

Marketing Training Report

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Contents

1 Sanand Bottling Plant	5
1.1 Important Terms and Abbreviations	5
1.2 Sanand Bottling Plant - Day 1 (13.08.2019)	5
1.2.1 Introduction to Sanand LPG Bottling Plant - Salient Points	5
1.2.2 Roles and Responsibilities - Salient Points	6
1.2.3 LPG Plant Layout - Salient Points	6
1.3 Sanand Bottling Plant - Day 2 (14.08.2019)	7
1.3.1 Electrical Systems - Salient Points	7
1.3.2 LPG Plant Safety - Salient Points	7
1.4 Sanand Bottling Plant - Day 3 (16.08.2019)	8
1.4.1 Supply & Distribution - Salient Points	8
1.4.2 Bulk - Salient Points	8
1.5 Sanand Bottling Plant - Day 4 (17.08.2019)	8
1.5.1 Stores - Salient Points	8
1.5.2 Shed Visit	8
1.5.3 Closing Session - Salient Points	9
1.6 Tables	10
1.7 Figures	12
2 Bareja Terminal	16
2.1 Important Terms and Abbreviations	16
2.2 Operations	16
2.2.1 Receipt	16
2.2.2 Storage	16
2.2.3 Dispatch	17
2.2.4 Quality	17
2.3 Safety and Maintenance	18
2.3.1 Cone Roof Tanks	18
2.3.2 Floating Roof Tanks	18
2.3.3 Pipeline Maintenance	18
2.3.4 Pumps Maintenance	18
2.3.5 Electrical Maintenance	18
2.3.6 Safety Equipments	18
2.3.7 Safety of TT	19
2.3.8 Additional Safety Measures	19
2.4 Tables	20
2.5 Figures	21
3 LPG Distributorship	26
3.1 Important Terms and Abbreviations	26
3.2 Salient Points about the LPG Distribution Operation	26
3.3 Tables	27
4 Gujarat Refinery	28
4.1 Important Terms and Abbreviations	28
4.2 Salient points about Gujarat Refinery	28
4.3 Sulphur removal from fuel	28
4.4 Figures	29

5 Pipelines Session by Mr. Sanjiv Kumar Samal	30
5.1 Salient Points from the session	30
5.2 Supply & Distribution	30
5.3 Figures	30
6 FAQs	32

List of Figures

1.1	Types of valves attached to LPG cylinders	12
1.2	LPG filling process flow	12
1.3	Basic single line diagram of a bottling plant electrical distribution system	13
1.4	Theoretical and real panel equipment protection apparatus	13
1.5	DC power delivery system	14
1.6	Different types of earthing schemes	14
1.7	Hazchem decoded (BA=Breathing Apparatus)	15
2.1	Interface cutting norms	21
2.2	Pictorial representation of the storage tanks present at the Bareja terminal	21
2.3	Modes of operation of tanks	22
2.4	Alarms to prevent over filling or over emptying a tank	22
2.5	Valves attached to a tank	22
2.6	Equipments and process flow enabling the completely automatic filling of TTs	23
2.7	The TLF process flow (magnified to the filling part)	23
2.8	The complete TLF process flow	24
2.9	Quality flow at Bareja terminal	25
2.10	Major safety concepts	25
4.1	Brief process flow of refinery operations	29
4.2	Process flow of the fuel desulphurisation operation in refinery	29
5.1	Receiving crude oil from sea tankers	31
5.2	Pipeline construction process flow	31

List of Tables

1.1	VCB1 technical specifications made in technical collaboration with Toshiba Japan	10
1.2	Data card for the Isolation Transformer for the lighting equipment as mentioned in Fig 1.3	10
1.3	Datacard for the main step down transformer connected to the Electricity Board in Fig 1.3	11
2.1	Tank Capacities & Storing Limit	20
3.1	Various pricing elements in domestic LPG distribution	27

Chapter 1

Sanand Bottling Plant

1.1 Important Terms and Abbreviations

- OISD= Oil Industry and Safety Directorate
- PESO= Petroleum and Explosives Safety Organization
- TT= Tanker Trucks
- Cavitation = Cavitation is a phenomenon in which rapid changes of pressure in a liquid lead to the formation of small vapor-filled cavities, in places where the pressure is relatively low. When subjected to higher pressure, these cavities, called "bubbles" or "voids", collapse and can generate an intense shock wave. These shock waves can damage pumps/motors.
- CFM= Cubic Feet per Minute
- SO= State Office
- HO= Head Office
- DOA= Delegation of Authority
- BCW= Blue Collar Workers
- VCB= Vacuum Circuit Breaker
- ACB= Air Circuit Breaker
- EB= Electricity Board
- T/F= Transformer
- CT= Current Transformer
- PT= Potential Transformer
- CB= Circuit Breaker
- SFU= Switch Fuse Unit (See Fig 1.4a)
- EP= Earthing Pit
- TLV= Threshold Limit Value
- LEL= Lower Explosive Limit
- UEL= Upper Explosive Limit
- BA= Breathing Apparatus
- STEL= Short Term Exposure Level
- TLD= Tank Lorry Decantation
- SRD= Stay Ring Defect
- FRD= Foot Ring Defect

1.2 Sanand Bottling Plant - Day 1 (13.08.2019)

1.2.1 Introduction to Sanand LPG Bottling Plant - Salient Points

Faculty: Shri. Joydev Ojha, DGM(P), Sanand BP

- Due to low land prices and government push, this particular bottling plant has much more space than what is required under the OISD guidelines.
- In addition to that, there is a 66 acre buffer area which is not required anymore according to the latest OISD guidelines so, the plant "occupier" or location in charge Shri. Joydev Ojha, DGM(P) has decided to utilize it to benefit the corporation in the following ways:-
 - A 8MW solar plant was established in the buffer area which generates about Rs.3 lacs of electricity per day, part of which is used up by the factory and part is distributed to other IOCL facilities via the grid. It is important to note that according to some regulations in the Gujarat solar power consumption policy, IOCL at max can only generate 50% of their net electricity demand if they wish to stay on grid and share their power with other IOCL facilities using the same. This facility covers 66 acre of the buffer area.
 - A 2 acre lube storage facility (CFA). It is important to note here that lube being a high flashpoint product is an "excluded product". Therefore, storing it in buffer areas do not raise any safety concerns.
 - 4 acres are being delegated to the pipelines division to facilitate the Kandla-Gorakhpur pipeline.
- Product is sourced into the bottling plant using approximately 100 LPG TTs of 18-20 MTs from the following sources -
 - Kandla port
 - Pipawa port
 - Varoda refinery
 - Reliance refinery, Jamanagar

- Essar refinery, Jamnagar etc.
- There are 8 TLDs which takes about 3-4 hours to completely decant all the trucks and this happens in about 4 batches a day.
- Storage of LPG is done as follows-
 - 3 Horton Spheres 1400 MT, 1200 X 2 MT
 - 1 Stationary Vessel ie. Bullet 150 X 4 MT

Therefore, net storage capacity = $1400 + 12 \times 1200 + 150 \times 4 = 4400\text{MT}$
- Decantation is done via pressure difference using a vapour compressor in the following steps:-
 - First vapour of TT is pressurized by taking vapour from vessel. This forces liquid LPG to move from TT to vessel.
 - Then, liquid valve is closed and then vapour is sucked from the tanker using vapour suction.

This method is preferred over simply using pumps to pump the LPG from TT to vessel because if the pump pulls vapor by mistake, that will lead to cavitation.
- There are 3 carousels - 1400 cylinders/hour X 2 and 1600 cylinders per hour.
- The 3 carousels are fed by 3 pumps - 110 , 90, 36 X 2 CFM each with a max capacity of 6000 cylinders per month therefore, the net capacity would be approximately 18000 per month, but generally only about 15000 are required to be produced as per guidance from SO.
- The following requirement from SO side is generated by a computer model which takes the following factors into account -
 - Bulk receiving cost
 - Capacity of plant
 - Demand from market
 - Transportation cost from plant to market
- There are 2 types of valves in cylinders ie. Self Closing Valve (SC) 1.1band Liquid Off Take Valves (LOT) 1.1a.
- Delivery within 24 hours to distributor.
- There are baffle plates in LPG TTs to arrest momentum of the fluid thereby causing less hindrance to the driver.

1.2.2 Roles and Responsibilities - Salient Points

Faculty: Shri. Joydev Ojha, DGM(P), Sanand BP

- Occupier has he role responsibility and has the power of attorney
- The occupier then delegates the responsibility /authority to other officers below him via DOA guidelines.
- Finally the grass root users of official authority are Grade 'A' Officers who get the work done by the BCW in company payroll and contractors.

1.2.3 LPG Plant Layout - Salient Points

Faculty: Shri. B.H. Bharti, SM(P), Sanand BP

- There are four sizes of BPs based on net production per annum-
 1. less than 6000 — Micro
 2. between 6000 to 22000 — Mini
 3. between 22000 to 68000 — Major
 4. greater than 68000 — Mega

Based on information given above the average production per month of Sanand BP is 15000 therefore appx. production per annum $15000 \times 12 = 180000$ which is greater than 68000. Therefore, Sanand BP is a Mega Plant.2
- Vapour seals are used in water drains so that LPG vapour (which is heavier than air) cannot travel outside the plant licensed area where it can catch spark and ignite thereby causing grave fatalities and carry the ignition to plant and cause an even bigger calamity.
- Types of storage at any LPG facility can be as follows:-
 - Above ground storage- Bullets, Horton Spheres, Mounded Storage
 - Under ground storage
 - Cavern storage
 - Refrigerated storage tank @ -42°C and atm pressure
- Minimum of 3 vessels are to be kept at a plant.
- Storage vessel should be filled upto 84-85% to keep room for LPG expansion with change of temperature, failing this, risk of explosions due to expansions are considerably increased which renders such operating procedure ineffective and useless.
- Minimum compressor air pressure for carousel is 5.5 kg/cc and for the latest fully automatic carousel it is 6 kg/cc
- The following are the various types of LPG cylinders in the portfolio of IndianOil-Indane - (all are weight of LPG only)
 - 5 kg (domestic/commercial)
 - 14.2 kg (subsidized/non-subsidized domestic)
 - 19 kg (commercial for hotels etc./nanocut for fabrication etc.)
 - 47.5 kg (commercial for furnace, biscuit burners etc with SC or LOT valves/ domestic)
 - 425 kg (only commercial)
- The color coding for Indane cylinders is red for domestic and blue for commercial.
- Nanocut cylinders contain LPG along with an additive which gives rise to a sharp flame, which helps in cutting metal easily and accurately.
- The following are the truck capacities of the LPG cylinder trucks -306, 450, 504, 540 cylinders.
- SAP code for induction of new trucks - O4V1
- The bulk tankers incoming have the following capacities - 18 MT and 21 MT

- The following are defects for which cylinders are returned to IOCL from market and the corporation has to suitably compensate the distributor via credit according to policy (**Market Return Policy**)-
 - Oversize/undersize valve
 - Bung leak
 - Underweight/overweight
 - Broken pin
 - Pin stuck up
 - Water filled cylinder
 - Body leak
 - Other OMC (Oil Marketing Company) Cylinder
 - Burnt cylinder
 - SRD (Stay Ring Defect) / FRD (Foot Ring Defect)

1.3 Sanand Bottling Plant - Day 2 (14.08.2019)

1.3.1 Electrical Systems - Salient Points

Faculty: Shri. Prakash Chand Meena, OO(P), Sanand BP

With respect to Fig 1.3, the following points should be noted:-

- VCB1 monitors the following - voltage, power factor, frequency, current and has ratings as defined in Table 1.1
- The VCB has the following components for operation - CTs, PTs and CBs.
- Inside any panel, the electrical power goes through the following equipment-s in order:- SFU (415 V), Fuse, Contactor(125 A rating), Thermal Relay (only for over current). See Fig 1.4a.
- There are total 17 racks each with 2 sides and 6 units (as rows) on each side. So all in all there is accommodation for 17 X 2 X 6 = 228 equipment such as conveyer motor etc.
- All the control signals for the VCB and ACBs need 110 V DC supply as does the emergency lights. This is supplied by a DC distribution system as shown in Fig. 1.5a.
- In the panels the following protection measures are present **Switch to Fuse**(Now replaced by **SFU** - Switch Fuse Unit See Fig 1.4a) to **Contactor** to **Thermal Relay** to **Equipment**. The practical example of this can be seen in Fig 1.4b.
- In tranformers, as we can see from Table 1.2, 1.3 there is a guaranteed rise of temperature of winding and oil upto 55°C, therefore the high temperature alarm goes off at 60°C and trips the transformers at 90°C for oil OR winding overheating.
- Other than this, there is no inline protection for transformers such as differential protection (protection by Mertz-Price Circulating Current principle).
- However, for protection of transformers from Incipient faults, there are Buchholz Relays attached to each transformer.
- For reactive power compensation there are capacitor banks which are switched on and off via thyristors with the help of a automatic VAR compensator which keeps the power factor above 0.96 by switching on as many capacitors as required. The following are the capacities of the compensators available (Total Capacity= 340 kVAR):-
 - 25 kVAR X 13 = 325 kVAR
 - 10 kVAR X 1 = 010 kVAR
 - 5 kVAR X 1 = 005 kVAR
- There are 3 types of earthing present in a bottling plant (or any industrial facility for that matter) - Neutral Earthing (for DG and TF), Lightning Earthing (for Buildings and other structures), Body Earthing (for every electrical equipment in the plant and 2 point earthing if operating voltage is more than 250 Volts). The earthing schemes as per OISD regulations are roughly described in Fig 1.6

1.3.2 LPG Plant Safety - Salient Points

Faculty: Shri. Umesh Malviya, OO(LPG-Safety), Sanand BP

- Safety is the freedom from injury, death and damage.
- All accidents are preventable.
- Incident = Something wrong happened but no one was harmed or no damage was done whatsoever.
- Near Miss = Some minor injury occurred or injury was just avoided.
- Accident = Someone died and some major property damage has occurred.
- Reasons for accidents are 88% human error, 10% unsafe condition and 2% a combination of both.
- The fire triangle consists of 3 things required for a fire - product, air (oxygen) and spark. Therefore, just by removing any one of the three, fire can be stopped. However, that is not always the case for compounds like **Ethylene Oxide** which itself consists of oxygen, therefore the only way to stop the fire is to cut the fuel out of the equation.
- TLV for any chemical is a measure of how toxic it is to human beings. If the chemical concentration is more than the TLV then the max amount of time for which a person can operate in that environment without incurring serious damage is 8 hours. The TLV for LPG is 1000 ppm.
- All equipments present inside the licensed area have to be PESO approved.

- If the mixture of fuel and air is below LEL (1.9% for LPG) then it will not burn due to lack of fuel and is considered “too lean to burn”, and if the mixture is above UEL then it will not burn due to lack of oxygen and is considered “too rich to burn”. Therefore, the danger lies when the concentration is between LEL and UEL.
- Using a fire extinguisher (PASS) - **P**ull the pin, **A**im at the base of fire, **SS**weep.
- There are 2 types of fire protection - Active and Passive Fire protection. Active fire protection is a group of systems that require some amount of action in order to work efficiently in the event of a fire eg. fire extinguishers, automatic sprinkler systems, alarms etc. Passive fire protection is a group of systems that compartmentalize a building through the use of fire-resistance rated walls and floors, keeping the fire from spreading quickly and providing time to escape for people in the building eg. fire doors, photoluminescent egress path markers etc.
- There are 3 types of safety audits - Internal Safety Audit (Every 1 year), External audit by OISD (Every 5 years) and Surprise Audits.
- The expansion ratio of LPG is 1:250.
- The hazchem code for LPG is 2WE. See Fig 1.7 to know how to read hazchem signs. 2WE means that in case of an incident, fog of water must be sprayed, full protective clothing must be worn with Breathing Apparatus (BA), spill must be contained.
- Self Contained BA shows contained air pressure in bar. To convert it into minutes remaining, the shortcut formula is to remove the ending 0 and then add it to half of itself. For eg 300 bar means $30+15=45$ mins, similarly 200 bar means $20+10=30$ mins.
-

1.4 Sanand Bottling Plant - Day 3 (16.08.2019)

1.4.1 Supply & Distribution - Salient Points

Faculty: Shri. Himanshu Jatav, OO(P), Sanand BP

- Truck carrying cylinders have the following capacities :- 306/450/504 (no partial loads are given to any distributor)
- Under the current Market Return Policy in the MDG, the following forms grounds for return of cylinder from market:-
 - Oversize or undersize valve
 - Bung leak
 - Underweight or overweight
 - Broken pin
 - Pin stuck up
 - Water filled cylinder
 - Body leak
 - Other OMC cylinder
 - Burnt cylinder
 - SRD or FRD

1.4.2 Bulk - Salient Points

Faculty: Shri. Shirish Rao, SM(P), Sanand BP

- Bulk domestic product= 89000 MT
- Bulk international product= 94000 MT
- Supply for domestic from Kandla
- Supply for only non domestic from Dumar
- Supply for domestic from Essar Oil Limited (EOL), Jamnagar and Reliance, Jamnagar
- +-200g allowed in Gross Weight-Tear Weight
- TLD tests performed - Visual inspection, Pneumatic Test, Hydrostatic Test, Electrical Continuity.

1.5 Sanand Bottling Plant - Day 4 (17.08.2019)

1.5.1 Stores - Salient Points

Faculty: Shri. Nitin Parwani, AM(P), Sanand BP

Store contains the following:-

- Project - Contains project materials when such projects are being performed - Compressor, DG, Lights etc.
- LPG Consumables - SC valve, Pressure Regulator, O-Ring, TES, Soap Solution, Safety Caps
- HSD - for DG sets
- Lube - lube oil, I5W40
- Revenue Maintenance - Conveyer material, bearing, solenoid valve.

1.5.2 Shed Visit

The filling shed operation can be summarised by the following points:-

- Washing unit
- Drying unit
- Pre-O Ring Machine
- Carousel

- Check scale
- Weight correction unit
- Valve leak detector
- Post-O Ring Machine
- Water Bath
- Sealing Machine
- Purging Machine - Taking pressure to -0.365 kg/cm^2 , in order to aide filling of LPG.

The correct order of things can be seen in Fig 1.2.

1.5.3 Closing Session - Salient Points

Faculty: Shri. Joydev Ojha, DGM(P), Sanand BP

- CVT= Continuous Valve Testing which checks for both valve leak and o ring leak.
- CVT verifier is to check if CVT is working or not
- When a cylinder is beyond repair, the following steps are taken to discard it -
 1. Evacuation
 2. Depressurize
 3. Valve removal
 4. Degassing
 5. Sent for scraping

1.6 Tables

S. No.	SPECIFICATION	VALUE
1	TYPE	VK 10J20
2	SERIAL NUMBER	2639
3	YEAR	1995
4	STANDARD	IS:13118 / IEC-56
5	RATED FREQUENCY	50 Hz
6	RATED VOLTAGE	12 kV
7	RATED CURRENT	630
8	Ins.LEVEL Imp.	75 kVp;P.F.28 kV
9	RATED BREAKING CURRENT	20 kA
10	RATED MAKING CURRENT	50 A (Peak)
11	SUPPLY VOLTAGE CLOSING	110 V DC
12	SUPPLY VOLTAGE TRIPPING	110 V DC
13	RATED SHORT TIME CURRENT	20 kA (3 secs)
14	WEIGHT OF BREAKER	70 kg

Table 1.1: VCB1 technical specifications made in technical collaboration with Toshiba Japan

S. No.	Specification	Value
1	Specification	IS 2028
2	Phase	3
3	Frequency	50Hz
4	Ambient Temperature	45 Degree C
5	Max Temperature Allowed	55 Degree C
6	Primary Winding	433 Volts +2.5%+5% DELTA
7	Secondary Winding	433 Volts STAR
8	Primary Vpeak or Amplitude	266.67 Volts
9	Secondary Vpeak or Amplitude	266.67 Volts
10	Impedance Volts	4.62%
11	Oil	330 l
12	Vector Group Ref.	Dyn11
13	Cooling	ON/AN
14	KVol	200
15	Insulation Class	A
16	Type	DW
17	Weight	1110 kg
18	Serial Number	ABY-1-9

Table 1.2: Data card for the Isolation Transformer for the lighting equipment as mentioned in Fig 1.3

S. No.	Specifications	Value
1	Standard	IS 2026-1977
2	kVA Rating	1000 kVA
3	HV Voltage Rating (No Load)	11000 Volts
4	LV Voltage Rating (No Load)	433 Volts
5	HV Current Rating	52.5 A
6	LV Current Rating	1333 A
7	No. of phases at HV and LV	3
8	Type of Cooling	ONAN
9	Impedance Volts	4.13%
10	Vector Group Reference	Dyn 11
11	Core and Windings Weight	1520 kg
12	Oil Weight	740 kg
13	Total Weight	3260 kg
14	Oil Quantity	770 litres
15	Year of Manufacture	1995
16	Max Temp Rise of Oil and Wdg	55 degrees C
17	Insulation Level	LI 75 AC 28/LI AC-3

Table 1.3: Datacard for the main step down transformer connected to the Electricity Board in Fig 1.3

1.7 Figures

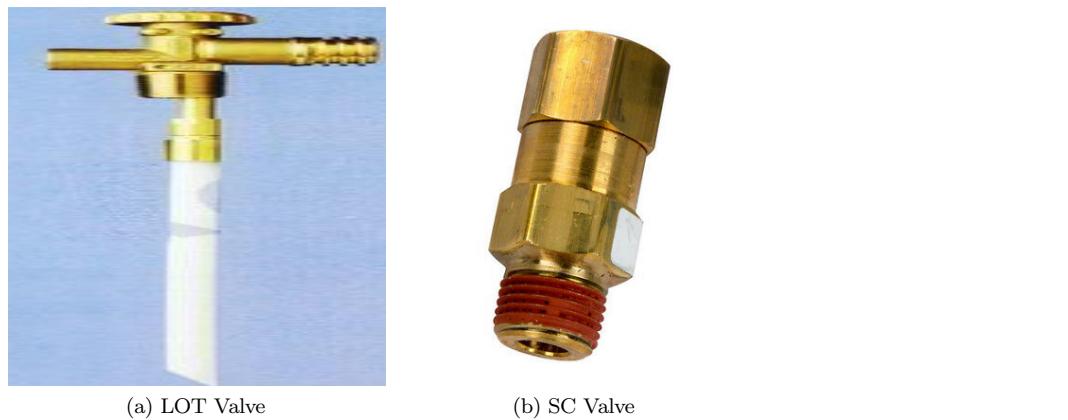


Figure 1.1: Types of valves attached to LPG cylinders

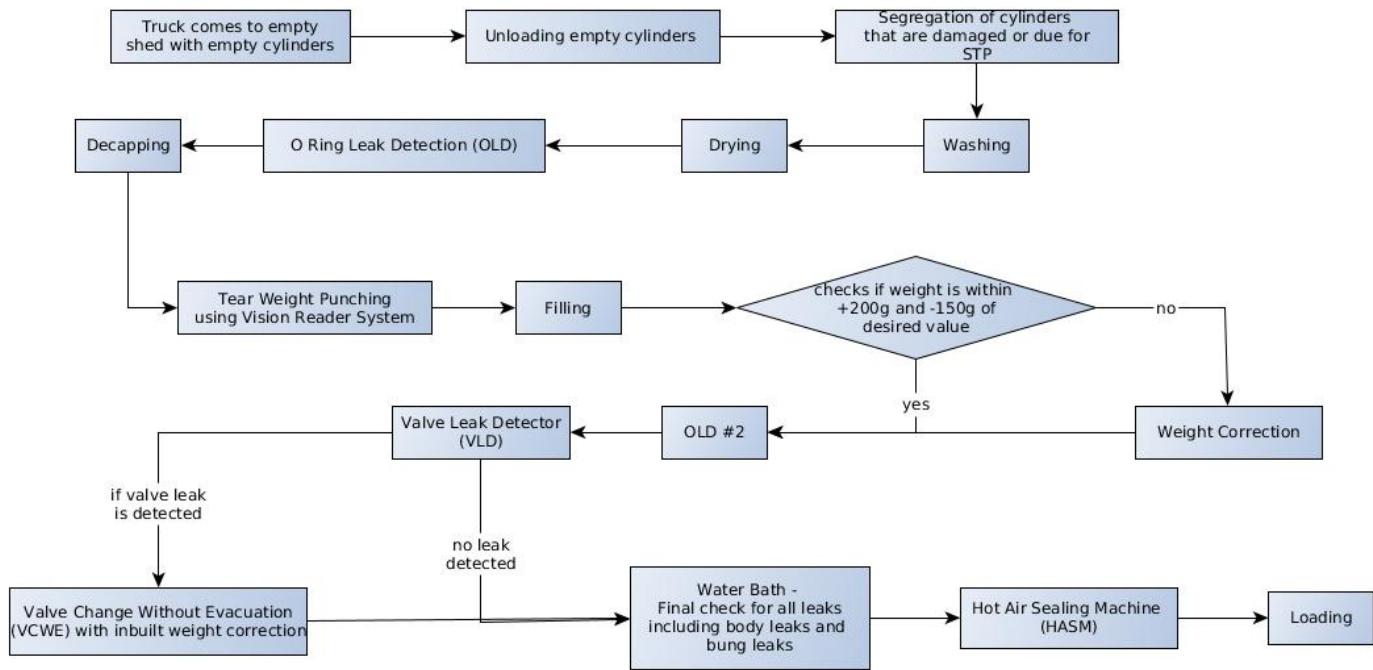


Figure 1.2: LPG filling process flow

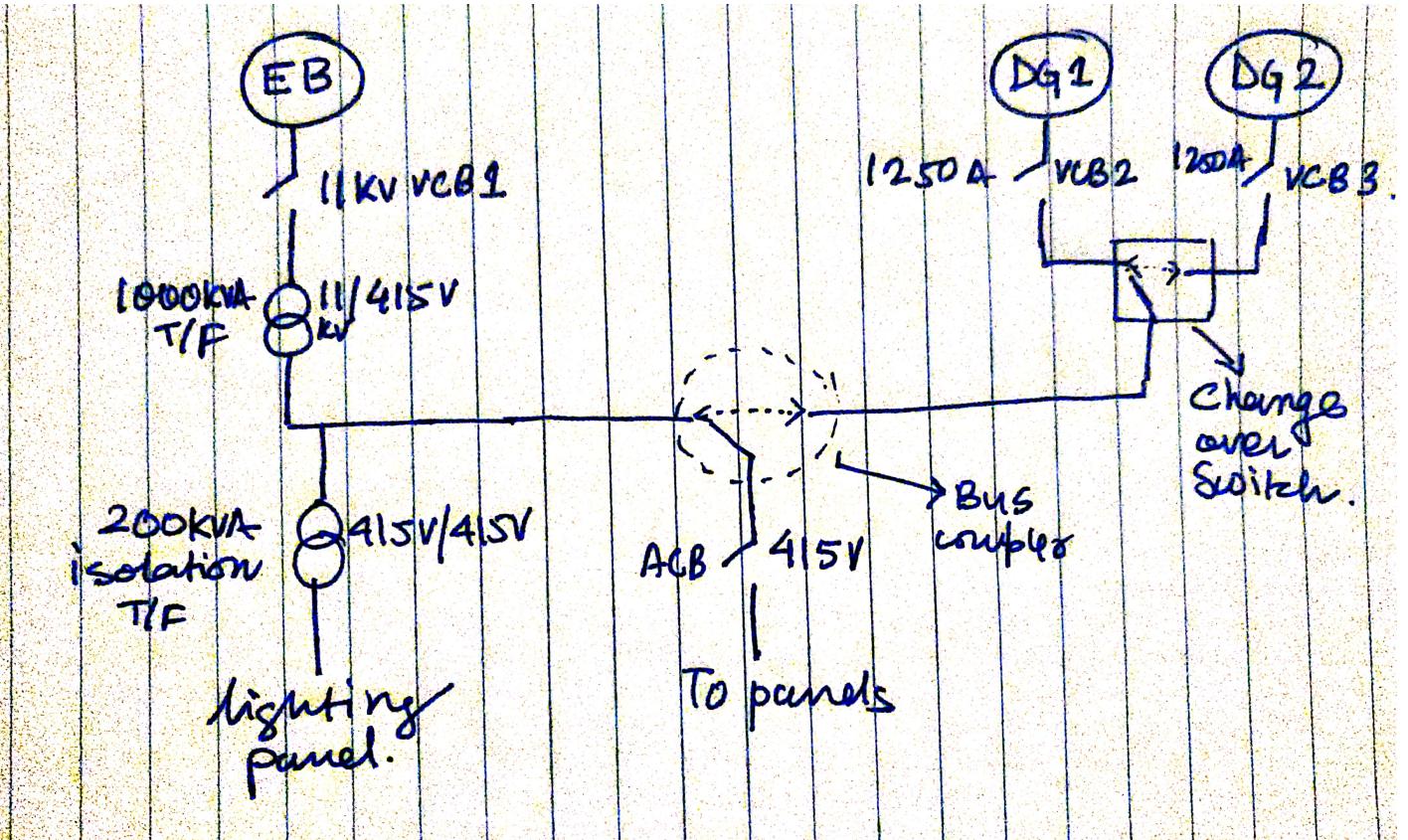
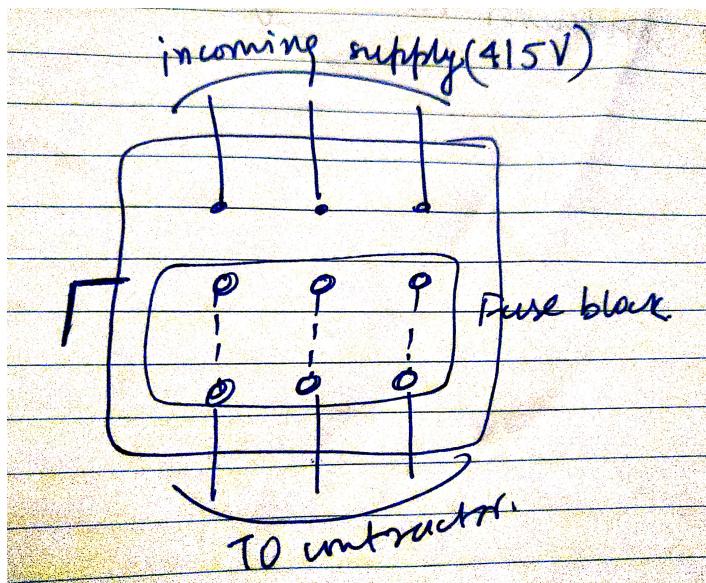
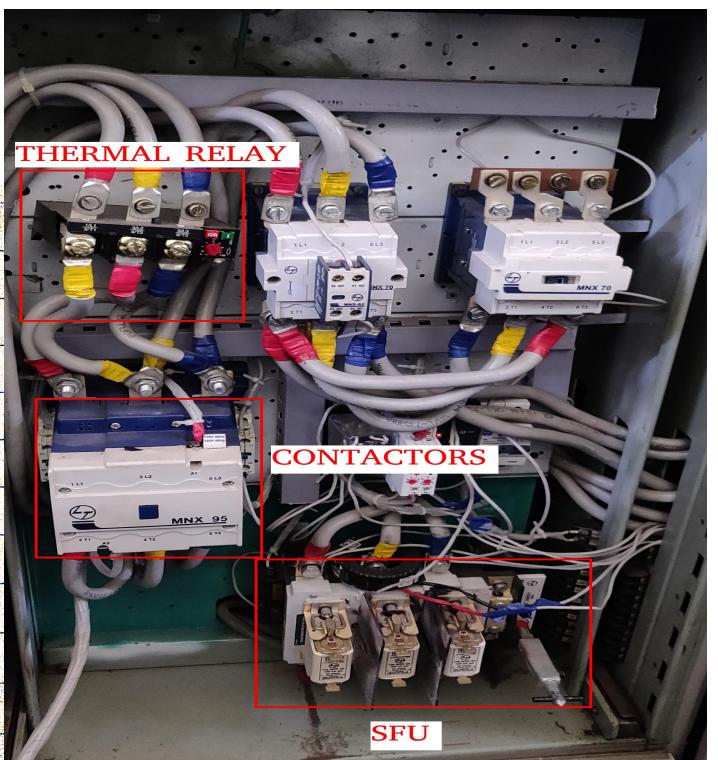


Figure 1.3: Basic single line diagram of a bottling plant electrical distribution system

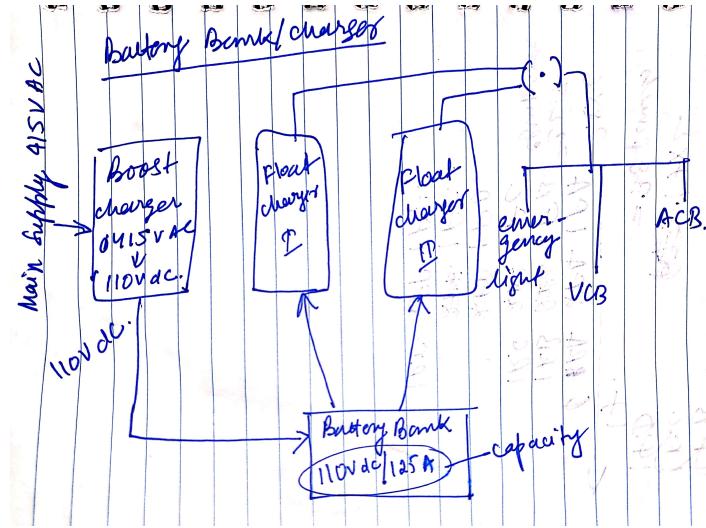


(a) Schematic diagram of a Switch Fuse Unit

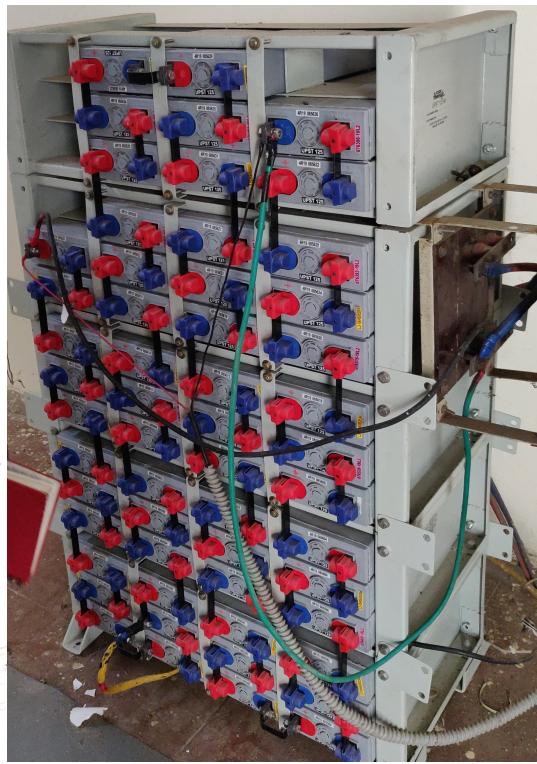


(b) Inside view of a panel showing its safety features

Figure 1.4: Theoretical and real panel equipment protection apparatus

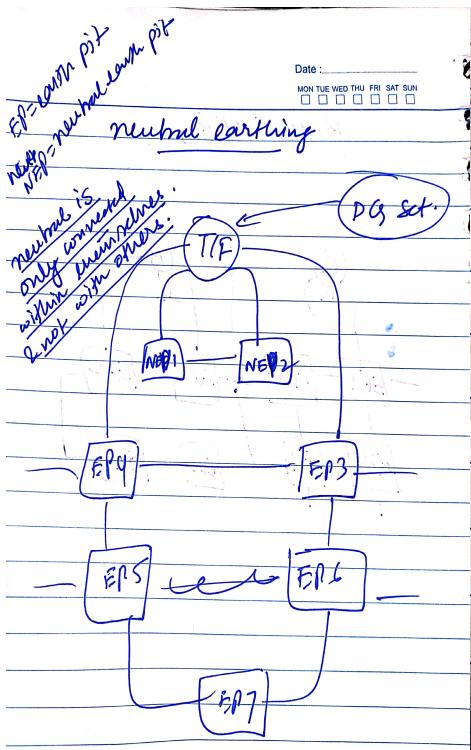


(a) Schematic diagram of the dc power delivery system

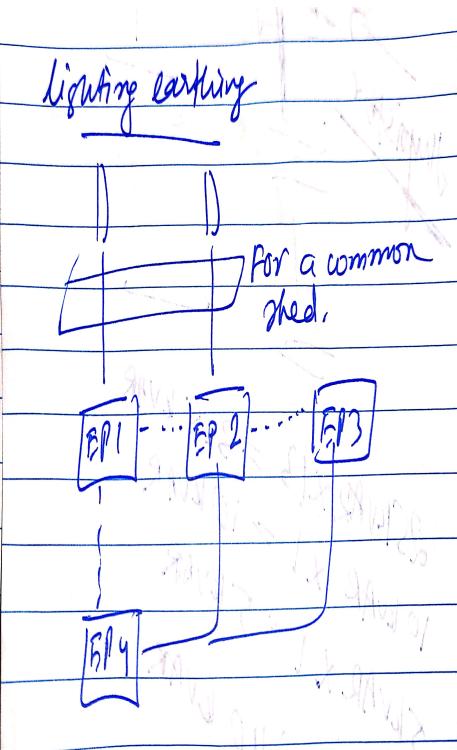


(b) Schematic diagram of the dc power delivery system

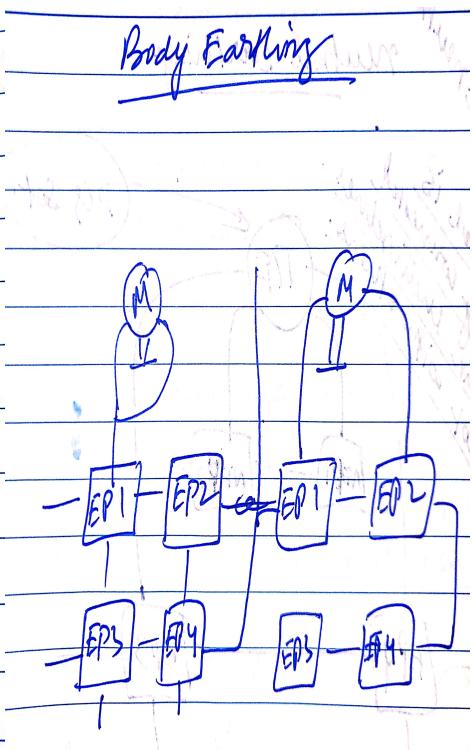
Figure 1.5: DC power delivery system



(a) Neutral Earthing



(b) Lightning Earthing



(c) Body Earthing

Figure 1.6: Different types of earthing schemes

HAZCHEM CODE																																												
1. JETS 2. FOG 3. FOAM 4. DRY AGENT					Notes for Guidance																																							
<table border="1"> <tr> <td>P</td><td>V</td><td>FULL</td><td rowspan="4">DILUTE</td></tr> <tr> <td>R</td><td></td><td>BA</td></tr> <tr> <td>S</td><td>V</td><td>BA for FIRE only</td></tr> <tr> <td>S</td><td></td><td>BA for FIRE only</td></tr> <tr> <td>T</td><td>V</td><td>FULL</td><td rowspan="4">CONTAIN</td></tr> <tr> <td>T</td><td></td><td>BA</td></tr> <tr> <td>W</td><td>V</td><td>BA</td></tr> <tr> <td>X</td><td></td><td>BA for FIRE only</td></tr> <tr> <td>Y</td><td>V</td><td>BA</td><td rowspan="3"></td></tr> <tr> <td>Y</td><td></td><td>BA for FIRE only</td></tr> <tr> <td>Z</td><td>V</td><td>BA</td></tr> <tr> <td>Z</td><td></td><td>BA for FIRE only</td><td></td></tr> </table>					P	V	FULL	DILUTE	R		BA	S	V	BA for FIRE only	S		BA for FIRE only	T	V	FULL	CONTAIN	T		BA	W	V	BA	X		BA for FIRE only	Y	V	BA		Y		BA for FIRE only	Z	V	BA	Z		BA for FIRE only	
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E CONSIDER EVACUATION					FOG : In the absence of fog equipment a fire spray may be used. DRY AGENT : Water must not be allowed to come into contact with the substances at risk. V : Can be violently or even explosively reactive FULL : Full body protective clothing with BA. BA : Breathing apparatus plus protective gloves. DILUTE : May be washed to drain with large quantities of water CONTAIN : Prevent by any means available, the spillage from entering drains or water course.																																							

Figure 1.7: Hazchem decoded (BA=Breathing Apparatus)

Chapter 2

Bareja Terminal

2.1 Important Terms and Abbreviations

- ROSOV= Remotely Operated Shut Off Valve
- DBBV= Double Block and Bleed Valve
- COCO= Company Owned and Company Operated
- PD Meter= Positive Displacement Meter
- DCV= Digital Control Valve
- BCU= Batch Control Unit
- MS= Motor Spirit (Petrol)
- HSD= High Speed Diesel
- SKO= Superior Kerosene Oil
- ATF= Aviation Turbine Fuel
- MDG= Marketing Discipline Guidelines
- TLF= Tank Lorry Filling
- DCP= Dry Chemical Powder
- PPE= Personal Protection Equipment

2.2 Operations

Operations at Bareja Terminal consists of the following things:-

- Receipt
- Storage
- Dispatch
- Quality

Each of these are described in further detail below.

2.2.1 Receipt

Bareja terminal receives product via 2 pipelines:-

- KSPL (Koyali- Sanganer Pipe Line) = Multiproduct pipeline tapped at Ahmedabad
- KAPL (Koyali- Ahmedabad Pipe Line) = Dedicated ATF pipeline which supplies the whole of Gujarat and parts of Rajasthan. Then interface cutting (See Fig 2.1)is done by the pipelines division at the exchange pit and supplied to the terminal via pipelines.

2.2.2 Storage

- Tank farm at bareja terminal can be represented by Fig 2.2.
- The storage capacities of the aforementioned tanks can be realized by Table 2.1.
- Tanks are classified in 3 ways -
 - Underground and Aboveground tanks
 - Floating roof tanks and cone roof tanks
 - Horizontal and Vertical tanks
- Floating roof tanks are used to store class A products such as MS, which are very volatile thereby prone to vapor loss. The floating roof of the tank floats just over the product thereby not giving any space for vapor to form.
- A floating roof tank has the following attachments to its roof with their specific purpose -
 - Articulated Vent - to remove water stored on roof by rain or foam pouring drills etc.
 - Primary seal - Metal (aluminum) clamps sealing the product in.
 - Secondary seal - Secondary line of defense from product leakage and provides weather protection to the primary seal.
 - Stands - So the floating roof doesn't touch the bottom of the tank when tank is emptied for cleaning or maintenance purposes (6ft length).
 - Auto-bleeder valve - Leg length a bit longer than the stand and open cap on other side. This opens the valve when the floating roof lowers beyond a point thereby stopping vacuum locking.
 - For safety there are foam pourers and foam dams to direct foam towards the secondary seal which is most prone to product leakage and fire.

- There are automatically triggered (by the rate of increase of temperature) foam pourers which pour foam directly over the primary seal in case of an emergency.
- The bottom of any tank has a central sump to collect any water that has infiltrated the system and a water draw off line to drain that water.
- The sand pad that forms the base of the tank should - have no cracks, have no vegetation since roots crack the base even further.
- A tank can be either of the 3 modes - Receipt, Dispatch and Dormant. (See Fig 2.3)
- There are alarms for overfilling and underfilling of tanks, the details about which can be easily understood from Fig 2.4.
- There are various valves attached to the inlet and the outlet of the tanks which can be seen in Fig 2.5. It is important to note here that the ROSOV can only be shutoff remotely but has to be turned on manually whereas the DBBV can be shutoff and turned on remotely and in case of loss of power, the ROSOV closes automatically. This is done, so that when someone manually opens the ROSOV, then that person can check the surroundings for any hazards before doing so.

2.2.3 Dispatch

- There are 2 types of customers - Retail Outlets, Bulk Consumers
- It is to be noted that product given to COCO ROs and AFS are treated as stock transfer rather than sale.
- Dispatch is done via tank trucks which can be - dealer owned, transporter owned and consortium owned.
- The demand sensing or indenting is done via sms or web indenting.
- ATF has dedicated tankers which is coated internally with epicoating to prevent chemical reaction with the tanker metal thereby contaminating it.
- The following is the priority list of the customers while dispatching loads to it -
 1. Consumer sales
 2. Priority dealers
 3. COCO
 4. Non Priority dealers
- The complete flow of the TT coming in empty and leaving the automated terminal can be seen in Fig 2.8.
- The filling of the TT can be further magnified to a process flow as seen in Fig 2.7.
- The instruments used to automatically fill the TTs along with their order of operation is shown in Fig 2.6. The PD meter (sensor) supplies information to the BCU which then sends the open or close signal to the DCV (actuator). The DCV can either be open or close, anything in between is achieved by repeatedly turning the valve ON and OFF.

2.2.4 Quality

The various stages at which quality checks are done can be seen in Fig 2.9.

Batch formation test for MS,HSD,SKO :-

- Settling time of one hour
- Sample from Top, Bottom and Middle (TMB sampling)
- 9 different tests are performed
- Density, Distillation, Sulphur, Copper, ROE, Appearance, Color, RON
- Tests are carried Monthly, weekly and MDG
- Test reports are issued to Control Room

Batch formation test for ATF :- (Quality control is significantly more important in this case because of the huge risk of human lives)

- Settling time of two hours
- Sample from Upper, Lower and Middle
- 21 different tests are performed
- Tests are carried Monthly, weekly and MDG
- Test reports are issued to Control Room
- Every TT carries the test report

Checks done during TLF:-

- Density Checks (done by online density meter and by the TT crew in presence of officer)
- Dip Check (done by the TT crew for their own satisfaction)
- Water Check (only for ATF)
- Sediment Check (only for ATF)

Important quality points for different products :-

- MS,HSD : Density MS(720-775 kg/m³) HSD(815-845 kg/m³)
- SKO : Flashpoint (35°C)
- ATF : Water and sediment present only in tolerable limits

2.3 Safety and Maintenance

2.3.1 Cone Roof Tanks

- Annular plate extension
- Air vent
- Water marks on roof
- Earthing strip
- Sprinkler Systems
- Stair case and handrail
- Water Drains
- Sand pad foundation
- Tank cleaning

2.3.2 Floating Roof Tanks

- Pontoons
- Articulated drains
- PV valves
- Auto Bleeder vents
- Sprinkler system
- Primary and secondary seal
- Foam Dam
- Sand Pad Foundation
- Tank cleaning

2.3.3 Pipeline Maintenance

- There are 2 types of pipelines - Hydrant and Product lines
- Solid rod between pipe and foundation
- Guiding rods
- Wrapping coating in underground pipeline
- Inspection of pipeline foundation
- No Vegetation
- Pressure testing
- Clamps for leakage
- Cathodic Protection
- Route Lines

2.3.4 Pumps Maintenance

- Strainer Cleaning
- Vibration Check
- Temperature Checks
- Rubber mat
- Flame Protection
- Coupling guard
- Pump house manifold
- Body Earthing

2.3.5 Electrical Maintenance

- Electrical Audit by CEA every 3 years
- Periodic change of transformer oil
- Periodic replacement of silica gel in transformers

2.3.6 Safety Equipments

- DCP Fire Extinguishers
- Medium Expansion Foam Generator (MEFG)
- High Velocity Long Range Monitor (HVLRM)
- Hydrocarbon Detectors
- Dyke valve indicator
- Level Alarms (HHH, HH, H, L, LL, LLL)

2.3.7 Safety of TT

- Hazardous Chemical handling certification
- Green Card
- Battery cut-off
- Master valve
- Emergency valve
- Safety lock
- Spark Arrestors
- Space between tanker and driver cabin
- Tank size less than drivers cabin
- Lead fire safety link
- Earthing
- Air vent

2.3.8 Additional Safety Measures

- Water Sprinkler System
- Emergency Alarms
- Fire Water Pump House
- Flame Proof Equipments
- Earthing
- Frisking
- Sand Buckets
- Follow SOP
- PPEs

2.4 Tables

Storage Tank	Quantity	Level Filled (kL)	Tank Diameter (m)
MS	3	8300	24
HSD	4	11000	32
ATF	2	6300	28
SKO	2	3300	18
Ethanol	2	70	
Water	3	2600/5200	

Table 2.1: Tank Capacities & Storing Limit

2.5 Figures

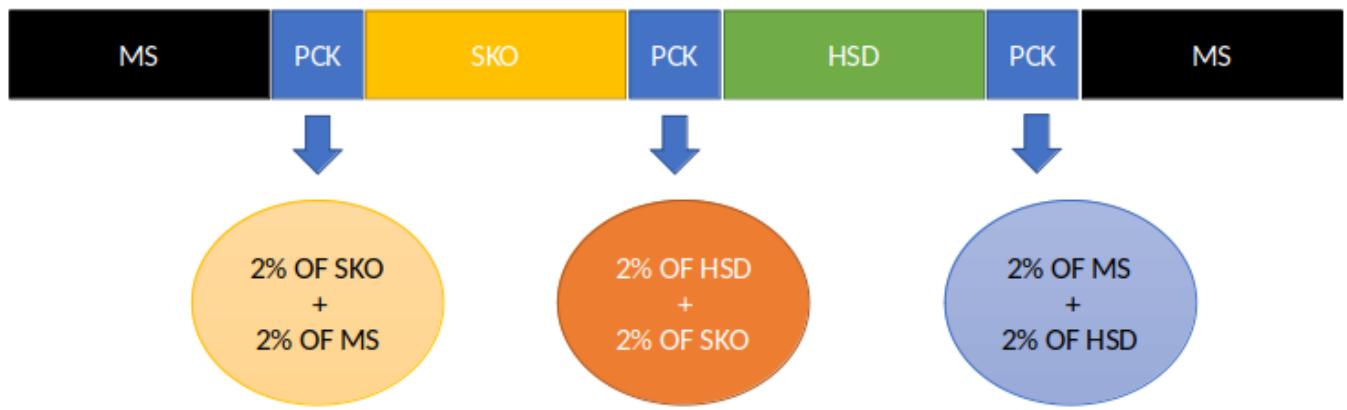


Figure 2.1: Interface cutting norms

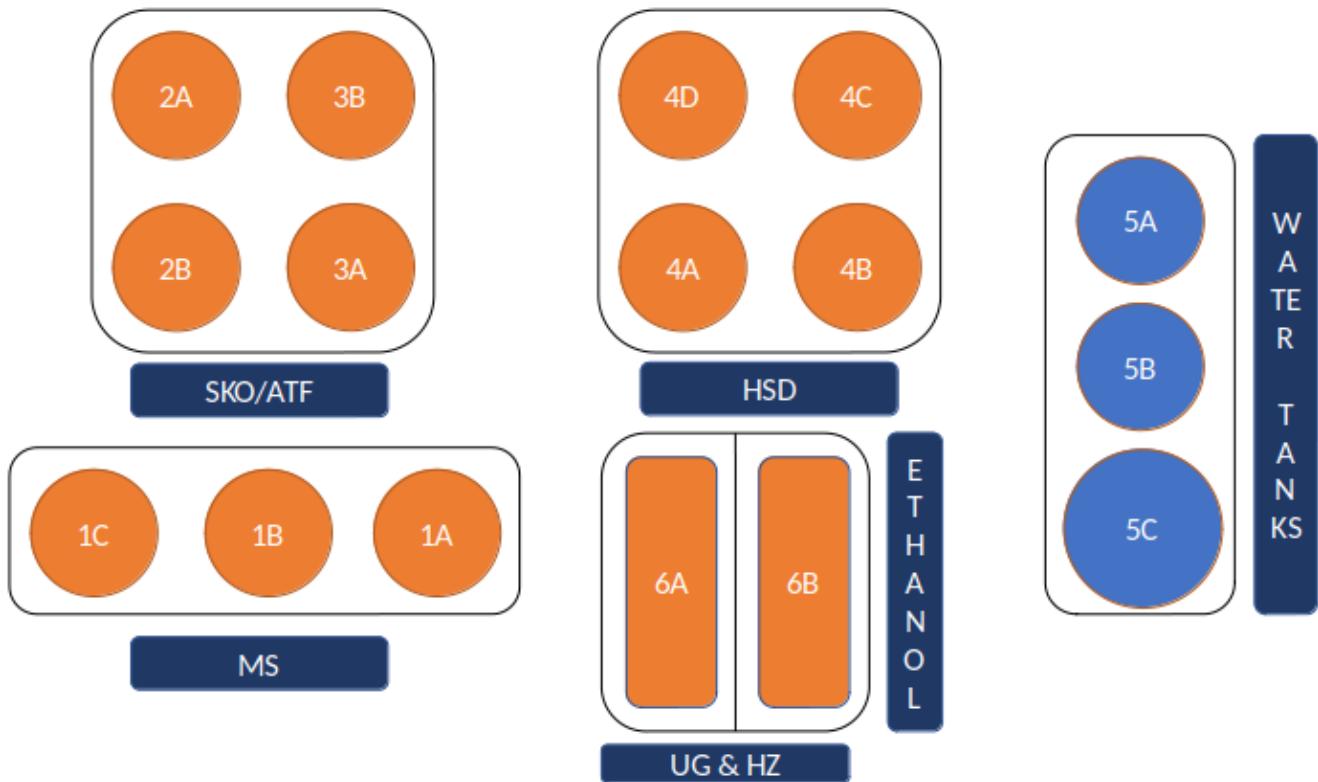
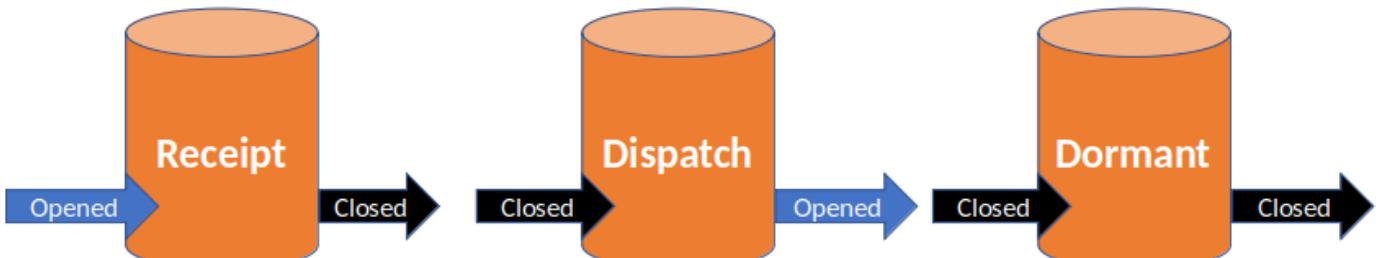


Figure 2.2: Pictorial representation of the storage tanks present at the Bareja terminal



- Product is being received either from Pipeline or other Tanks.
- No Dispatch occurs during this period.
- Product is dispatched to TLF or other Tanks.
- No receiving Operation occurs during this period.
- Tank is Ideal. No dispatch or receiving is done.
- Due to maintenance or other reasons.

Figure 2.3: Modes of operation of tanks

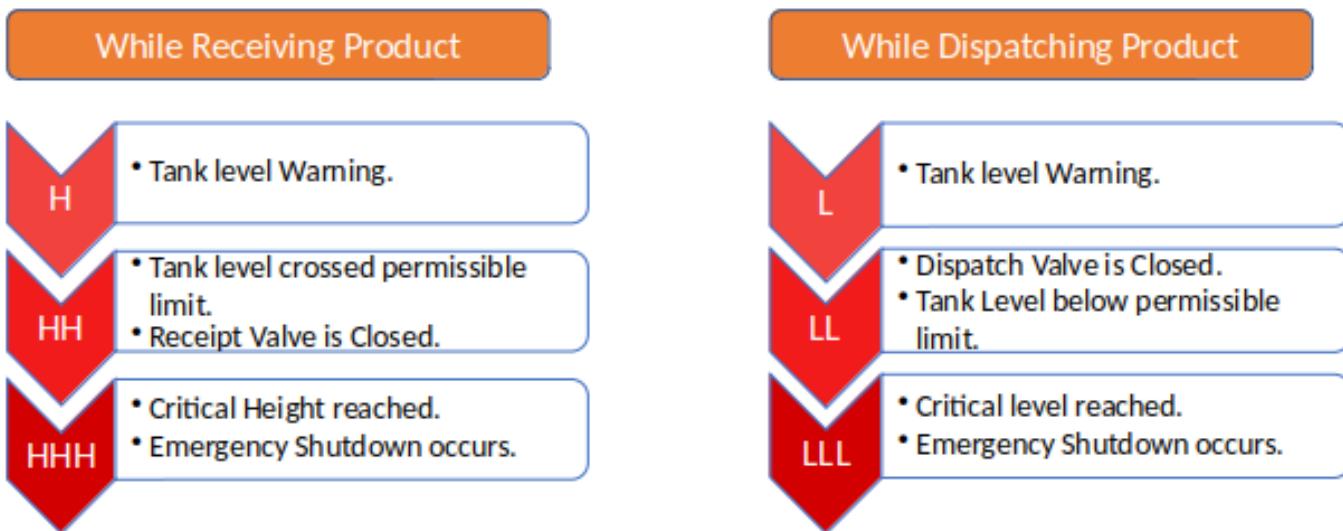


Figure 2.4: Alarms to prevent over filling or over emptying a tank

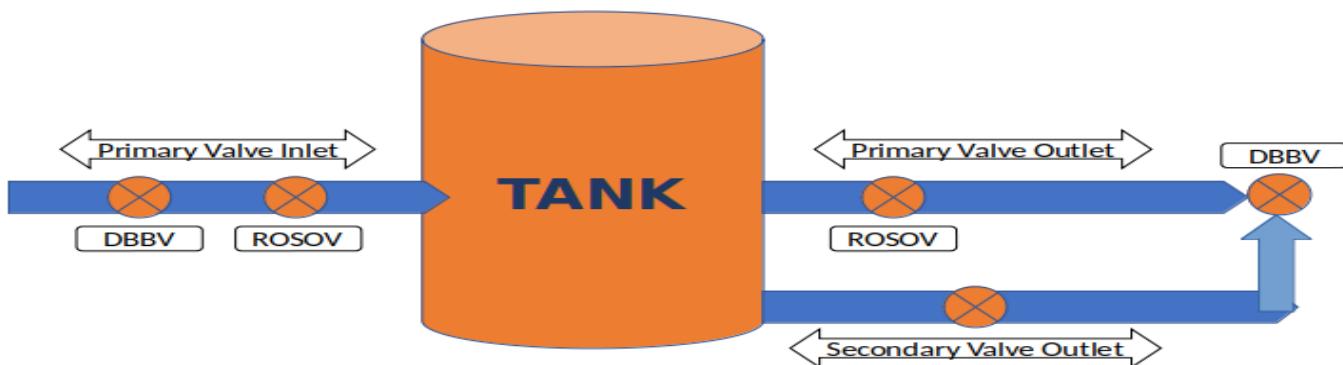


Figure 2.5: Valves attached to a tank

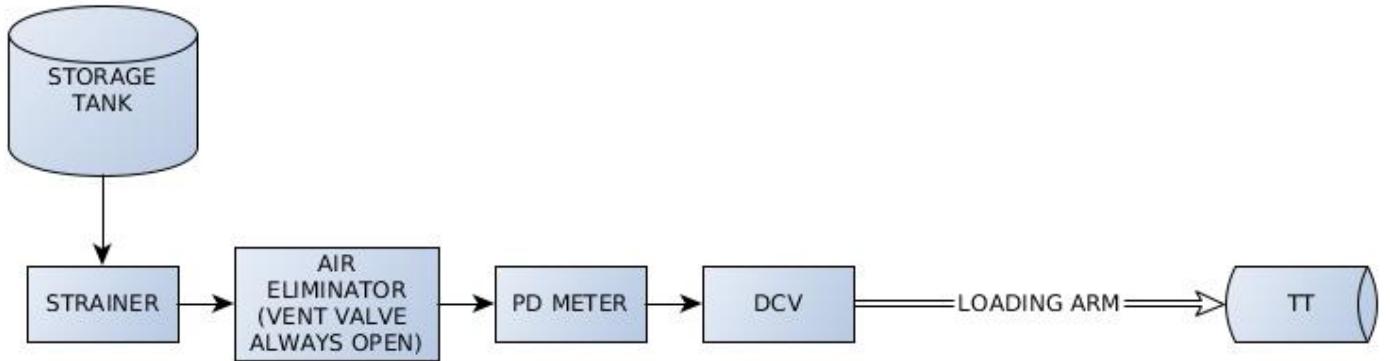


Figure 2.6: Equipments and process flow enabling the completely automatic filling of TTs

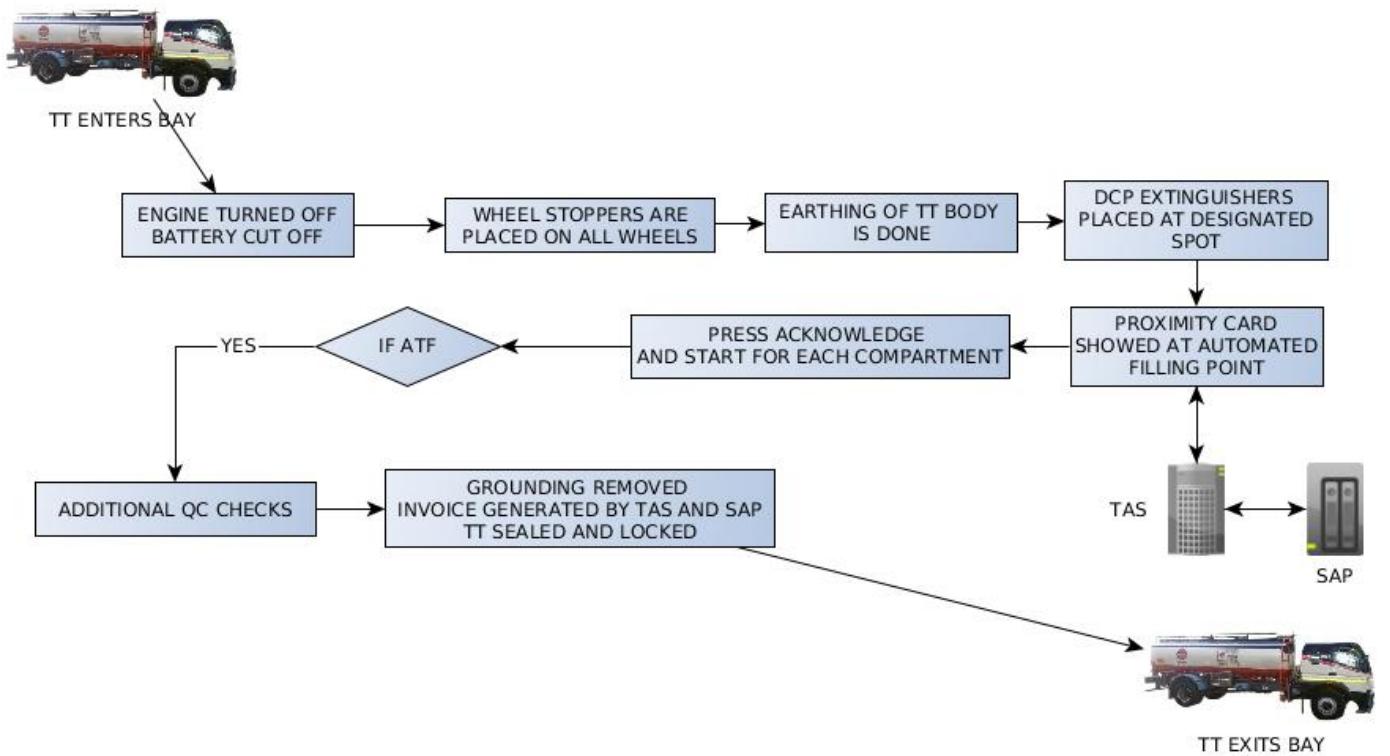


Figure 2.7: The TLF process flow (magnified to the filling part)

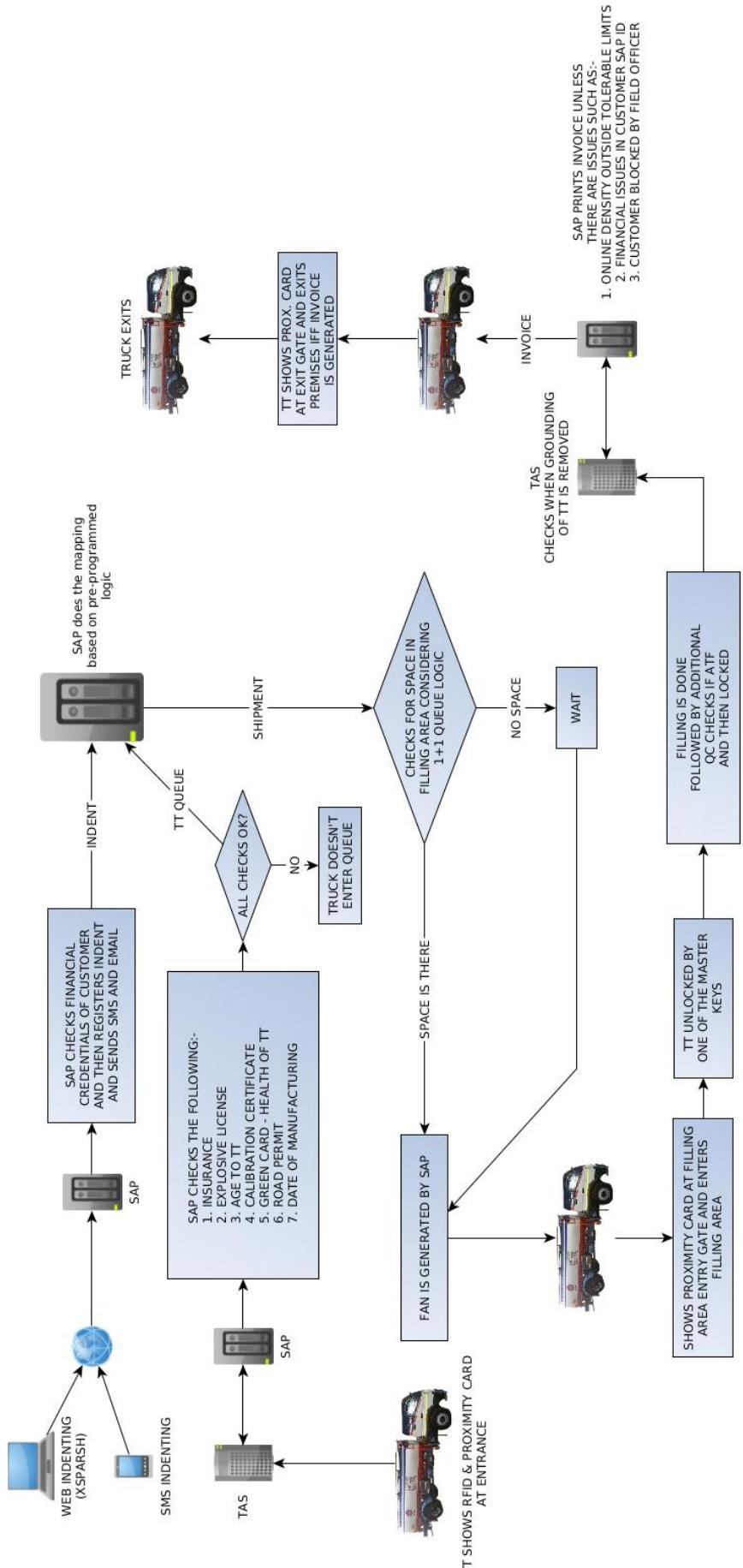


Figure 2.8: The complete TLF process flow

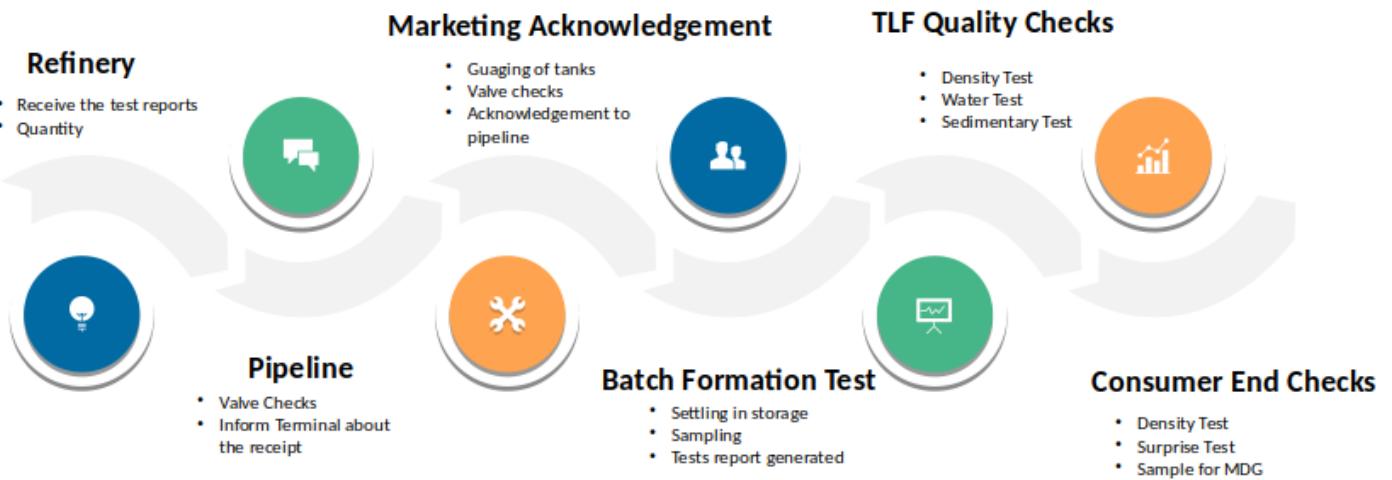


Figure 2.9: Quality flow at Bareja terminal

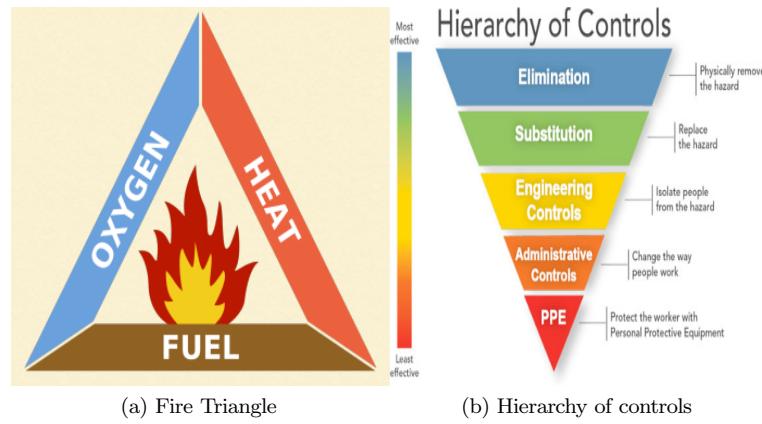


Figure 2.10: Major safety concepts

Chapter 3

LPG Distributorship

3.1 Important Terms and Abbreviations

- POI= Proof of Identity
- POA= Proof of Address
- RSP= Retail Selling Price
- PDC= Pre Delivery Check

3.2 Salient Points about the LPG Distribution Operation

- Distributors are expected to be “sellers”
- Distributor has a office (showroom) and a godown
- Flame lighters are much better than spark lighters since they provide a continuous flame and do not allow for any gas leakage before ignition. However they have couple of disadvantages as are listed below:-
 - They have to be refueled
 - Fuel level is not visible so it can stop working anytime
 - Not an easily marketable product since it has cheap replacements such as a matchstick or a simple lighter
 - Can be easily replaced by filament based electrical lighter which could be charged by the customer as his/her ease.
 - Flame lighters are not very durable due to their complicated mechanism of working.
- The following documents are required by any distributor in order to run their operation -
 - Fire license
 - Trade license
 - Retail selling license (for certain states)
 - Shop and establishment license
- The following documents are required from the customer in order to get a new connection :-
 - POI
 - POA
 - KYC Form
 - Aadhar Card (if subsidy is required)
- If there are 3 stay plates, its a PSU cylinder and if there are 4 stay plates, its a private OMC cylinder
- Cylinder classification based on Shroud colour - BPC is Yellow, HPC is Blue and IOCL has no separate colour
- Documents generated at a distributorship:-
 - SV= Subscription Voucher - acknowledgment for deposit of voucher
 - TV= Termination Voucher - deposit comes back
 - TTV= Transfer Termination Voucher - deposit doesn't come back
 - TSV= Transfer Subscription Voucher - deposit is not required
- A distributor should have 1 platform weighing scale at godown and all the delivery boys should have one portable weighing scale.
- The capacity of a distributor's godown is the amount of gas he is allowed to keep. For eg. 8000 kg means $8000\text{kg}/14.2\text{kg}=564$ filled cylinders to be kept.
- RSP is the only price that can be charged for a cylinder. Only, the district distributor can give permit to collect charges over and above RSP.
- Grievance Redressal phone number for all three OMCs : 1800 2333 555 (not for leakage)
- According to the Unified Selection Guidelines, there are 4 types of LPG distributorships - Sahari Vikratis, Rurban Vikratis, Gramin Vikratis and Durgam Shetriya Vikratis
- Percentage of location allocation between the three OMCs - 50% for IOCL , 25% for BPCL, 25% for HPCL.
- The customer ID remains same when a customer shifts from one OMC to another OMC under the portability scheme, only the customer number changes.
- During delivery of the cylinders to the warehouse, 10% of the cylinders should be checked for underweight (max -100 g) and overweight (max +200 g).
- During delivery of the cylinders to the customer's premises, all the cylinders should go through PDC which includes- weight check, o ring leak check, valve leak check.
- The distributorship software is being shifted from Insoft to SDMS on a selective rollout basis.

- The number to call to book a cylinder - (96)24365365 where the 96 part changes according to the state, but the rest remains same - 24 hours a day for 365 days therefore 24 365 365.
- The cash and carry rebate is Rs. 24.05 currently.
- The pricing details of the various aspects of domestic LPG distribution is given in Table 3.1. In Ujjawala scheme, the govt pays for the deposit - cylinder and pressure regulator which is not recovered. However, the first free Gas Refill and Stove cost is paid by the OMC and recovered by absorbing subsidies. The hose and DGCC is paid for by OMC and not recovered. So initially, the ujjawala customer only has to pay the franking cost and later couple of subsidies are absorbed.

3.3 Tables

S. No.	Item	Price in Rs. (inclusive of GST)
1	Cylinder Deposit	1450
2	Pressure Regulator Deposit	150
3	DGCC Book	59
4	Installation and Administration	118
5	Admin Charges	88.5
6	Suraksha Hose 1.5m (normal)	190
7	Suraksha Hose 1.2m (Ujjawala)	170
		1 burner = 100 + GST
8	Stove inspection charges if stove is not bought	then for each burner 50 is added.
9	Franking Cost on SV	300
10	Ujjawala Stove (2 burner)	990

Table 3.1: Various pricing elements in domestic LPG distribution

Chapter 4

Gujarat Refinery

4.1 Important Terms and Abbreviations

- AU= Atmospheric Unit
- LGO= Light Gas Oil
- HGO= Heavy Has Oil
- DHDT= Diesel HyDro Treater
- SRU= Sulphur Recovery Unit

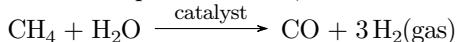
4.2 Salient points about Gujarat Refinery

- Total capacity = 13.7 MMTPA (the amount of crude it can process)
- All India IOCL capacity = 80.70 MMTPA but will be increased 100+ MMTPA (in 5 years)
- Land size = 1000 acre
- 80% crude is imported by IB Department
- Crude comes only in pipeline due to financial reasons
- Earlier kerosene was the main product but with the introduction of electrical lighting and internal combustion engines, the main product shifted to MS,HSD. Then began the slow declination of sulphur. All this means the refinery operation is highly dynamic
- Feedback from marketing department helps in refinery product optimization.
- The three things required for successful refinery operation - Equipment, Energy, Employee
- The refinery has a captive power plant of 120 MW
- Maximum capacity of tankage present in refinery is 5000 kL
- A desalter is a device which removes salt by density difference via electrostatic precipitator.

The refinery process flow is summarized in Fig 4.1.

4.3 Sulphur removal from fuel

To remove sulphur from fuel, we need to react the fuel with hydrogen. This hydrogen we get from the chemical reaction -



This reaction occurs in the reformer unit. The CH₄ here cannot have any higher hydrocarbon or it would poison the catalyst. Therefore, to remove any higher hydrocarbon we need a pre-reformer unit.

The pre-reformer unit removes all higher hydrocarbons from the CH₄ feed, however, if there is sulphur in the feed, it will poison the catalyst. Therefore, to remove sulphur from the feed we need a desulphurisation which required much less hydrogen.

The process flow of the sulphur removal process can be seen in Fig 4.2.

4.4 Figures

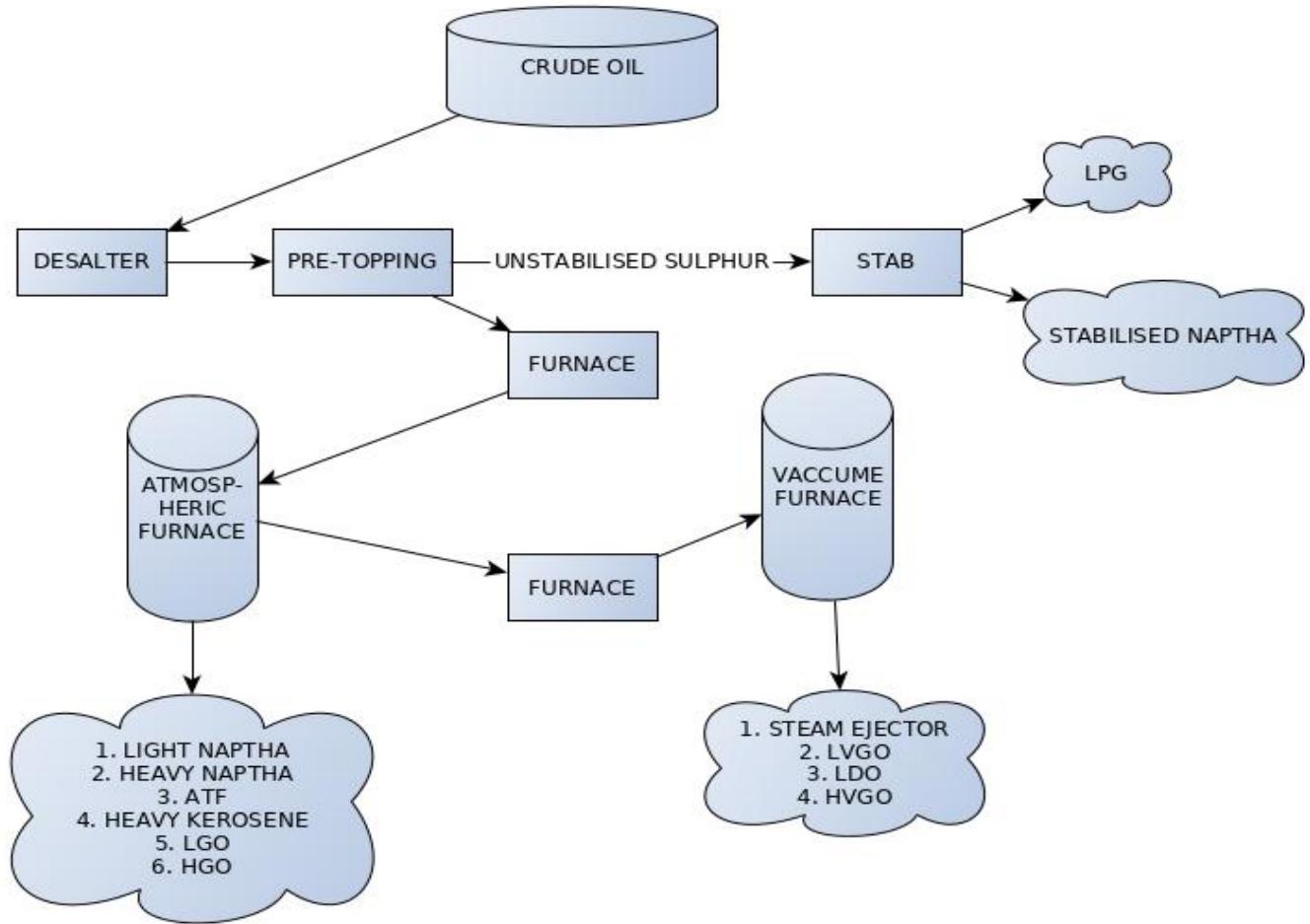


Figure 4.1: Brief process flow of refinery operations

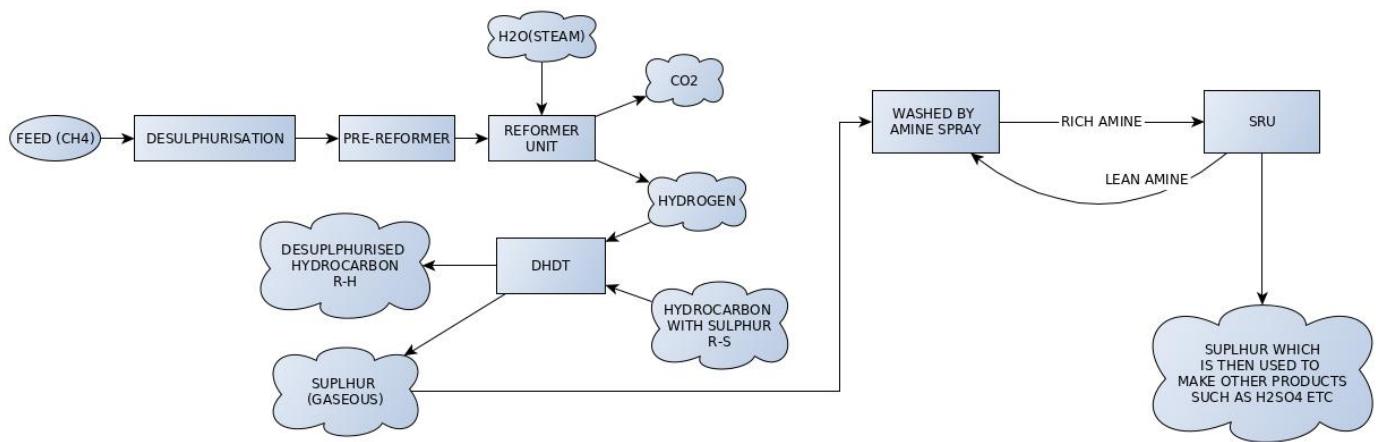


Figure 4.2: Process flow of the fuel desulphurisation operation in refinery

Chapter 5

Pipelines Session by Mr. Sanjiv Kumar Samal

5.1 Salient Points from the session

- For the pipelines division, the revenue is ‘notional’ since their only customers are the refineries and marketing division.
- For any pipeline to be built, it has to be approved by PNGRB = Petroleum and Natural Gas Regulatory Body.
- Yearly target of 86.585 MMT - 48.175 MMT Crude and 38.140 MMT of Product throughput.
- Total 14292km of pipelines - 8830 product, 5301 Crude and 161 Gas. It is important to note however, that length doesn’t always equate capacity, diameter of the pipeline also comes into play.
- IOCL has recently entered City Gas Distribution (CGD) in the 9th bid.
- Oldest pipeline of IOCL is GSPL (Guwahati Siliguri Pipeline)
- Benefits of Pipelines:-
 - Cheap
 - Energy Efficient
 - NIL carbon emission
 - Large delivery in short time
 - No disruption due to transporter strikes etc.
 - Reducing load on other modes of transportation
 - Lower transmission losses
 - Environment friendly
- For more information on how fuel is received into refineries from sea tankers see Fig 5.1.

5.2 Supply & Distribution

- There are 3 plans of supply and distribution - Annual Plan (Crude Oil Procurement & Tanker Planning), Quarterly Plan (Reassessment of annual plan) and Monthly Plan (Detailed planning on distribution needs)
- Pipelines have 2 lines - Main line and loop line (parallel to main line to increase throughput and provide product during mainline maintenance)
- Booster stations are there to maintain pressure so that product can be transported for a long time without mixing of products.
- Consider 100kL of interface between SKO and MS; 1% tolerance of SKO in MS. Calculate the minimum batch length.
Consider 50% division in 100kL interface means 50kL SKO and 50kL MS

Let minimum batch length be ‘x’

1% of x is 0.01x which is equal to 50kL

$$0.01x = 50kL$$

$$x = 5000kL$$

Therefore, the minimum batch length is 5000 kL

For any tap off before terminal station, fuel is added in excess of this minimum batch amount

- For pipeline construction process flow see Fig 5.2.

5.3 Figures



Figure 5.1: Receiving crude oil from sea tankers

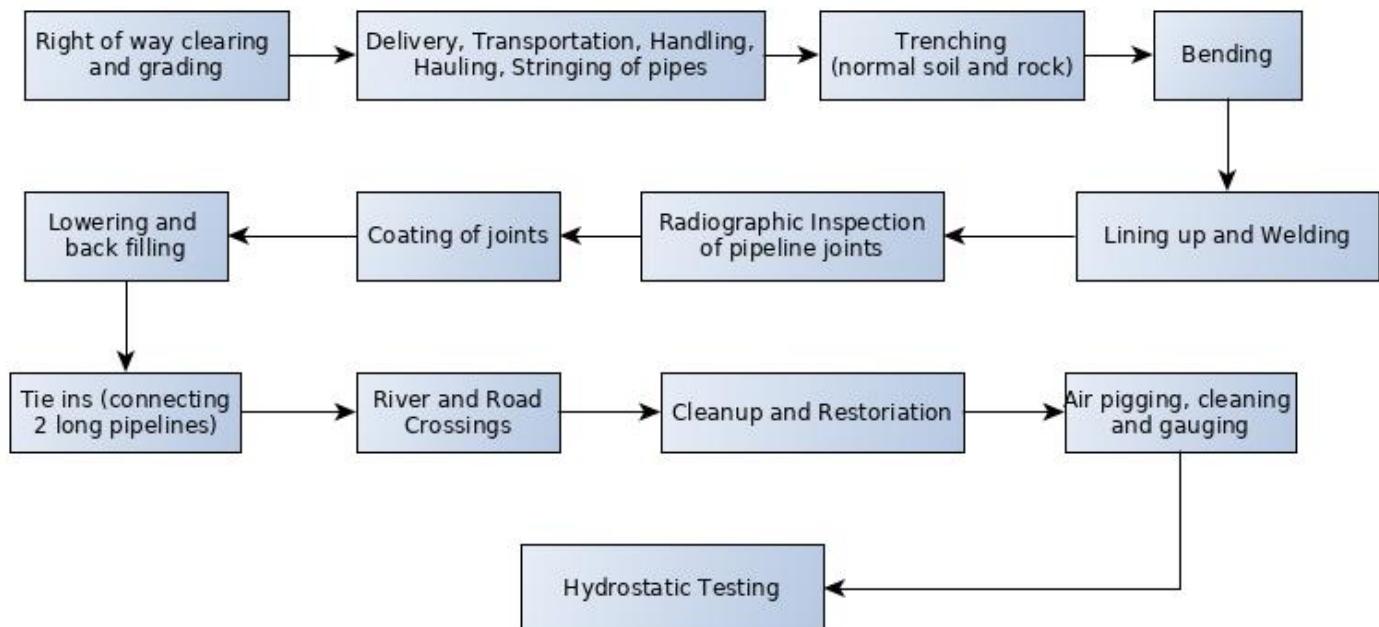


Figure 5.2: Pipeline construction process flow

Chapter 6

FAQs

1. What is the standard pressure in a LPG T/T?
2. What is the minimum pressure in a LPG cylinder?
3. What factors go into the calculation of production requirement of a bottling plant?
4. Why are LOT cylinders required?
5. What is the additive added to LPG in Nanocut cylinder and what parameter of the LPG does it change?
6. What is MSDS of a product?
7. What principle is used in LPG TT decantation ?
8. Being an odourless product, why does LPG have a particular odour ?
9. What is UEL and LEL for LPG?
10. What is BLEVE ?
11. What is UVCE? - Unconfined Vapour Cloud Explosion
12. Why is EFCV placed inside and outside the body of the TT now-a-days?
13. What is the function of SC valve?
14. What are three methods of fire control?
15. What is the OISD standard code for LPG? - OISD 144
16. What is the emergency LPG leakage contact number?
17. What is STP?
18. What is the Door Drishti Programme? - automated software which gives OLD (o ring detector) and VLD (valve ring detector) details
19. What is the purpose of unlicensed and licensed areas in plants/terminals?
20. What are the documents required by the tank trucks?
21. What are the documents required by the LPG cylinder distribution trucks?
22. Which kind of flooring is required in shed and godown?
23. What pressure is maintained in the hydrant lines?
24. Why don't bullets face any other facilities?
25. What is the function of Roto-gauge?
26. What is the purpose of sprinkler systems on LPG storage tanks?
27. What percentage of space should be present in LPG storage vessel/TT?
28. Why are cylinder deshaped before scrapping?
29. Which body formulates the norms for STP?
30. Why is soap solution used for lubrication of chains in conveyer belts in LPG BP?
31. What is GMS?
32. What is SCABA? - Self Contained Air Breathing Apparatus
33. What is LOTO and why is it required?
34. What is the hazchem code for LPG? - 2WE
35. What is breakaway coupling?
36. What is the purpose of jockey pumps?
37. What is the requirement of LL and LLL alarm?
38. What are basic operation of Terminal?
39. What is bridging?
40. Why is floating roof tank used in MS?
41. What is stock loss and stock gain? - volume change of LPG due to temp change
42. What is ROSOV and DBBV?
43. What are the 4 modes of operation of a storage tank? - receipt, dispatch, dormant, under maintainance
44. What is the purpose of secondary outlet in storage tanks of MS/HSD?
45. What is single contingency and double contingency?
46. Why to blend ethanol?
47. What are the sources of ethanol?
48. What additive is added to ethanol to make it toxic and thereby rendering it unfit for consumption? - Crotonaldehyde
49. What is the purpose of secondary seal? - 2nd line of defence and weatherproofing primary seal
50. What are pontoons and why are they required?

51. What is the difference in operating parameters of ACB and VCB?
52. At what oil and winding temperature does the overheat sensor set off an alarm and trip?
53. What is the ideal colour of silica gel used in transformers? - blue colour
54. What is principle of automatic triggering of foam pouring system onto primary seal?
55. Which thermometer is required for density testing ? - IP64C
56. What are the ways to place indent?
57. What is the difference between TMB and UML sampling?
58. What is the difference between PCK and SKO? - PCK has less sulphur content and can be mixed with MS, HSD or SKO
59. What is the most durable identification of Indane cylinders? - 6 horizontal oval holes in the footing
60. What are the fire protection systems at place in godowns?
61. What are the prequalifications required for a party to participate in public tender?
62. What is the purpose of sand bitumen mixture between concrete foundation and annular plate extension of storage tanks?
63. What is the function of saddle plates in pipelines?
64. What is the testing pressure of pipelines? - 1.5 times for water , 1.1 times for product ; the operating pressure
65. Where is cathodic protection used?
66. What is function of quartzoid bulb?
67. What are the types of pricing for aviation fuels?
68. What are the two methods of filling aviation fuel into the aircraft?
69. Who is the main authority of all aviation related matters in India?
70. What is floating suction in ATF and why is it used?
71. What is function of air vent and free vent ?
72. What is function of tail-tale hole?
73. Which test is done before decantation of ATF TT?
74. What is Deadman switch and why is it required?
75. What are the personnel present during refuelling? - driver, operator, officer, aircraft maintenance officer
76. What are the two critical checks in ATF?
77. Why does all ATF storage vessels require epicoating?
78. What is the colour change of aquades capsule? - colourless to pink in presence of water
79. What is PTO gear?
80. Why is brake interlock system required in aviation refuellers?
81. How much sediments are allowed in ATF as per IOCL norms? - 0.2 mg/l (1 mg/l as per IATA norms)
82. How much water is allowed in ATF as per IOCL norms? - 15 ppm (30 ppm as per IATA norms)
83. What is allowable density variation in ATF? - +/- 2.5 kg/m³
84. What is hazchem code for ATF? - 3YE
85. Why are spark lighters being replaced by flame lighters?
86. What are the statutory licenses required for LPG distributorship? - fire license, trade license, retail selling license (for certain states) , shop and establishment license
87. What are the documents to be collected from new customers? - POI, POA, KYC, Aadhar(for subsidy)
88. What are the classifications of LPG distributors as per USG?
89. Can distributors take loads on credit and how ?
90. What is the number for IVR booking? - (96)24365365 96 is dependent on state
91. What are the PDCs? - o ring check, valve leak check, weight check
92. What is the technical name of the bluebook which a LPG customer has? - DGCC book (Domestic Gas Consumer Card)
93. What are NDNE retailer? - standalone commercial retailers
94. What are godown stacking guidelines? - filled 25 X 4 X 2 , empty 25 X 4 X 2 or 3
95. Where is LAB(Linear Alkyl Benzene) used ? - detergents
96. What is the mother unit of refineries? - AU
97. What is the chemical used to convert gaseous H2S to liquid for physical separation? - washed with amine to form rich amine
98. How many hours of fire fighting capacity is required at any facility? - 4 hours
99. What is the replacement of Insoft which is being rolled out to LPG distributors on a pilot basis?
100. What is the ceiling limit of sale of a distributor?
101. What is flash point, smoke point and fire point?
102. How do we check RON and cetane number?