

INTRODUCTION TO STORAGE TANKS & TANK INTERNALS

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PARADEEP REFINERY PROJECT
A Sunrise Project for a Sunshine Future





fixed-roof tank



GENERAL CLASSIFICATION OF PETROLEUM PRODUCTS

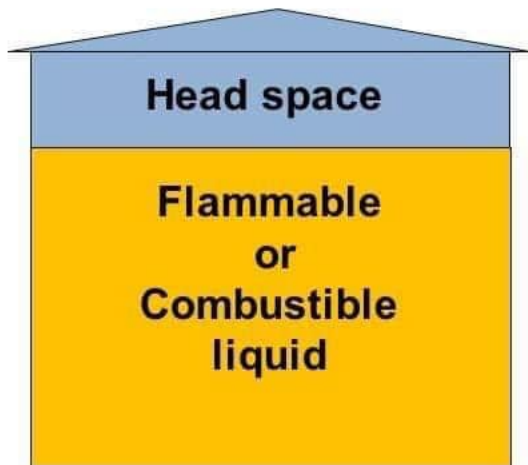
Petroleum products are classified according to their closed cup Flash Points as given below:

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

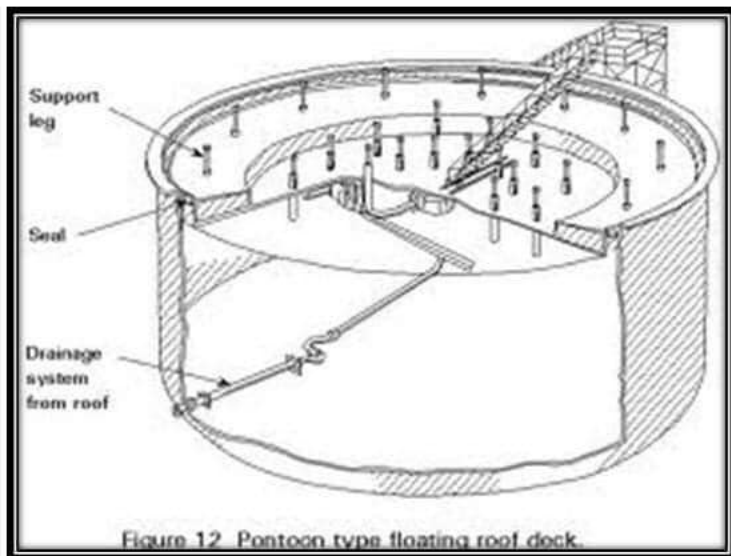
Liquefied gases including LPG do not fall under this classification but form separate category.

- ☐ Fixed roof tanks (Cone roof / Dome roof)
- ☐ Floating roof tanks
- ☐ Fixed cum floating roof tanks

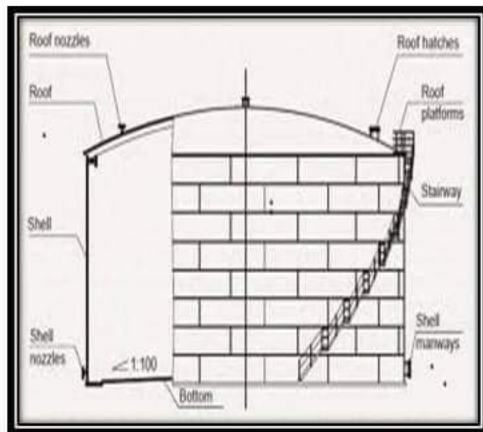
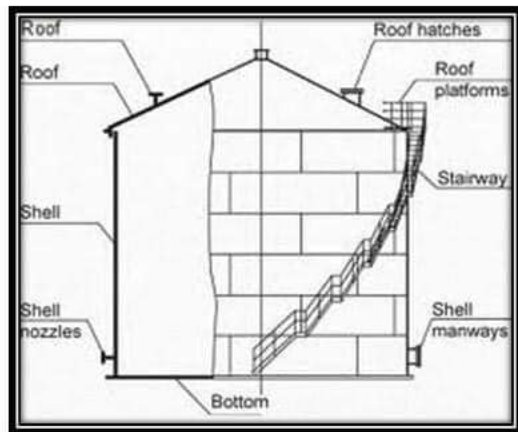
FIXED ROOF TANK



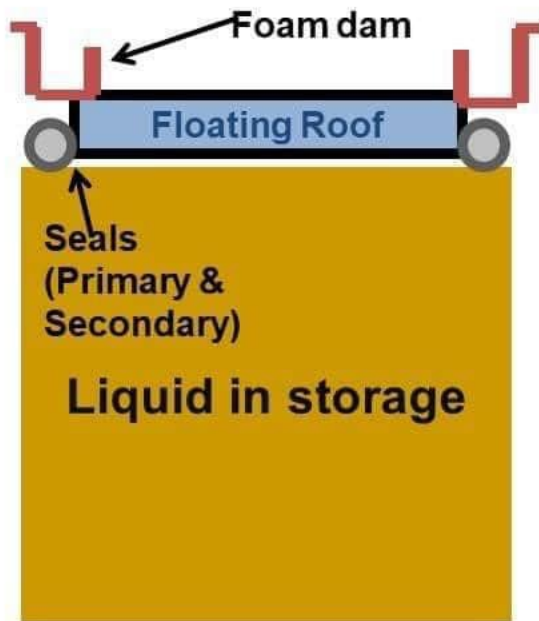
FLOATING ROOF TANK



CONE ROOF TANK / DOME ROOF TANK

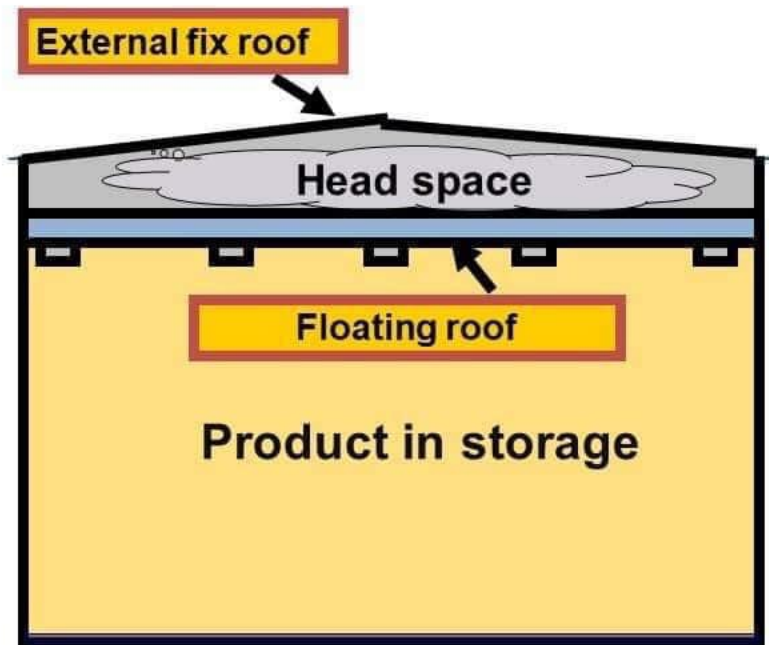


FLOATING ROOF TANK

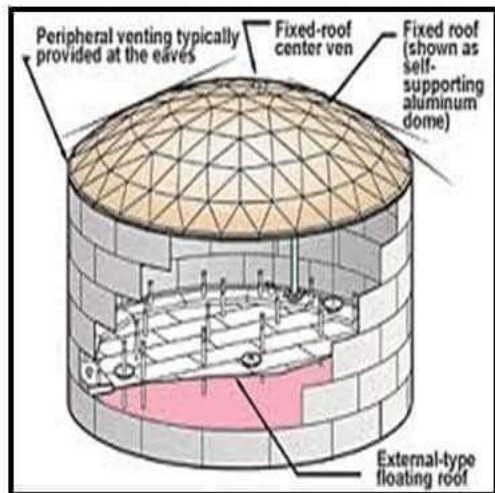
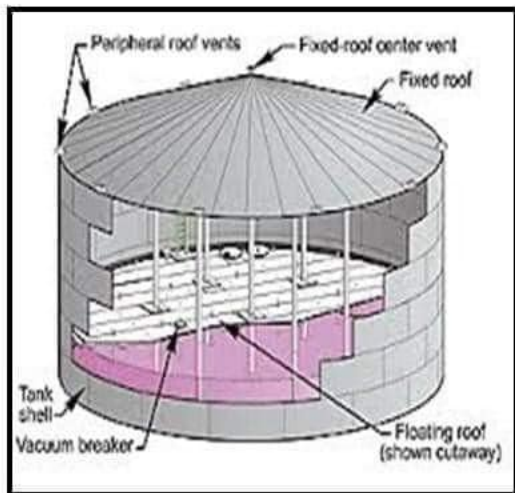




FIXED CUM FLOATING ROOF TANK



FIXED CUM FLOATING ROOF TANK



- ❖ Inlet line or receiving line
- ❖ Out let line or pump suction line
- ❖ Inter tank transfer line / Jet mixing line
- ❖ Heel stripping line
- ❖ Siphon drain
- ❖ Cleanout door
- ❖ Shell manhole
- ❖ Steam Coil & condensate line
- ❖ Datum Plate

EXTERNALS & INTERNALS OF TANKS

- ❖ Tank Dyke
- ❖ Surface drain
- ❖ Stair case
- ❖ Tank Pad
- ❖ Shell manhole

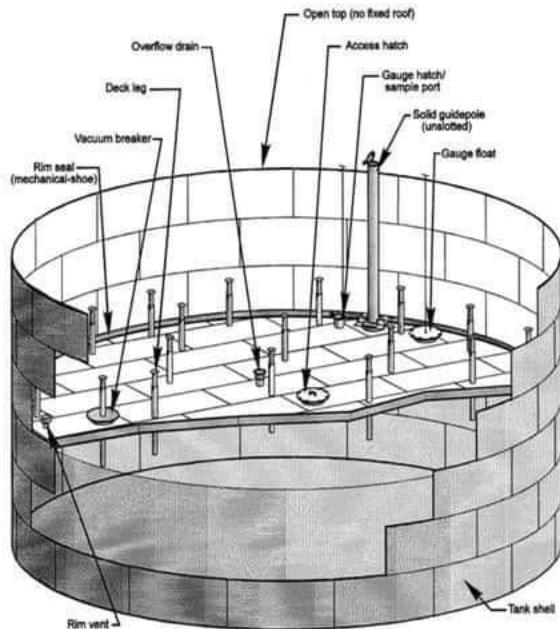




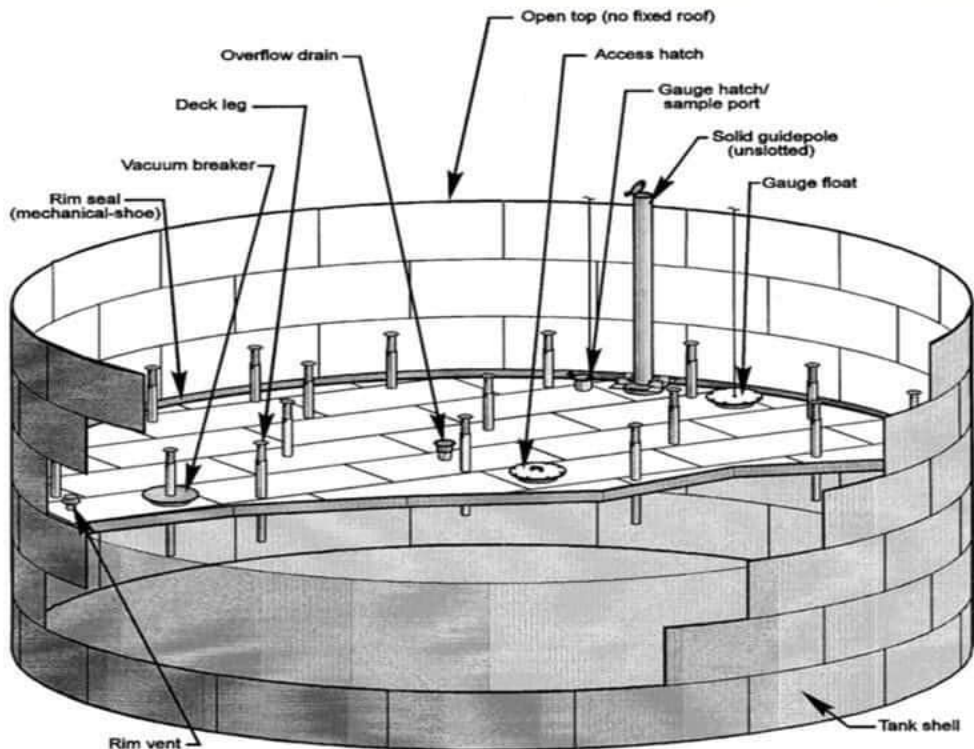
EXTERNALS & INTERNALS OF TANKS

- ❖ Gauge platform
- ❖ Tank gauging instrument
- ❖ Spark proof gauge hatch with steeling well
- ❖ PV valves
- ❖ Goose neck
- ❖ Rolling ladder / Rolling ladder wheel
- ❖ Automatic bleeder vent

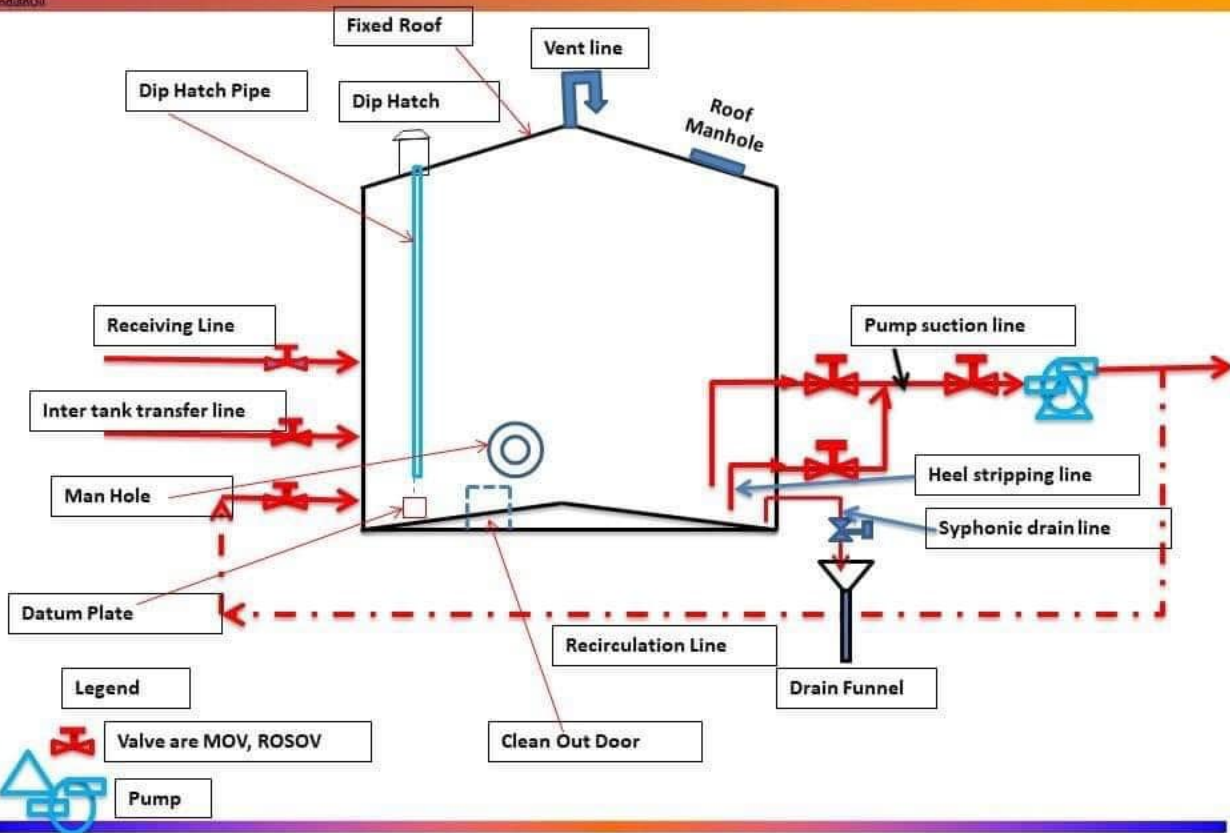
- ❖ Roof drain assembly
- ❖ Emergency roof drain
- ❖ Leg support
- ❖ Roof seal system
- ❖ Roof manhole
- ❖ Roof pontoons
- ❖ Earthing cable
- ❖ Foam dam



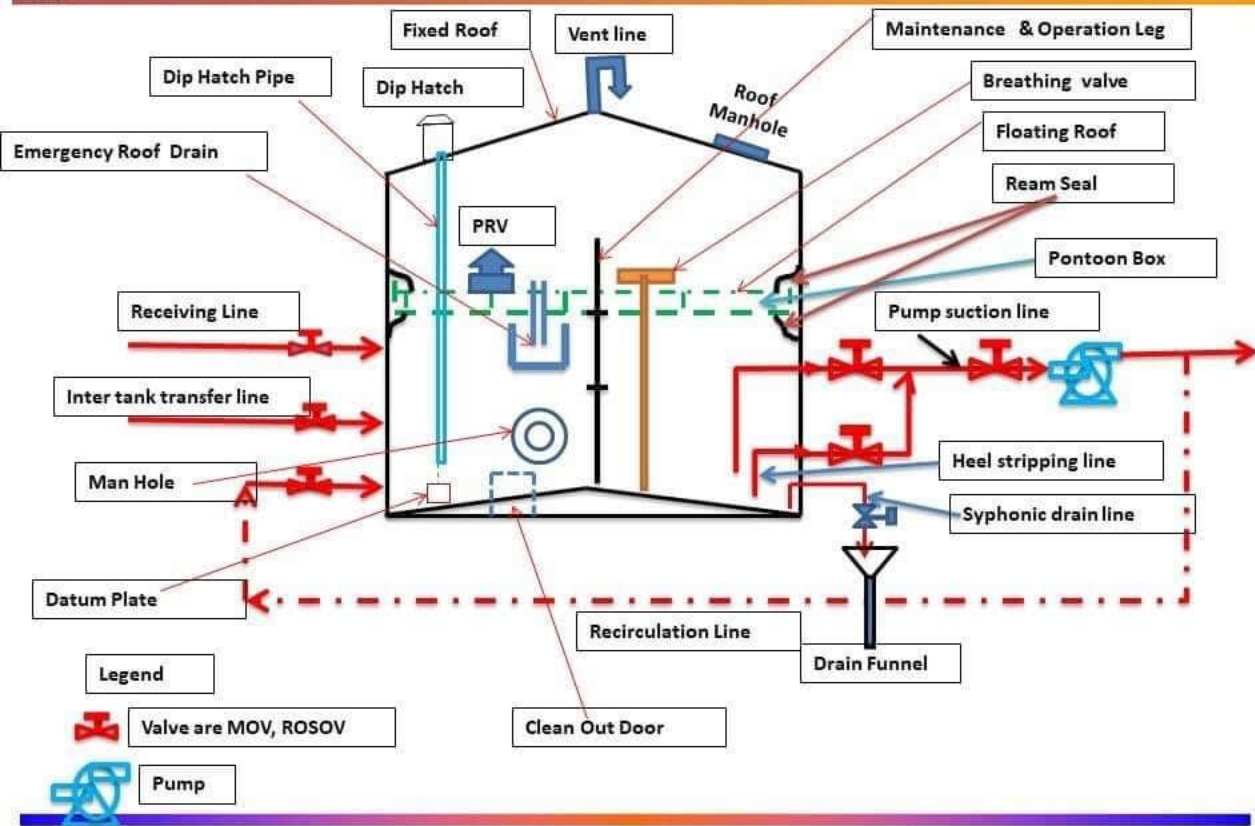
EXTERNALS & INTERNALS OF TANKS



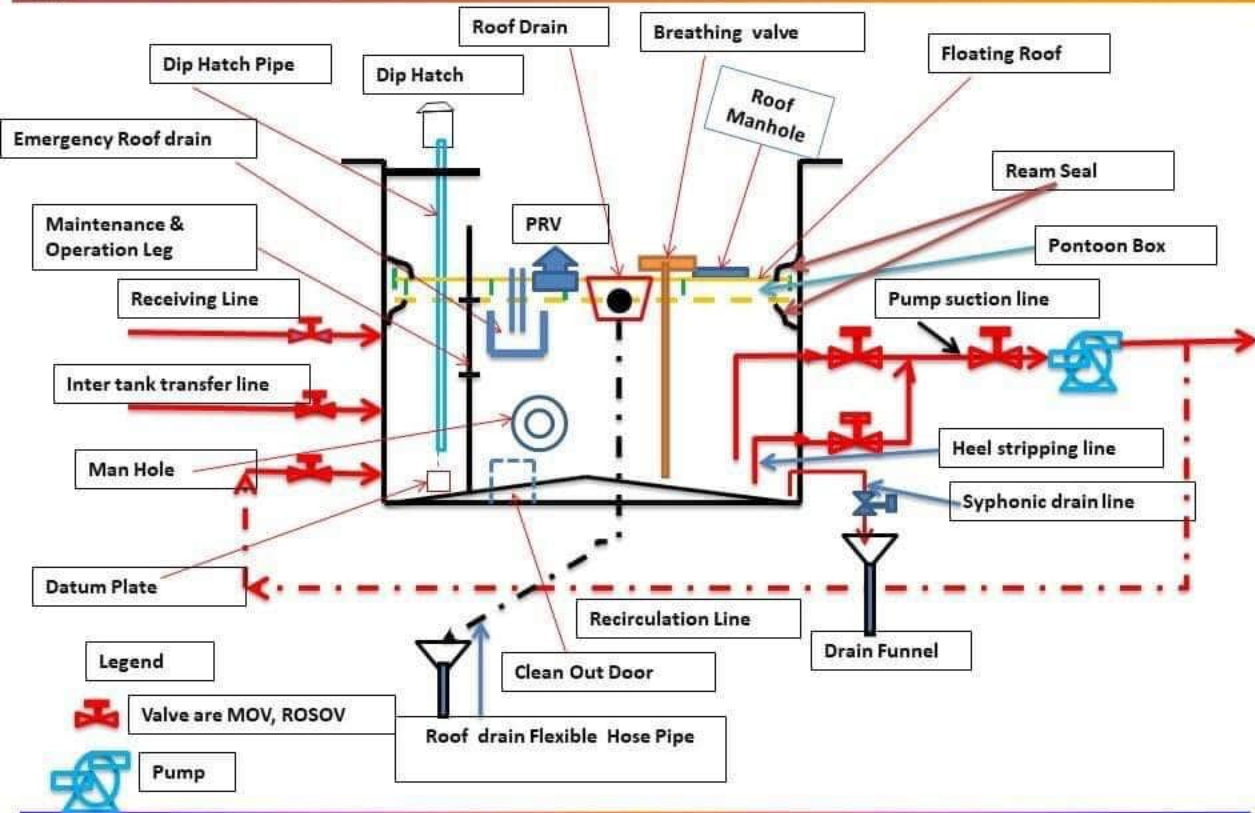
FIXED ROOF TANK



FIXED CUM FLOATING ROOF TANK



FLOATING ROOF TANK



TANK COMPONENTS



Co-flex type Roof drain



Roof Drain- NRV

TANK COMPONENTS



Emergency Roof drain



Breather vent

TANK COMPONENTS



Roof Manhole



Roof to Tank Ladder

TANK COMPONENTS



Pontoon Box



PVRV

TANK COMPONENTS



Jet mixer



Drain Sump



❖ 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

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.

STORAGE TANK CAPACITY

Gross Capacity: Capacity of the tank up to the maximum safe filling height of the tank.

Nominal Capacity: Geometric volume of the tank from bottom up to curb angle in case of fixed roof tanks and the underside of the roof deck up to the maximum floating position of floating roof in case of floating roof tanks.

Net Capacity: Net pumpable capacity of the tank during operation after subtracting the volume of the tank bottom contents up to the top of normal pump out nozzle from safe filling capacity of the tank.

Dead stock: Product that remains in the tank at a point where the pump suction fails.

LAYOUT OF TANKS AS PER OISD-118

- The tank height shall not exceed **one and half times** the diameter of the tank or **20 m** whichever is less.
- 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.
- In a dyked enclosure where more than one tank is located, firewalls of minimum height **600mm** shall be provided.
- 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.
- Dyked enclosure shall be able to contain the complete contents of the largest tank in the dyke in case of any emergency.
- A group of small tanks each not exceeding 9 meters in diameter and in all not exceeding **5000 M³** in capacity shall be treated as one tank for the provision of firewall.



INTER-DISTANCE BETWEEN TANKS

- Floating roof tanks (Class A & B) : Dia upto 50M or more = $(D+d)/4$
- Fixed roof tanks (Class A & B) : Dia upto 50M = $(D+d)/4$
- Fixed roof tanks (Class A & B) : Dia more than 50M or more = $(D+d)/3$
- Distance between Class C tanks: Dia upto 50M = $(D+d)/6$

DYKED ENCLOSURE

- ❖ 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 m**, whichever is more.
- ❖ 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.
- ❖ 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.
- ❖ Tanks shall be arranged in maximum two rows so that each tank is approachable from the road surrounding the enclosure.
- ❖ Tanks having **50,000 m³** capacity and above shall be laid in single row.

REFERENCE HEIGHT

Datum height: Height of datum plate from bottom of tank

Safe filling height: Height from datum plate up to safe filling capacity

Reference height: Height from datum plate to a reference mark at dip hatch

Calibration chart: To calculate volume with respect to height of tank

Tank Factor: Approx volume of tank per cm height

- ☐ Sprinkler system
- ☐ Foam System
- ☐ Rim seal fire protection system
- ☐ High volume long range monitor (HVLRM)
- ☐ Double headed hydrant monitor
- ☐ Medium expansion foam generator
- ☐ Gas detection system -CCTV
- ☐ Flame detection system

SAFETY SYSTEMS OF TANKS



Foam Pourer



Rim seal fire protection

SAFETY SYSTEMS OF TANKS



HVLRM



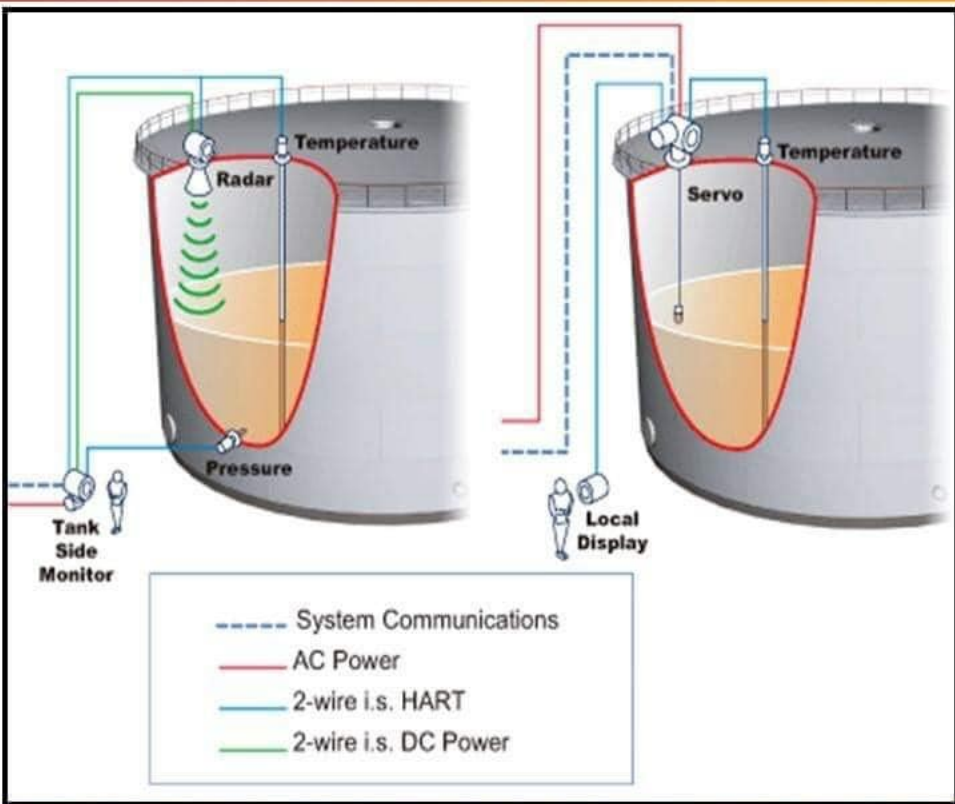
Sprinkler

Electrical system:

- Cathodic protection (CP) system
- Earthing System
- Bonding (Shell to ladder & Roof to ladder)

Instrumentation system:

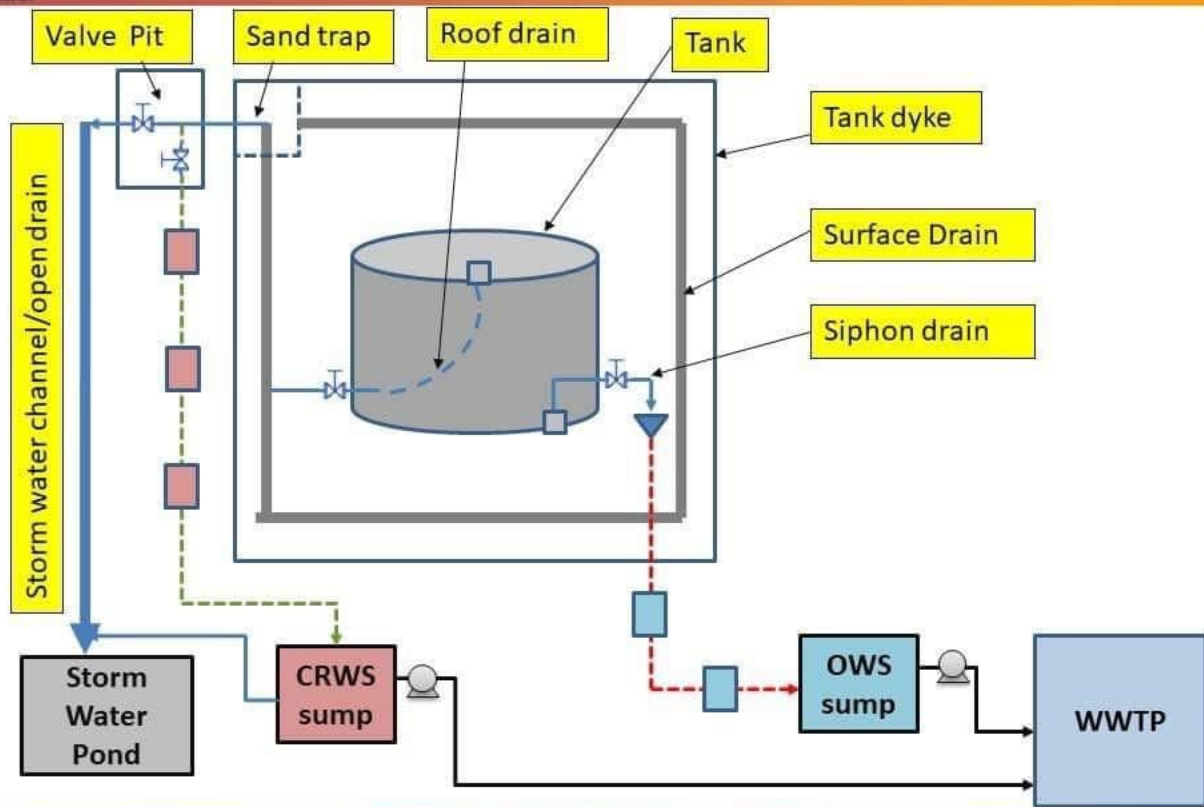
- Level transmitter (Servo & Radar)
- Temperature Transmitter



Draining System:

- ☐ Oily water system (OWS)
- ☐ Contaminated rain water system (CRWS)
- ☐ Storm water system / open drain

DRAINING SYSTEM OF TANKS





DO's and DON'Ts

- Un-authorized entry restricted.
- Do not carry mobile phone inside Refinery/ tank farm area.
- Always use proper PPE's.
- Watch your steps and use handrails.
- Maintain good housekeeping.
- In case of any abnormalities inform control room immediately.
- Maintain clear and proper communication with control room.
- Sampling and water draining has to be done in presence of authorized persons.
- Never leave water draining from tanks without isolating drain isolation valve.
- Do not allow tank dip to increase beyond safe filling height of the tank.



DO's and DON'Ts

- Proper line up to be checked before receiving or pumping out to/from a tank.
- Tank dip showing in instrument is to be cross checked by manual dipping intermittently.
- Check tank level depletion/increase by comparing with receiving/pumping out rate.
- Use proper tools & tackles.
- Do not allow any job(both HOT & COLD) with out clearance in work permit system
- Always be aware of up-wind direction and emergency exit.
- Break glass of nearest manual call point during fire.
- Be aware of siren codes and assembly point