarm.**

(b) **Main fire siren (3 km Range): switch shall be provided in fire control room or security room.**

(c) **Electrical fire siren shall have alternate supply source both from normal panel or supply and through emergency panel or supply.**

(d) **The tone of fire siren shall be different from shift siren.**
(e) **The following fire or emergency siren codes shall be followed as per PNGRB ERDMP Regulations, 2010.**

13.5.16 Fire Safety Organisation And Training:

13.5.16.1 Organisation

A well-defined comprehensive shall be developed in accordance with the PNGRB (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010. The key action points of this comprehensive ERDMP shall be displayed at strategic locations in the installation for ready reference. The emergency response planning shall have clear written procedures for expected actions during anticipated emergencies and emergency response plan shall include operational and procedural requirements for various emergency scenarios that are relevant for the installation.

13.5.16.2 Training:

(a) **Training on safety, firefighting and rescue operation shall be compulsory for all officers, operators, security, TT drivers and contract workmen, and clericals who are likely to be present or working in the plant and record shall be maintained in this regard. The above training shall be imparted before induction.**
(b) **Each employee shall undergo a refresher course once in every three years after initial training.**
(c) **The training shall be conducted through an expert agency such as Fire Brigade or recognized training institute or Oil industry approved reputed agency. The training also includes usage of Personnel Protective Equipment.**
(d) **All operating personnel shall be given training on Live Fire training at any of the reputed institutes having facilities for simulations representing fire scenarios likely to occur at plant. Security as first respondent may also be considered for above live fire training.**
(e) **Every employee or authorized person of contractor working in the installation shall be familiarized with fire or emergency siren codes and the location of fire siren operating switch nearest to his place of work.**
(f) **Instructions on the action to be taken in the event of fire, should be pasted at each siren point and familiarity with these instructions shall be ensured and recorded.**
(g) **Monthly fire drills considering various scenarios shall be conducted regularly with full involvement of all employees of the installation. The mock drill should include the full shut down system activation once in six months.**
(h) **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".**
(i) **The post drill analysis should be carried out and discussed emphasizing areas of improvements.**
(j) **The record of such drills should be maintained at the location.**
(k) **Mock drill scenarios shall include all probable scenarios and the key areas such as Tank Farm, Rim seal fire, Gantry, Pump House, Tank Wagon gantry, which shall be covered at least once in six months.**
(l) **Security staff should be trained as first responders for firefighting and rescue operation along with plant operating personnel through oil industry approved reputed institute.**

13.5.16.3 Mutual aid:

(a) **Installation shall have a 'Mutual Aid' arrangement with nearby industries to pool in their resources during emergency.**

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

13.5.17 Fire Emergency Manual:

(a) **A well-defined comprehensive Emergency Response and Disaster Management Plan (ERDMP) shall be developed in accordance with the PNGRB (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010 and the copies of the ERDMP shall be available to all personnel in the installation.**

(b) **The key action points of this comprehensive ERDMP shall be displayed at strategic locations in the installation for ready reference.**

13.5.18 Fire Protection System, Inspection And Testing:

13.5.18.1 General:

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

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

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

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

(e) **In addition to the following routine checks or maintenance, the requirements of relevant standards in respect of periodic inspection, maintenance and testing of fire-fighting equipment shall be complied with.**

13.5.18.2 Fire water pumps

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

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

:

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

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

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

13.5.18.3 Fire Water Ring Mains:

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

(b) **The ring mains, hydrant, monitor and water spray header valves should be visually inspected for any missing accessories, defects, damage and corrosion every month and records shall be maintained in this regard.**

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

13.5.18.4 Fire Water Spray System (If Applicable):

(a) **Water spray system shall be tested for performance that is to say, its effectiveness and coverage once in six months.**

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

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

13.5.18.5 Fixed Or Semi Fixed Foam System:

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

13.5.18.6 Clean Agent System:

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

(a) **Agent quantity and pressure of refillable containers shall be checked once every six months.**

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

13.5.18.7 Hoses:

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

13.5.18.8 Communication System:

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

(a) **Fire Water Tank or Reservoir:**

(b) **Above ground fire water tanks should be inspected externally and internally.**

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

(d) **Fire extinguishers Inspection, testing frequency and procedure should be in line with Gas Cylinder Rules and these Regulations.**

13.6Maintenance And Inspection Of Equipment:

The required maintenance and inspection practices should be followed to ensure safe and trouble-free operation of various equipments.

13.6.1 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 that is to say, daily, weekly, monthly, half yearly and yearly schedules, shall be worked out. Basic recommendations given by the manufacturers should be considered and modified bearing in mind the local conditions.

13.6.2 Personal Protective Equipment:

Personnel protective equipment such as safety shoes, hand gloves, apron, safety goggles, safety belt, helmet, ear muff, dust respirator, self-contained breathing apparatus (SCBA), resuscitator, as applicable, shall be worn while carrying out any maintenance activity. Such equipment shall be checked periodically and maintained for ready use in normal and emergency situations.

13.6.3 Work Permit System:

Any maintenance, inspection, disassembly or removal of fittings shall not be carried out without a proper work permit and approved procedure and-

(a) **all maintenance and inspection jobs shall be carried out in line with OISD-STD-105 on "Work Permit System".**
(b) **working at height shall be as per provisions of OISD-GDN-192.**

13.6.4 Inspection And Maintenance of Various Facilities In Installations:

13.6.4.1 Storage Tanks:

Inspection and maintenance of storage tanks shall be carried out as given below, namely: -

(a) **Routine In-Service Inspection:**

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

(b) **External Inspection:**

(i) All storage tanks shall be given a visual External Inspection at least once in a year by a qualified and experienced authorized person.

(ii) The detailed External Inspection along with ultrasonic thickness survey of tanks shall be conducted as under, namely:-

S.N.	Fluid Stored	External Inspection Interval(Years)	
		With Corrosion Rate Based Assessment	Without Corrosion Rate BasedAssessment

1	Class-B, LDO, Lube Oils	5	3
2	Furnace Oil, LSHS andslops	3	3

(c) **Internal inspection:**

All storage tanks shall be subjected to a detailed internal inspection after an interval as detailed below and where the inspection intervals are prescribed in the Quality Control Manual, the same shall override the table below, namely:-

S.N.	Fluid Stored	External Inspection Interval (Years)	
		With Corrosion Rate Based Assessment	Without Corrosion Rate Based Assessment
1	Class-B, LDO, Lube Oils, Furnace Oil	Years determined by Corrosion Rate and Integrity Assessment or 15 years, whichever is lower	10.
2	Slops	-do-	8.

13.6.4.2 Underground Storage Tank:

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

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

(c) **After the repairs, the tank shall be hydrostatically tested of at test pressure of 0.75 kg/sq.cm. g- or as specified in the design code and checked for leaks.**

(d) **Timely inspection and preventive maintenance of these storage tanks assume high importance. Accordingly, the inspection schedules of storage tanks should be prepared and implemented.**

(e) **This paragraph 13.6.4.2 covers the minimum inspection requirements for atmospheric and low-pressure storage tanks constructed as per standards IS-803, API620, API-650, IS 10987 or equivalent standards. The various types of storage tank inspections along with types of repairs and areas of inspections have been covered in this paragraph 13.6.4.2.**

13.6.4.3 Pipes, Valves and Fittings:

Inspection and maintenance of piping systems should be followed as given below, namely: -

(a) **Safety in petroleum installations flows 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.

(b) **This standard covers minimum inspection requirements for plant piping as per Standard ANSI B-31.3 or equivalent standards. 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 to be specified which alsoincluded briefly are the inspection and testing requirements for the pipelines post commissioning.**

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

(d) **Type of Inspection: The post-commissioning inspections of pipelines shall be as under , namely:–**

(i) External inspection.

(ii) Comprehensive inspection.

13.6.4.4 Inspection Intervals: Pipelines in plant mainly comes under Class-III category And Inspection Interval are as under, namely:-

Class	**Service**	**Maximum Inspection Interval in Years**	
		External on stream	**Comprehensive**
Class-III	Class –B, Lubes, Furnace, asphalt.	4	10.
Class-III	Air process, cooling water and fire water	4	10.

Note:

(i) Any other service which is not covered in the above tables shall be included under appropriate class, as the case may be.

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

13.6.4.5 Boiler:

Inspection, testing and maintenance shall be as per manufacturer's guidelines and requirement in line with IBR norms. All applicable statutory norms as per requirement of inspector of boiler shall be followed.

13.6.4.6 Pressure Vessels:

Inspection, testing and maintenance shall be carried out as per statutory requirement.

13.6.4.7 Weigh Bridge:

Inspection and maintenance shall be as per manufacturer's guidelines. All statutory norms as per requirement of Inspector of legal metrology shall be followed.

13.6.4.8 Hoist, EOT And Joist:

Inspection and maintenance shall be as per manufacturer's guidelines. All statutory norms as per requirement of Inspector of Factory shall be followed.

13.6.4.9 Fork Lift:

(a) **Inspection and maintenance shall be as per manufacturer's guidelines. All statutory norms as per requirement of Inspector of Factory shall be followed.**
(b) **Periodical eye testing shall be carried out in line with requirement of Inspector of Factories and record shall be maintained in this regard.**
(c) **Inspection, testing and maintenance of thermic fluid heater and cooling tower. shall be done as per manufacturers guidelines and record shall be maintained in this regard.**

13.6.4.10 Ladder Safety (Portable Or Fixed):

(a) **The foot ladder should be properly supported on the firm surface and the top end should be securely fixed to prevent its slippage. At a time, only one person should use the ladder. The ladder should be checked periodically for its fitness for use.**
(b) **The ladder should extend at least one meter above the platform for landing place. The ladder should be placed at suitable safe angle to minimize the risk of slippage (ideally 75 deg angle to the horizontal). The heavier objects should not be carried up the ladder.**

13.6.4.11 Strainers and Filters:

Strainers and filters shall be inspected and cleaned as per following frequency, unless sluggish operation warrants earlier inspection, namely:-

(a) **Frequency of inspection and cleaning (Upstream of Pump Suction): Quarterly Upstream of PD meter quarterly.**
(b) **Water spray strainer quarterly.**

13.6.4.12 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, namely:-

(a) **Blinds do not exist;**
(b) **Upstream and downstream isolation valves, if any, are opened and sealed;**

(c) **Seals protecting the spring setting have not been broken;**
(d) **Relief device is not leaking. This should be checked visually or by thermography or contact thermometers or by hand touch at outlet nozzle wherever practicable;**
(e) **The continuous operation of heat tracing provision, if any, provided for low temperature application on valve and discharge piping;**
(f) **Condition of insulation and cladding on the heat traced piping and valves; and**
(g) **Provisions of relevant standards on Inspection of Pressure Relieving Devices shall be followed.**
(h)

13.6.4.13 Rotary Equipment:

(a) **Compressors: Periodic maintenance checks, as detailed in Annexure-2 to be followed.**
(b) **Pumps: Periodic checks as detailed in Annexure-2 to this part to be followed.**
(c) **Diesel Engines: For maintenance of Diesel Engines Original Equipment manufacturer guidelines shall be followed.**
(d) **Pressure gauges: Pressure gauges shall be checked daily for its proper functioning and shall be calibrated once in 6 months.**
(e) **Flow measuring devices: All flow measuring devices shall be checked daily for proper functioning. Calibration of the flow measuring devices shall be carried out in line with requirement of Department of Legal Metrology of concern State.**

13.6.4.14 Firefighting Equipment (Portable And Trolley Mounted):

(a) **Portable fire extinguishers are not expected to deal with large fires. Nevertheless, these are very valuable in the early stages of fire. The most important features of these extinguishers are their immediate availability and can be used by one or two persons. A fully charged fire extinguisher should not be more than 17 kgs. The extinguishing medium is discharged and directed into fire by storage pressure or release of pressurized charged stored in a cartridge.**
(b) **Extinguishers shall be classified by the types of extinguishing medium which they contain. At present, the main types of extinguishers are –(a) water and or foam-based, (b) powder, (c) carbon dioxide and (d) clean agents.**
(c) **Relevant IS code for fire extinguishers and schedule for hydraulic pressure testing of fire extinguisher are specified as below, namely:-.**

S.No.	Type of extinguisher	IS Code	Test interval (Year)	Test pressure (kg/sq.cm)	Duration (minutes)
1	Mechanical foam type (gas cartridge)	IS:15683or IS:13386 or IS:14951	3	35	2.5.
2	Mechanical foam type (stored pressure)	IS:15683	3	35	2.5.
3	Dry powder (stored pressure)	IS:15683	3	35	2.5.
4	Dry powder (gas cartridge)	IS:15683 or IS:10658 or IS:11833	3	35	2.5.
5	Carbon dioxide	IS:15683	5	250	2.5.
6	Clean agent	IS:15683	3	35	2.5.

Note: Extinguisher should be hydraulically tested with cap.

(d) **Each extinguishing media should comply respective IS code (given in following matrix), namely:-**

S. No	Extinguishing media	Respective IS code
1	Foam concentrate	IS 4989 or ISO 7203.
2	Powders (Class –BC)	IS 4308.
3	Powders (Class –ABC)	IS 14609.
4	Carbon dioxide	IS 15222.
5	Clean agents	IS 15493 or NFPA 2001 latest edition.

Note 1:

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

(ii) lives of fire extinguishers: (IS 2190:2010) are specified as below, namely:-

S. No	Type of extinguisher	Lifetime (year)
1	Foam type	10.
2	Powder type	10.
3	Carbon dioxide	15.
4	Clean agent	10.

Note2:

(i) Lives of extinguishers shall be considered from date of manufacture of extinguishers. In case failure in hydraulic pressure testing, extinguisher should be rejected immediately before the lifetime given above.

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

(iii) Mounting: Each extinguisher intended for wall mounting should be provided with a means of mounting.

13.6.4.15 Electrical Equipment:

(a) **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.**

(b) **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 relevant standards.**

(c) **Special emphasis shall be laid on the maintenance of equipment installed in hazardous areas.**

(d) **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.**

(e) **Precautions to be taken for repairs and testing of flameproof equipment shall be as below, namely:-**

(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.

(iv) 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 that is to say, in a luminaire or other enclosures, except by replacement with the complete assembly or part obtainable from the manufacturer, complying with the approval certificate.

(v) 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.

(vi) 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 the appropriate manner.

(vii) 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.

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

13.6.4.16 Ladders:

(a) **Inspection and testing:**

Wooden ladders shall be inspected at least once in a week for damage and deterioration. Metal ladders shall be inspected at least once in three months and all parts checked for wear, corrosion and structural failure.

(b) **Storage and maintenance:**

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

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

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

ANNEXURE- 1
Checklist for Bulk or Packed Lube Trucks at Loading or Unloading points:

S.No.	Item	Remarks
	Daily Checks	
1	Whether driver is having requisite or mandatory documents required for vehicle and driver?	
2	Whether the vehicle has at least one driver and one helper as its crew member?	
3	Whether the vehicle has two fire extinguishers?	
4	Whether vehicle's cabin is checked for presence of any flammable or explosivesubstance being carried by the crew?	
5	Whether there are any sources of ignition such as matches in the vehicle?	
6	Whether the engine exhaust is wholly in front of bulk truck and has ampleclearance from fuel oil system and combustible material?	
7	Whether approved quality flame arrester provided on the engine exhaust andmuffler or silencer is properly bolted and without any sign of leaks?	
8	Whether each compartment of tank is fitted with independent vacuum and pre-operated vents (PV Valve)?	
	Additional Checks:	
9	Whether the vehicle has a cutoff switch for electrical system?	
10	Whether all electric wiring is properly insulated, and all junction boxes are sealed properly?	
11	Whether there is a quick shut off facility for the drain valves in case of emergency?	
12	Whether the vehicle has First Aid Box, Toolbox and Emergency search light?	
13	Whether the driver has a copy of standing instructions and TERM card?	
14	Whether electrical equipment like generator switches, fuses and circuit breakersare located inside the cabin or engine compartment?	
15	Whether battery is in easily accessible position with a heavy duty switch close by,to cut off the battery in emergency?	
16	Whether battery terminals have protective rubber covers?	

ANNEXURE- 2

Maintenance Schedule of Critical Equipments (Compressor):

S.No.	Equipment Parameters to check	Periodicity			
		Daily	Weekly	Monthly	Quarterly
1.	Check Lube Oil Level of plunger pump unit and top up, if necessary.				
2.	Check the oil level in the crank case and top up, if necessary.				
3.	Before start check flow of cylinder jacket cooling water.				
4.	Check oil flow from plunger pump to gland packing assembly and compressor cylinder.				
5.	Check for flow rate from plunger pump.				
6.	Drain water from receiver or liquid trap.				
7.	Check belt tension and adjust, if necessary.				
8.	Ensure tightness of foundation bolts.				
9.	Flush out lube oil system: (a) Crank case, (b) Pump chamber and fill fresh oil.				
10	Flush jacket water cooling system.				
11	Check alignment of compressor and motor pullies.				
12	Change lube oil filter and clean Suction filter.				
13	Clean oil strainer.				
14	Clean Breather.				
15	Open and inspect suction and discharge valves.				
16	Check instrumentation calibrate, if necessary.				
17	Check safety release valve.				
18	Suction and discharge valves of compressor cylinder				
19	Interlock with High level alarm.				
20	All Trips.	.			
21	Pressure and Temperature Gauges.				
22	Control Panel.				
23	Complete over-haul.				

MAINTENANCE SCHEDULE:
(CENTRIFUGAL PUMP)

S.No.	Equipment Parameters to check	Periodicity			
		Daily	Weekly	Monthly	Quarterly
1.	Check lube oil and top up level, if necessary, Check cooling water flow (where provided).				
2.	Check mechanical seal or gland leakage.				
3.	Check the "AMPS" are within limits.				
4.	Change lubes oil every 800 running hours.				
5.	Check coupling and coupling bolts and replace worn out parts.				
6.	Check tightness of foundation bolts.				
7.	Clean suction strainer of: (a) Product pumps. (b) Other pumps.				
8.	Check alignment of pump and motor.				
9.	Overhauling.				

10.	Greasing of Bearings.				
11.	High Level Alarm.				
12.	Relief Valve				

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

S.No.	Maintenance Steps	Remarks
1.	Check previous day's engine log book	Correct as required.
2.	Drain water and sediment from fuel tank and fuel filter through drain cock	Before starting engine.
3.	Check engine oil level and top up, if necessary	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).
4.	Check for Fuel, oil, water	Correct if leaking.
5.	Fill radiator or surge tank with treated water (Chromate concentration 3500 ppm)	Radiator cap must be firmly tightened back into the radiator or surge tank neck , and engine must not be operated without the radiator cap since this will cause aeration and overheating of the coolant.
6.	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	Use clean engine oil
7.	Check air line connections for leaks	Correct as required
8.	Remove and clean air compressor breather, if equipped	Fill with clean oil, up-to mark.
9.	Drain air receiver tank at the beginning of each shift and, then ,close the drain cock	
10.	Clean crankcase breather	Discard paper type element, if clogged.
11.	Check oil level in hydraulic governor, if provided	Check for leaks, use specified engine oil for topping up.
12.	Start the engine and note the oil pressure both at idling and maximum	If there is a change in oil pressure from that recorded in the long book on earlier occasion, then ,stop engine and check through

S.No.	Maintenance Steps	Remarks
	speed	trouble shooting technique the cause for oil pressure changes and correct, if necessary (for Assistance in diagnosing the change in oil pressure and call your service representative, if necessary.
13.	Record oil pressure	Refer OEM Manual for Lube. Oil pressure limits.
14.	Fill fuel tank at the end of the shift	Use clean fuel and a strainer. Also clean the cap and surrounding area before opening the filler cap.

Note: In addition, Diesel Engines "B", "C", "D" and "E" checks shall be carried out as per manufacturers guide lines.

VANDANA SHARMA, Secy.
[ADVT.-III/4/Exty./369/2020-21]

Annexure 1 – List of Applicable Standards and References

Standard Number	Title of Standard
API STD 650	Welded Tanks for Oil Storage.
API STD 620	Design and Construction of Large, Welded, Low-pressure Storage Tanks.
API STD 2000	Venting Atmospheric and Low-Pressure Storage Tanks.
API 5L	Specification for Line Pipe.
API 15LR	Low Pressure Fiberglass Line Pipe.
API 15HR	High-pressure Fiberglass Line Pipe.
NFPA 2001	Standard on Clean Agent Fire Extinguishing Systems.
NFPA 11	Standard for Low-, Medium-, and High-Expansion Foam.
ASME B 31.3	Process Piping Guide.
ASME B 31.4	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
ASME B 16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric or Inch Standard.
ASME B 16.11	Forged Fittings, Socket – Welding and Threaded.
IS 12709	Installation of Glass Fibre Reinforced Plastic (GRP) Piping System Code of Practice.
IS 5572	Classification of Hazardous Areas (Other Than Mines) Having Flammable Gases and Vapours for Electrical Installation.
IS 11006	Flash Back Arrestor (Flame Arrestor).
IS 5571	Guide for Selection and installation of Electrical Equipment for Hazardous Areas (other than mines).
IS 10810	Methods of Test for Cables.
IS 3043	Code of practice for earthing.
IS 2309	Code of practice for the protection of buildings and allied structures against lightning.

IS 3844	Code of Practice for Installation and Maintenance of Internal Fire Hydrants and Hose Reels on Premises.
IS 636	Non-percolating flexible delivery hose for fire fighting.
IS 1978	Specification for Line Pipe.
IS 15683	Portable Fire Extinguishers-Performance and Construction– Specification.
IS 4991	Criteria for Blast Resistant Design of Structures for Explosions Above Ground.
IS 10658	Specification for Higher Capacity Dry Powder Fire Extinguisher.

Footnote: The Principal regulations were notified in the Official Gazette vide F. No. PNGRB/Tech/7-T4SPI (1)/2020, dated 11th November, 2020 and amended vide File No. PNGRB/Tech/7-T4SPI/(1)/ 2022 (P-4116) dated 29th March 2023.