

OISD-STD-118
Revision - II

**FOR RESTRICTED
CIRCULATION**

**LAYOUTS
FOR
OIL AND GAS INSTALLATIONS**

OISD – STANDARD – 118
Revision – II, September 2004

**Oil Industry Safety Directorate
Government of India
Ministry of Petroleum & Natural Gas**

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September 2004

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CIRCULATION**

**LAYOUTS
FOR
OIL AND GAS INSTALLATIONS**

**Prepared by
Committee on
Layouts for Oil and Gas Installations**

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

FOREWORD

Oil Industry in India is over 100 years old. As such variety of practices have been in vogue because of collaboration / association with different foreign companies and governments. Standardization in design philosophies and operating & maintenance practices at national level was hardly in existence. This, coupled with feed back from some serious accidents that occurred in the recent past in India and abroad, emphasised the need for the industry to review the existing state-of-the-art in designing, operating and maintaining oil and gas installations.

With this in view, Oil Industry Safety Directorate (OISD) was established in 1986 staffed from within the industry in formulating and implementing a series of self regulatory measures aimed at removing obsolescence, standardising and upgrading the existing standards to ensure safer operations. Accordingly, OISD constituted number of functional committees comprising experts nominated from the industry to draw up standards and guidelines on various subjects.

The original document on "Layouts for Oil and Gas Installations" was published in November 1988 and its first revision released in July 1995. In August 2000 it was amended inline with the recommendations of the High Power Committee. The present document on "Layouts for Oil and Gas Installation" is the second revision of this OISD Standard.

Attempts have been made to incorporate the latest technological changes, experience gained after the implementation of standards and relevant updation in the various national and international codes and practices.

It is hoped that the provision of this document, if implemented objectively, will go a long way in improving the safety in oil and gas industry.

This document will be reviewed periodically for improvements based on the experience and better understanding. Suggestions from industry members may be addressed to:

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Shri S N Mathur (April 95 – July95)

Amended Edition – August 2000

Amendments were carried out to this standard based on the recommendation of High Power Committee set up in 1997 by the Ministry of Petroleum and Natural gas to review the standard with respect to land requirement inline with national and international standards.

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LAYOUTS FOR OIL AND GAS INSTALLATIONS

1.0 INTRODUCTION

Hydrocarbon processing and handling plants are inherently hazardous. Today's trend of large and complex plants present substantial risk potential. At times plants are modified to operate at higher capacities or efficiencies necessitating larger storage requirements than contemplated earlier. For these reasons, initial site analysis for the proposed new construction or addition should be done carefully while considering the space allocation to the various facilities.

The hydrocarbon industry over the years learnt lessons from fires and explosions throughout the world and has been updating plant safety norms including inter-distances between facilities and their relative locations. The minimum distances recommended many years ago need review in the context of today's environment in the industry.

It is not intended that requirement of this standard should be applied rigidly to existing premises where, for a variety of reasons, it may not be practicable to comply with.

2.0 SCOPE

This document lays down minimum requirements of layouts within the plant boundary for petroleum refineries, Oil / Gas production and processing plants, LPG facilities, Pipeline installations / terminals, Lube oil installations and other Petroleum storage installations such as Crude oil gathering stations, Marketing depots and terminals, Aviation storage & fuelling stations, Tank farm for storage of crude / products.

The requirement of green belt / buffer zone beyond the plant boundary is outside the scope of this standard. Such provisions should be considered based on local environmental / security requirements.

3.0 DEFINITIONS

a) **Block**

Facilities operated / used in integrated way and surrounded by roads. For example process unit, boiler house, group of tanks located in a dyke, group of pressurized storage tanks, loading gantries, flare etc.

b) **C4 and Lighter ends**

Hydrocarbons or a mixture of Hydrocarbons containing four or less than four carbon atoms. Examples are Butane, Propane, Propylene etc. LPG, a mixture of propane and butane also fall under the same category.

c) **Crude Oil Gathering Station:**

Crude oil gathering station / Group gathering station is a production installation used for gathering, treating or storing crude oil and includes central tank farm, oil collecting station, gas compressor station and well head installation.

d) **Facility**

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

e) **Fire station**

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

f) **Fire Water pump house**

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

g) **Flash Point**

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

h) Gas Processing Plant

Gas processing plant is a facility where natural gas is received and processed to separate gas, LPG, condensate etc.

i) General Classification Of Petroleum Products

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

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

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

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

- (i) Where ambient temperatures or the handling temperatures are higher than the flash point of the product.
- (ii) Where product handled is artificially heated to a temperature above its flash point.

j) Hazardous Area

An area will be deemed to be hazardous where;

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

For classification and extent of hazardous area, refer "The Petroleum Rules - 2002".

k) LPG Facilities

LPG facility is one where liquefied petroleum gas (LPG) is stored, received / despatched by rail / road / pipeline and / or filled in cylinders.

l) Lube Oil Installations

The facilities for receipt, storage and blending of base oils & additives into finished Lube products. It includes lube-blending plants, grease manufacturing plants.

m) May

Indicates provisions that are optional.

n) Oil / Gas Production Plant

Oil / Gas production plant is a plant where oil and/or gas is collected, stabilized and despatched for further processing. Drilling activities and facilities upstream of the Christmas Tree of a well are not covered under this definition.

o) Pipeline Installations

Pipeline Installations are the facilities on cross-country pipelines and include sectionalizing valve station, pig launching / receiving station, intermediate pumping station / compressor station, tap-off station, dispatch and receiving facilities with or without storage.

p) Petroleum Refinery

Petroleum Refinery is a plant where crude oil is received and processed into intermediates and finished products.

q) Process Unit

A unit having integrated sequence of operation, physical and chemical, and may involve preparation, separation, purification, or change in state, energy content or composition.

r) Protection for exposure

This refers to fire protection for structures on property adjacent to liquid storage.

s) Service building

A building housing facilities for inspection / maintenance / other supporting services which are directly required for operation of the plant e.g. warehouse, workshop etc.

- t) Shall**
Indicates provisions that are mandatory.
- u) Should**
Indicates provisions that are recommended but not mandatory. Implementation of these provisions shall be made based upon consideration of the followings, as appropriate: (a) risk / benefit analysis, (b) company standards, (c) company experience, and (d) company philosophy.
- v) Stabling Line**
It is an additional railway line / spur reserved for additional rake / stabling.
- w) Storage / filling shed**
Facility for storage and filling of packed (non-bulk) petroleum product.
- x) Tank height**
Tank height is the height from tank bottom to top kerb angle for cone roof tanks. For floating roof tanks, it is the height from tank bottom to top of tank shell.
- y) Tank vehicle loading / unloading**
Facility for loading / unloading of petroleum product to / from tank wagon or tank truck.
- 4.0 PLANT LAYOUT PHILOSOPHY**
Following philosophy should be adopted in layout of an installation;
- a) Block layout should be adopted as far as possible. Plant layout arrangement should follow the general route of raw material to process unit(s) with tankages interposed as required followed by storage & despatch facilities. The entire area should be sub-divided into blocks.
- b) All process units and dyked enclosures of storage tanks shall be planned in separate blocks with roads all around for access and safety.
- c) Primary traffic roads in the installation should be outside hazardous areas. Roads separating the blocks shall act as firebreaks.
- d) Pedestrian pathways should be provided / marked alongside the primary traffic roads.
- e) Alternative access shall be provided for each facility so that it can be approached for fire fighting in the event of blockage on one route.
- f) Road widths, gradient and turning radii at road junctions shall be designed to facilitate movement of the largest fire-fighting vehicle in the event of emergency.
- g) Rail spur shall be located close to the periphery of the plant to minimise road/pipe crossings and blockage of roads during shunting.
- h) Layout of the facilities shall be made to minimise truck traffic ingress in the plant.
- i) Two road approaches from the highway / major road should be provided, one for employees and other for product / material movement. Both these approaches should be available for receipt of assistance in emergency.
- j) Presence of ignition source shall always be contemplated beyond the boundary wall of the installation.
- k) Orientation of flares, furnaces & heaters, dusty operations (e.g. sulphur handling etc) and cooling towers should be decided based on prevailing wind direction to avoid travel of hydrocarbon vapour over sources of ignition.
- l) Erection methods shall be studied for all types of equipment / structures. Towers, reactors, fired equipment etc should be located in such an area so to facilitate erection.
- m) Maintenance requirements for each type of equipment shall be identified and considered.
- n) For construction activities, area should be earmarked.
- o) Future expansion should be assessed and space provision be made accordingly.

5.0. LAYOUT OF BLOCKS / FACILITIES

To prepare a layout, information should be collected on the following aspects, as applicable;

- Process units, utility requirements, storage tanks, LPG storage vessels and other pressurized storage vessels

- Product receipt / despatch and mode of transport (rail, road and pipeline)
- Warehouses, storage areas for solid products such as petroleum coke, petroleum wax, sulfur, bitumen / asphalt etc and other open storage areas like scrap yards and dumping ground
- Chemical / Toxic chemicals storage, hazardous waste storage / disposal.
- Flares
- Service buildings, fire station and fire training ground
- Site topography including elevation, slope, and drainage
- Meteorological data,
- Bathymetric data (high tide level, surge wave height etc.) for installations in coastal areas.
- Seismic data
- Highest flood level in the area, water table, natural streams/ canals
- Approach roads to main plant areas
- Aviation considerations
- Risk to and from adjacent facilities
- Environmental considerations
- Statutory obligations

5.1 General consideration for the layout of blocks / facilities

While locating the various facilities / blocks, the following should be considered:

- (a) Layout of Blocks / facilities should be in sequential order of process flow.
- (b) Process unit(s), tank farm, loading gantry, solid storage, utilities, Effluent Treatment Plant (ETP) and approach roads should be located on high ground to avoid flooding.
- (c) In case process units are operated in an integrated way and shutdowns are taken simultaneously, then it may be considered as a single block.
- (d) Control room should be located in a non-hazardous area upwind of process plants / hydrocarbon storage and handling facilities. It shall not be located

on a lower level than surrounding plants and tank farms. There shall be no structure that would fall on the control room in case of a blast. For details, refer OISD-STD-163.

- (e) Utility block(s) should preferably be located adjacent to unit blocks.
- (f) Power generation facilities which also supply steam for process requirement should be located near the process unit block. When external power grid is interconnected with plant power generation facilities, either the power plant should be located at the side of the boundary wall or the external power transmission lines should be taken underground upto interconnection grid.
- (g) Overhead power transmission lines shall not pass over the installation including the parking areas. Horizontal clearance shall be in line with the Indian Electricity Rules.
- (h) High Tension (HT) sub-station(s) should be located close to major load centers.
- (i) Low Tension (LT) sub-station should be located at load centers in such a way that the distance between distribution transformer and farthest motor is minimum.
- (j) Cooling Towers should be located downwind of process equipment and substation so that fog developed will not cause corrosion or obstruct vision or short-circuiting.
- (k) Storage tanks should be grouped according to product classification. In undulating areas, storage tanks should be located at lower elevations
- (l) Truck loading / unloading facilities should be located close to product movement gate and should be oriented to provide one-way traffic pattern for entrance and exit.
Rail loading facilities should be located along the periphery of the installation.
- (m) Sulphur recovery unit and sulphur loading area should be located close to product movement gate and away from process units, hazardous and populated areas.
Equipment drawing air (e.g. air compressors, air blower, FD fan etc) should be located away from Sulfur recovery unit / Sulfur handling facility.

- Minimum separation distance of 50 meters is recommended between sulfur storage / handling and any facility or boundary wall.
- (n) Petroleum coke storage and handling facilities should be located as far as possible away from process units, air separation plants, populated and hazardous areas.
 - (o) Separate collection system should be provided for different types of waste generated in the process plant such as oily water, caustic, acid effluents, fecal etc. Effluent Treatment Plant should be located minimum one block away from process unit area, down wind of process units and important areas considering odour & emission of volatile organic compound. This should be closer to disposal point by the side of the boundary and at lower grade to facilitate gravity flow of effluent.
 - (p) Flare should be located upwind of process units and the area around flare should be paved. For more details OISD-STD-106 on "Process Design and Operating Philosophies on Relief and Disposal systems" shall be referred.
 - (q) Main pipe racks / pipe track shall not be routed through process units. Provide overhead clearance for vehicles over roadways and railroads.
 - (r) Roads should be provided in a symmetric manner to serve all process areas requiring access for the operation, maintenance and fire fighting. These roads should encircle the process blocks/ process units.
 - (s) Smoking booths should not be provided in the hydrocarbon industry. However if required, these shall be located at minimum distance of 60 meters from any hydrocarbon source.
 - (t) Fire station, firewater storage & firewater pump house shall be located at a safe place away from hazardous areas. Fire station should be upwind of process units and hydrocarbon storage area with straight approach to process units / other critical areas.
 - (u) Location of firewater pumps & tanks shall be inline with OISD-STD-116, OISD-STD-117 & OISD-STD-144 as the case may be.

5.2 Separation distances;

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

6.0 LAYOUT OF PROCESS UNITS

Equipment in process unit can be arranged in many ways. Safety, economy, operability, and ease of maintenance should be considered in locating each item within the unit. Adequate spacing between equipment will help in minimizing the spread of fire. Consideration should be given to access for fire fighting.

6.1 General Considerations for the layout of Process Equipment

- (a) Process flow sequence and operating procedures should be thoroughly understood so that equipment arrangement in the plot plan is functional. Equipment should be arranged in logistic process sequence for optimum piping runs and operational and maintenance ease. Spacing between equipment shall be adequate for undertaking maintenance jobs.
- (b) The unit pipe rack should be kept in the centre, thereby splitting the unit into two or more areas of equipment. Pumps may be arranged in two rows close to and on either side of the pipe rack. Heat Exchangers and vessels should be grouped together forming outer rows on both sides of the rack.
- (c) Heat exchangers should be located perpendicular to the pipe rack on the outer row to facilitate pulling of tube bundles with mobile crane or by other means. Shell and tube heat exchanger should have a longitudinal clearance of at least one-meter plus the length of removable bundles.
- (d) Air fin coolers should be installed above the pipe rack / technological structures / independent structure. Pumps handling hydrocarbons above the temperature of 230 C or C₄ and Lighters should not be installed underneath the air fin coolers.
- (e) Vessels having large liquid hold-up should be installed at lower heights and

- preferably at grade. Adequate drainage should be provided around such vessels. Where process requirement dictates their installation above grade, these should be located in open area.
- (f) Towers / columns should be located along the pipe rack towards open areas for unobstructed erection as well as maintenance of internals at grade. Tall towers requiring frequent operating attention at upper levels may be located at one place so that common connecting platform can be provided.
- (g) Thermo-siphon reboilers should preferably be placed close to their associated towers.
- (h) Vessels, column, Reactors with internals and / or containing catalysts, chemicals etc should have a drop-out area for removing / installing the internals and / or for loading / unloading of catalysts and chemicals.
- (i) Heaters should be located up wind at one corner of the unit. Space should be provided for removal and cleaning of heater tubes besides approach for crane. Areas around the heaters shall be graded for guiding spills away from process equipment. Forced Draft fans shall be located away from process equipment from where they are likely to suck hydrocarbon vapors.
- (j) No trenches or pits which might hold flammables should extend under the furnace and connections with underground drain system should be sealed over an area 15 meters from the furnace walls.
- (k) The local control panel for soot blower control and flue gas analyzer only should be located on and near the process heater. The rest of controls should be taken to control room.
- (l) Gas compressors should be located down wind from heaters so that leaked gases will not drift towards the heater. Gas compressors should have roofing and open from sides to avoid accumulation of heavier vapours/gases on the floor of compressor house. Compressor house should be located near the battery limits to facilitate ease in maintenance and operation. Drop out area should be provided for maintenance.
- (m) No other tankage except day tanks / process chemicals shall be provided within battery limits of any process unit.
- (n) Process chemicals storage tanks should be provided with kerb wall of minimum 300-mm height. Hydrocarbons day tanks shall be provided with dyke in line section 7.0 of this standard.
- (o) Cold boxes should be located on grade or on separate elevated structures. Adequate space should be provided around cold boxes for ease of operation and maintenance.
- (p) Flare knock out drum for the process units should be located at battery limit of the unit.
- (q) Blow down facilities / buried drum should be located at one corner of the plant farthest from furnace or any fired equipment and on the lee-ward side of the unit.
- Vent from Blow down facility shall be minimum 6m above the highest equipment falling within radius of 15 m from the vent stack.
- (r) Operators cabin may be provided in the process unit. The cabin should be located upwind side of the unit in non-hazardous area and away from draining / sampling facilities. The cabin should be for minimum occupancy of the shift operators of the respective facilities only.
- (s) Stairways should be provided for the main access.
- (t) Minimum headroom under vessels, pipes, cable racks, etc should be 2.1 meters.
- (u) Equipment should be spaced to permit use of mobile equipment and power tools or servicing and maintaining equipment during turn around periods.

6.2 Equipment spacing within process units;

Minimum separation distances between various equipment within process units are given in Table-2. The distances recommended should be followed to the extent feasible. Equipment spacing within the process unit may be varied to meet the requirements specified by Licensors or of the Engineering

Consultants. However, the distances specified in notes to Table-2 shall be met.

7.0 LAYOUT OF STORAGE TANKS

7.1 General considerations

7.1.1 Dyked Enclosures;

- (a) Petroleum storage tanks shall be located in dyked enclosures with roads all around the enclosure. Aggregate capacity of tanks located in one dyked enclosure shall not exceed following values:

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

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

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

- (b) Dyked enclosure shall be able to contain the complete contents of the largest tank in the dyke in case of any emergency. Enclosure capacity shall be calculated after deducting the volume of tanks (other than the largest tank) and the tank pads within the dyke upto the height of the enclosure. A free board of 200 mm above the calculated liquid level shall be considered for fixing the height of the dyke.
- (c) The height of tank enclosure dyke (including free board) shall be at least 1.0 m and shall not be more than 2.0 m above average inside grade level. The dyke wall made up of earth, concrete or solid masonry shall be designed to withstand the hydrostatic load. Earthen dyke wall shall have not less than 0.6-meter wide flat section on top for stability of the dyke wall.
- (d) 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.

- (e) 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.
- (f) Process equipment should not be located inside the dyke. Pump stations and piping manifold should be located outside dyke areas by the side of roads.
- (g) Tanks located overhead shall meet safety distances and shall also have dyked enclosure of RCC construction and provided with efficient drainage system for the dyke enclosure.

7.1.2 Grouping;

- (a) Grouping of petroleum products for storage shall be based on the product classification. Class-A and / or Class-B petroleum may be stored in the same-dyked enclosure. Class-C petroleum should preferably be stored in separate enclosure. However, where Class-C petroleum is stored in a common dyke along with Class-A and/or Class-B petroleum, all safety stipulations applicable for Class-A and/ or Class-B respectively shall apply.
- (b) 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.
- (c) Tanks shall be arranged in maximum two rows so that each tank is approachable from the road surrounding the enclosure. This stipulation need not be applied to tanks storing excluded petroleum class.

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

7.1.3 Fire walls;

- (a) In a dyked enclosure where more than one tank is located, firewalls of minimum height 600mm shall be provided to prevent spills from one tank endangering any other tank in the same enclosure.
- (b) A group of small tanks each not exceeding 9 meters in diameter and in all not exceeding 5,000 cum in capacity shall be treated as one tank for the provision of firewall.
- (c) For excluded petroleum product storage, firewall of height not less than 300 mm shall be provided by limiting

the number of tanks to 10 or the capacity of group of tanks to 5,000 cum whichever is lower.

7.1.4 General;

- (a) The tank height shall not exceed one and half times the diameter of the tank or 20 m whichever is less. For the installations covered under Oil Mines Regulation, the maximum height of the tank, dyke requirements etc. shall be as per Oil Mines Regulations
- (b) Piping from / to any tank located in a dyked enclosure should not pass through any other dyked enclosure. Piping connected to tanks should run directly to outside of dyke to the extent possible to minimise piping within the enclosures.
- (c) 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.
- (d) There shall be access on all four sides of each dyke area and roads should be linked to minimize the effect if one road is cut off during the fire.

7.2 **Separation Distances between tanks / offsites facilities;**

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

- (a) For larger installation, minimum separation distances shall be as specified in Table- 3 and Table-4. The tables are applicable where total storage capacity for Class-A and Class-B petroleum products is more than 5000 cum or the diameter of Class-A or Class-B product tank is more than 9 meters.
- (b) For smaller installation, minimum separation distances shall be as specified in Table-5. This table is applicable where total storage capacity of Class-A & Class-B is less than 5000 cum and diameter of any tank storing Class-A and Class-B petroleum product does not exceed 9 meters. Table-5 shall also be applicable for the installation storing only Class-C petroleum.
- (c) Excluded petroleum should be treated as Class-C petroleum for the purpose of separation distances and Table – 5 shall be applicable for their separation distances.

8.0 **LAYOUT OF LPG FACILITIES**

8.1 **General Considerations:**

8.1.1 LPG Storage;

The requirements given below are applicable to above ground LPG storage facilities. For mounded LPG storage, refer OISD-STD-150.

- (a) Vessels shall be arranged into groups each having a maximum of six vessels. Capacity of each group shall be limited to 15000 cum. Each group shall be provided with a curb wall.
- (b) Any vessel in one group shall be separated from a vessel in another group by a minimum distance of 30 meters.
- (c) Spheres and bullets shall be treated as separate groups with 30 meters separation distance between two groups.
- (d) Longitudinal axes of horizontal vessels (Bullets) should not point towards other vessels, vital process equipments and control room.
- (e) Storage vessels should be located down wind of process units, important buildings and facilities.
- (f) LPG storage vessels shall not be located within the same dykes where other liquid hydrocarbons are stored.
- (g) Storage vessels shall be laid out in single row both in case of the spheres and bullets. Storage vessels shall not be stacked one above the other.
- (h) Spillage collection shallow sump shall be located at a distance where the flames from sump fire will not impinge on the vessel. This distance shall not be less than the diameter of the nearest vessel or 15 meters whichever is higher. The capacity of the collection sump shall be as per OISD-STD-144.
- (i) Curb wall around the storage tank shall have a minimum height of 30cm. However it shall not exceed 60cm at shallow sump position, as otherwise evaporation of spilled LPG may get affected.

8.1.2 LPG bottling facility;

- (a) LPG bottling facilities should be located at a safe distance from other facilities with minimum ingress to trucking traffic and downwind to storage.

- (b) There shall not be any deep ditches in the surrounding area to avoid LPG settling.
- (c) Stacking areas for empty and filled cylinders should be located separately. Cylinders shall be stacked vertically. Filling machines and testing facilities shall be organized in sequential manner distinctly in a separate area.
- (d) Filled LPG cylinders shall not be stored in the vicinity of cylinders containing other gases or hazardous substances.
- (e) Trucking traffic shall be smooth to avoid blocking/ obstruction for loading and unloading of cylinders.

8.1.3 Bulk handling facilities;

- (a) LPG truck loading/unloading gantry shall be located in a separate block and shall not be grouped with other petroleum products.

Maximum number of LPG tank truck bays shall be restricted to 8 in one group. The bay should be designed in such a way that the driver's cabin will be facing the exit direction and shall have no obstruction.

- (b) LPG rail loading/unloading gantry shall be located on a separate rail spur and shall not be grouped with other petroleum products.
- (c) Rail loading/unloading of LPG should be restricted to a maximum of half rake. Full rake loading / unloading is shall be done on two separate rail gantries having a minimum distance of 50m.

8.2 **Separation distances for LPG facilities;**

Minimum separation distances for above ground LPG facilities shall be as given in Table-6 & Table-7. For other details refer OISD-STD-144.

For mounded LPG storage, refer OISD-STD-150.

9.0 **REFERENCES:**

1. The Petroleum Rules - 2002.
2. The Static and Mobile Pressure Vessels (Unfired) Rules, 1981
3. Oil Mines Safety Regulations - 1984
4. OISD-STD-106 on Process Design and Operating Philosophies on Relief and Disposal System.
5. OISD-STD-116 on Fire protection Facilities for Petroleum Refineries / Process Plants
6. OISD-STD –117 on Fire protection facilities for Petroleum depots and terminals
7. OISD-STD- 144 on LPG bottling plant and layouts.
8. API Standard 2610–Design, construction, operation, maintenance and inspection of Terminal and Tank facilities.
9. API Recommended Practices 2001– Fire protection in Refineries.
10. Loss Prevention in process Industries by Frank P Lees.
11. NFPA 30, flammable and Combustible Liquid Code.

SEPARATION DISTANCES BETWEEN BLOCKS/FACILITIES
TABLE – 1

Sr no	From / To	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Process Units	Note-1	Note-3	30	30	30	60	90	45	45	60	45	30	60	60	30	90
2	Process Control Room (Note –2)	Note-3	x	Note-4	Note-5	30	60	90	45	45	30	Note-3	x	30	15	30	30
3	Storage Tanks Class-A	30	Note-4	Note-6	Note-6	Note-6	30	90	30	30	60	(90)	30	T3	60	30	50
4	Storage Tank Class-B	30	Note -5	Note-6	Note-6	Note-6	30	90	30	30	60	(90)	30	T3	30	30	50
5	Storage Tank Class-C	30	30	Note-6	Note-6	Note-6	30	90	30	30	60	(90)	30	T3	30	30	50
6	Pressurised Storage: LPG/ C4 & Lighter / H2	60	60	30	30	30	T7	90	30	T6	90	(90)	30	T7	45	30	60
7	Flare (Note-7)	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
8	Bulk Loading POL (Rail /Road)	45	45	30	30	30	30	90	Note-8	Note-9	60	30	Note-10	T3	60	30	50
9	Bulk Loading LPG (Rail /Road)	45	45	30	30	30	T6	90	Note-9	T6	90	(90)	T6	T6	60	30	50
10	Fire Station / First Aid Center	60	30	60	60	60	90	90	60	90	x	30	30	12	12	30	90
11	Boiler house / Process Unit Heaters (Note-11)	45	Note-3	(90)	(90)	(90)	(90)	90	30	(90)	30	x	15	50	30	30	Note-12
12	Rail Spur	30	x	30	30	30	30	90	Note-10	T6	30	15	x	30	6	15	50
13	Boundary wall around installation	60	30	T3	T3	T3	T7	90	T3	T6	12	50	30	x	6	30	50
14	Service buildings	60	15	60	30	30	45	90	60	60	12	30	6	6	x	30	50
15	Cooling tower,	30	30	30	30	30	30	90	30	30	30	30	15	30	30	x	15
16	API Separators / Oil sludge pit	90	30	50	50	50	60	90	50	50	90	Note-12	50	50	50	15	x

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General Notes to Table-1 :

- a) All distances are in meters. "T" indicates the table number to be referred. "x" means any distance suitable for constructional or operational convenience.
- b) All distances shall be measured between the nearest points on the perimeter of each facility except (i) In case of tank vehicle loading / unloading area where the distance shall be from the center of nearest bay. (ii) The distances given in the brackets () are from the shell of the Heater / Boiler / Furnace / Still.

Specific notes to Table-1:

- Note-1: This shall be 36 meters considering the 6-meter wide road passing through the center. The edge of the road shall not be less than 15 meters away from the edge of the unit.
- Note-2: Type of construction shall be as per OISD-STD-163.
- Note-3: Process control room to Process units / boiler house / heaters the minimum separation distance shall be 30 m. For a control room attached to single process unit or a boiler or a heater, the minimum separation distance shall be 16 m. For Gas processing plants, it shall be minimum 30 meters irrespective of whether it is for one or more units.
- Note-4: Shall be 60 m for non-blast construction and 30 m for blast resistant construction.
- Note-5: Shall be 45 m for non-blast construction and 30 m for blast resistant construction.
- Note-6: 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-3 and Table-4
- Note-7: The distances specified are for the elevated flare. For ground flare, these distances shall be 150 m. For Exploration & Production installations, this shall be in line with Oil Mines Regulations
- Note-8: Separation distance between Tank truck gantry and wagon gantry shall be 50m.
- Note-9: The separation distance shall be 50 m. However for LPG tank truck bulk loading to POL tank truck bulk loading it shall be 30 m.
- Note-10: Separation distance between tank truck gantry and rail spur shall be 50 m.
- Note-11: Boiler house or heater of a process unit is to be treated as a separate identity only for the consideration of surrounding blocks / facilities. However, heater of a process unit remains an integral part of the process unit to which it is attached and in that case the inter equipment distances should be inline with Table -2.
- Note-12: Centralized / common API separators, Corrugated Plate Interceptor (CPI), open oil separators shall be categorized under the same risk and shall be located at a distance of 90 meters from heaters / boilers. However, if these are covered from the top and provided with adequate venting to safe location, the minimum separation distance shall be 30 meter.

SEPARATION DISTANCES BETWEEN EQUIPMENT WITHIN PROCESS UNIT

TABLE-2

Sr no	From / To	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Fired Heater / Any fired equipment	x	15	15	15	22	15	15	20	15	15	15	x	18	6	30	15
2	Reactors	15	2	2	6	8	7	15	7	7	4	3	15	5	3	15	3
3	Distillation column	15	2	3	4	7	5	15	5	5	2	3	15	3	3	15	3
4	Accumulators – Hydrocarbons	15	6	4	2	8	5	15	4	4	2	3	15	3	3	15	3
5	Compressors - Hydrocarbons	22	8	7	8	3	7	15	7	7	7	7	15	4	3	20	7
6	Hot oil pump	15	7	5	5	7	1	7	1	1	2	2	15	3	x	15	x
7	Fuel Oil / HCs day tank	15	15	15	15	15	7	T-5	15	15	15	15	15	15	x	15	15
8	Pumps for class- A & all above Auto-ignition temp	20	7	5	4	7	1	15	1	1	2	2	15	3	x	15	x
9	Pumps - for all other Hydrocarbons	15	7	5	4	7	1	15	1	1	2	2	15	3	x	15	x
10	Heat Exchangers	15	4	2	2	7	2	15	2	2	2	2	15	2	2	15	x
11	Air fin coolers for Hydrocarbons	15	3	3	3	7	2	15	2	2	2	x	15	2	x	15	2
12	Fired heater Local control panel	x	15	15	15	15	15	15	15	15	15	15	x	10	x	15	5
13	Pressure vessels / Drums of Hydrocarbons	18	5	3	3	4	3	15	3	3	2	2	10	2	3	15	2
14	Main Pipe rack	6	3	3	3	3	x	x	x	x	2	x	x	3	x	15	x
15	Blow down facility – Drum, pump, vent stack	30	15	15	15	20	15	15	15	15	15	15	15	15	15	x	15
16	Structural main – Technological platforms	15	3	3	3	7	x	15	x	x	x	2	5	2	x	15	x

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General notes to Table –2:

- a) All distances are face-to-face clear minimum distances in meters.
- b) “x” indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements.
- c) Distances specified in Table-2 are the minimum recommended distances that the industry should adhere. These could be suitably modified as required to suit space constraints and relevant engineering practices except the followings.
 - (i) Blow down facility (open pit type) / oil catcher shall be located at a distance not less than 30 m from fired heater / any fired equipment. If the blow down drum is located underground / oil catcher is cover with vent to safe location, the minimum separation distance shall be 15m.
 - (ii) Fuel Oil day tank shall be located at a distance of not less than 15m from equipment except those facilities such as heat exchanger, pump connected directly with the Fuel Oil system.
- d) Firewater hydrant / monitors shall be minimum 15 m away from the equipment that is to be protected.
- e) Water spray deluge valve shall be minimum 15 m from equipment handling hydrocarbon.
- f) Fuel gas knock out drum shall be located at a minimum separation distance of 15 m from the heater.
- g) Separation distances specified in other OISD standards or elsewhere in this standard (other than Table –2) shall be followed as recommended.

SEPARATION DISTANCES BETWEEN TANK / OFFSITE FACILITIES - (For large installations)

TABLE - 3

	Tanks / Facility	1	2	3	4	5	6	7	8	9
1	Storage Tank for Petroleum Class A / Class B.	T4	T4	15	15	15	15	8	15	0.5 D Min 20 m
2	Storage Tank for Petroleum Class C	T4	x	15	x	8	x	x	x	0.5 D Min 20 m
3	Storage / Filling Shed for petroleum Class A or class B	15	15	x	8	15	15	8	15	15
4	Storage / Filling Shed for Petroleum Class C	15	x	8	x	8	x	x	x	10
5	Tank vehicle loading / Unloading for petroleum class A or class B	15	15	15	8	x	x	8	15	20
6	Tank Vehicle loading / unloading for Class C	15	x	15	x	x	x	x	x	10
7	Flame proof Electric Motor	8	x	8	x	8	x	x	8	x
8	Non flame proof electric Motor	15	x	15	x	15	x	8	x	x
9	Boundary wall	0.5 D Min 20 m	0.5 D Min 20 m	15	10	20	10	x	x	x

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SEPARATION DISTANCES BETWEEN STORAGE TANKS WITHIN A DYKE**TABLE- 4**

	Item	Between floating Roof Tanks Class A & B	Between fixed Roof Tanks Class A & B	Between Class C Petroleum Storage tanks
1	All tanks with Diameter upto 50 meters	(D+d) / 4 Min 10 m	(D+d) / 4 Min 10 m	(D+d) / 6 Min 6 m
2	Tanks with Diameter exceeding 50 meters.	(D+d) / 4	(D+d) / 3	(D+d) / 4

General notes to Table – 3 & 4

- a) All distances are in meters.
- b) “x” indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements
- c) D & d stands for diameter of larger and smaller tanks. Distances given are shell to shell in the same dyke
- d) In Table – 3 all distances shall be measured between the nearest points on the perimeter of each facility except in the case of tank vehicle loading/unloading area where the distance shall be measured from the center of each bay.
- e) In Table –4, Distances given are shell to shell in the same dyke.
- f) For different combination of storage tanks, the stringent of the applicable formulae shall be considered for minimum separation distance.
- g) The distance of storage tanks from boundary wall is applicable for;
 - (i) Floating roof tanks having protection for exposure
 - (ii) Tanks with weak roof-to-shell joint having approved foam or inerting system and the tank diameter not exceeding 50 meters
- h) For the facilities not covered in Table- 3, refer Table-1.

SEPARATION DISTANCES BETWEEN TANKS/OFFSITE FACILITIES - (For small installations)

TABLE – 5

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Storage Tank Class A	0.5D	0.5D	0.5D / 6.0	9	9	9	15	15	15	3	15	15	15
2	Storage Tank Class B	0.5D	0.5D	0.5D / 6.0	9	0.5D	0.5D	9	4.5	4.5	3	4.5	D Min 4.5	D Min 4.5
3	Storage Tank Class C	0.5D / 6.0	0.5D / 6.0	x	9	0.5D	x	9	4.5	x	x	x	0.5D Min 3.0	0.5D Min 3.0
4	Storage / Filling shed for petroleum Class -A	9	9	9	x	4.5	6	9	9	9	3	9	9	9
5	Storage / Filling shed for petroleum Class -B	9	0.5D	0.5D	4.5	x	1.5	9	4.5	4.5	1.5	4.5	4.5	4.5
6	Storage / Filling shed for petroleum Class -C	9	0.5D	x	6	1.5	x	9	4.5	x	x	x	3	3
7	Tank vehicle Loading / unloading Class - A	15	9	9	9	9	9	x	9	9	3	9	9	9
8	Tank vehicle Loading / unloading Class - B	15	4.5	4.5	9	4.5	4.5	9	x	4.5	1.5	4.5	4.5	4.5
9	Tank vehicle Loading / unloading Class - C	15	4.5	x	9	4.5	x	9	4.5	x	x	x	3	3
10	Flame proof Electric motors	3	3	x	3	1.5	x	3	1.5	x	x	3	x	x
11	Non Flame proof Electric motors	15	4.5	x	9	4.5	x	9	4.5	x	3	x	x	x
12	Office building, stores, amenities	15	D Min 4.5	0.5 D Min 3.0	9	4.5	3	9	4.5	3	x	x	x	x
13	Boundary wall	15	D Min 4.5	0.5D Min 3.0	9	4.5	3	9	4.5	3	x	x	x	x

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General notes to Table –5:

- a) All distances are in meter and the table specifies the minimum requirement.
- b) “x” indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements
- c) “D” indicates the diameter of the larger tank.
- d) Distances given for the tanks are shell to shell in the same dyke.
- e) Where alternate distances are specified (like 0.5 D / 6.0), the minimum thereof shall be used.
- f) All distances shall be measured between the nearest points on the perimeter of each facility except in case of tank vehicle loading /unloading area where the distance shall be from the center of each bay.
- g) Pig launcher/receiver at liquid hydrocarbon handling pipeline installations should be located at least 5 m from boundary.

SEPARATION DISTANCES FOR LPG FACILITIES

TABLE - 6

Sr no.	FROM / TO	1	2	3	4	5	6	7	8
1	LPG Storage vessels	Note-1	T7	30	30	50	30	15	60
2	Boundary wall / group of buildings not associated with LPG plant	T7	x	30	30	50	30	30	x
3	Shed for filling and storage of LPG, Cold repair shed, Cylinder evacuation facilities	30	30	15	30	50	30	15	60
4	Tank Truck Loading / unloading gantry	30	30	30	30	50	50	30	60
5	Tank wagon gantry	50	50	50	50	50	50	30	60
6	Rail spur	30	30	30	50	50	50	30	60
7	Pump house / Compressor house (LPG)	15	30	15	30	30	30	x	60
8	Fire Water pump house	60	x	60	60	60	60	60	x

TABLE- 7**SEPARATION DISTANCES BETWEEN LPG STORAGE VESSELS AND BOUNDARY WALL / GROUP OF BUILDINGS NOT ASSOCIATED WITH LPG FACILITIES**

Capacity of Each vessel in Cum of water	10 - 20	21 - 40	41 - 350	351 - 450	451-750	751 - 3800
Distance in meters	15	20	30	40	60	90

General Notes to Table-6 & Table-7;

- a) Table-6 is applicable for total storage of above 100 Tonnes.
- b) All distances are in meters
- c) “x “indicates suitable distance as per good engineering practices to meet construction, operational and maintenance requirements
- d) T7 indicates Table –7;
- e) Distance of stabling line shall be as per Railway Standards.

Specific Notes to Table- 6;

Note–1: The distance shall be 2 meters or 1/4 of the sum of the diameters of the adjacent vessels or half the diameter of the larger of the two adjacent vessels in the same group whichever is greater.