

USER MANUAL FOR LPG RETICULATED SYSTEM

PROPERTIES OF LPG

The result is a drop in temperature, following which the supply of heat can begin to surroundings as well.

The thermal energy or heat which is stored in the liquid LPG is significant importance during heavy gas withdrawals of short duration.

The vapourization capacity derived from the thermal contents of the liquid LPG is proportional to the temperature difference between the initial temperature.

Vapourization Rate kg/hr.

TABLE - 6

Capacity of Cylinders Temperature °C	19 Kg	35 Kg	47.5 Kg
26 °C	0.75	1.1	1.3
30 °C	0.8	1.2	1.4
37.7 °C	0.9	1.3	1.5

COMBUSTIONCOMBUSTION PROCESS

In its simplest terms the combustion process with respect to LP-Gases may be defined as the product or the combination of oxygen usually from air with LPG vapour to form water vapour.

As an example of the process 0.4 volume of LPG when combined with 9.5 volume of air will produce 1.6 volume of water vapour, 1.2 volume of carbon dioxide and 7.5 volume of nitrogen.

Since air contains approximately 20% oxygen, the chemical process of combustion in 1 volume of LPG and 2 volumes of oxygen contained within the 9.5 volumes of air, therefore nitrogen went through the combustion process and unchanged.

COMBUSTION PREPROCESS PROPANE

1	Unit Volume of Propane Liquid =
273	Volumes of Propane Vapour +
6500	Volumes of Air =
6773	Volumes of Flammable Mixture
	The application of a temperature of 460 °C to 580 °C will cause combustion
5150	Volumes of Nitrogen
820	Volumes of Carbon Dioxide
1100	Volumes of Water Vapour

BUTANE

1	Unit Volume of Butane Liquid =
238	Volumes of Propane Vapour +
7378	Volumes of Air =
7616	Volumes of Flammable Mixture
	The application of a temperature of 410 °C to 550 °C will cause combustion
5850	Volumes of Nitrogen
950	Volumes of Carbon Dioxide
1180	Volumes of Water Vapour

PROPERTIES OF LPG

Flame temperature of LPG depends on the composition of the product. The maximum flame temperature of commercial LPG attained is about 2000°C.

LIMITS OF FLAMMABILITY

In order for the combustion process to be accomplished or for LPG to be burned in the atmosphere, it is necessary that the proportions of LPG vapour and air be within certain limitations.

In the event there is an insufficient supply of LPG vapour mixed with air, the combination will not burn.

Conversely, if an excessive amount of LPG vapour is mixed in the atmosphere, combustion again cannot be accomplished.

TABLE - 7

Fuel	Percentage of Gas by Volume in Air/Gas Mixture	
	Lower Limit	Upper Limit
Propane	2.0	10
Butane	1.5	9
Coal Gas	4.0	29
Water Gas	5.0	46
Hydrogen	4.0	75
Acetylene	2.5	80

IGNITION TEMPERAUTE

In order for the combustion process or burning of LPG to occur, it is necessary that an ignition source be supplied.

A flammable mixture of LPG vapour and air will not ignite or explode unless the ignition source is present. The source may be any spark, flame or heated material which possesses sufficient heat to equal or exceed the required temperature.

Auto Ignition Temperature	-	Propane	481 °C
		Butane	441 °C

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DESIGN CRITERIA

LPG Reticulated system means providing LPG to the houses / flats through pipelines using multiple two stage of Pressure reduction. The system has been divided in four sections namely Storage of LPG in bulk, pipeline distribution network, metering unit and appliance installation.

DESIGN CRITERIA:

1. Number of persons assumed per house - 5
2. Average consumption of LPG for cooking - 400 gms per day
12 Kgs per month
3. Spread of maximum consumption over the day - 2 hrs. in the morning 7am to 9 am
2 hrs. in the afternoon 11am to 1 pm
2 hrs. in the evening 6pm to 8 pm
4. Maximum consumption on an hourly basis - 200 gms/hr.

Example : 1

Consider a 25 flats apartment: -

i. Monthly Consumption	=	25	x	12	=	300 kgs.
ii. Daily Consumption	=	25	x	0.4	=	10 kgs.
iii. Maximum Hourly Consumption	=	25	x	0.2	=	5 kgs./hr.

The Bulk Storage Installation is designed on the following basis.

- The Total LPG Storage available = 10 – 12 days Consumption
- Lead time for procurement
The Bulk product in the form of Cylinders or LPG in Bulk should be made available at site in a maximum of 5 days of indent.
- The design should be such to achieve a vapourisation of a peak hourly load at any given time during the operation.
- The Statutory requirements of space, capacity of storage should be met

The Bulk Storage can be provided in form a Cylinder Bank duly Manifold or Storage of Bulk in a Tank.

DESIGN CRITERIA

Cylinder Bank Manifold:

The Cylinder Bank Manifold shall consist of 2 arms, one, which is operational, and the other being a stand by.

TABLE – 8
Standard LPG Cylinder Banks

No. of Cylinders on each side	19		35		47.5	
	Storage in kgs	Vapourisation kg/hr	Storage in kg	Vapourisation kg/hr	Storage in kg	Vapourisation kg/hr
4	76	3.2	140	5.8	190	7.9
8	152	6.3	280	11.7	380	15.8
12	228	9.5	420	17.5	570	23.8
16	304	12.7	560	23.3	760	31.7
20	380	15.8	700	29.2	950	39.6
32	608	25.3	1120	46.7	1520	63.3
40	760	31.7	1400	58.3	1900	79.2

NATURAL VAPOURISATION RATES

TABLE – 9
i. Natural Vapourisation rates from a LPG Cylinder at 30 °C

LPG CYLINDER CAPACITY AND EVAPORATION RATE	
LPG CYLINDER CAPACITY Kg / Cylinder	LPG EVAPORATION RATE Kg. / hr/ Cylinder at 30 °C
19	0.8
35	1.2
47.5	1.4

LPG Storage Tank :

The Bulk Storage in Tank with the tank being installed either aboveground, underground or Mounded.

TABLE – 10
Standard Bulk LPG Storage Tanks

Water Capacity in Litres	Licenced Capacity of LPG in Kgs.	Availabe LPG for Operation in Kgs.
7500	3500	3000
10000	4700	4200
20000	9400	8900
40000	18800	18300

DESIGN CRITERIA

TABLE - 11

ii. Natural Vapourisation from a LPG Storage Tank of Capacity

UNDERGROUND AND MOUNDED VESSEL

Water Capacity in Litres	Licenced Capacity in MT	Natural Vapourisation in Kg/hr.
7500	3.5 MT	5
10000	4.7 MT	8
20000	9.4 MT	12
40000	18.8 MT	20

TABLE - 12

ABOVEGROUND VESSEL :

Water Capacity in Litres	Licenced Capacity in MT	Natural Vapourisation in Kg/hr.
7500	3.5 MT	10
10000	4.7 MT	15
20000	9.4 MT	25
40000	18.8 MT	40

Example : 2

A housing complex with 48 flats requires to be provided with a Reticulated LPG System.

- The daily consumption of the Complex is = $400 \text{ gm} \times 48 \text{ flats} = 19.2 \text{ kg.}$
- The designed Bulk Storage is = $10 \text{ days} \times 19.2 \text{ kgs.} = 192 \text{ kgs.}$
- The Peak Consumption of LPG is = $200 \text{ gm} \times 48 \text{ flats} = 9.6 \text{ kg/hr.}$

The Bulk Storage can be provided by a tank or Cylinder Bank Manifold. Tank Storage of minimum 7500 liters is equivalent to 3500 kgs. shall be very high. A Cylinder Bank Manifold shall provide adequate LPG. From the Table - 8 for the Cylinder Bank Manifold for 192 kgs. Storage and 9.6 kg/hr. Vapourisation following combinations are suitable.

	<u>Storage</u>	<u>Vapourisation</u>
a. 12 Cylinders of 19 kgs. each	228 kgs.	9.5 kg/hr.
b. 8 Cylinders of 35 kgs. each	280 kgs.	11.7 kg/hr.
c. 8 Cylinders of 47.5 kgs. each	380 kgs.	15.8 kg/hr.

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DESIGN CRITERIA

Any of the above 3 can be installed.

Example 3 :

A housing complex with 1200 flats requires to be provided with a Reticulated LPG System.

- a. The daily consumption of the Complex is = $400 \text{ gm} \times 1200 \text{ flats} = 480 \text{ kgs.}$
- b. The designed Bulk Storage is = $10 \text{ days} \times 480 \text{ kgs} = 4800 \text{ kgs.}$
- c. The Peak Consumption of LPG is = $200 \text{ gm} \times 1200 \text{ flats} = 240 \text{ kgs./hr}$

The Bulk Storage can be provided in a tank or Cylinders Bank Manifold. Providing Cylinders Bank Manifold of 4800 kgs. requires many Cylinders and providing many Cylinders is not a practical and also unsafe. The Bulk Storage Tank can be provided of capacity 4700 kgs. The choice of installation, aboveground, mounded installation or underground is decided based on the area available in the Complex.

Example 4 :

A housing complex with 550 flats requires to be provided with a Reticulated LPG System.

- a. The daily consumption of the Complex is = $400 \text{ gm} \times 550 \text{ flats} = 220 \text{ kgs.}$
- b. The designed Bulk Storage is = $10 \text{ days} \times 220 \text{ kgs.} = 2200 \text{ kgs.}$
- c. The Peak Consumption of LPG is = $200 \text{ gm} \times 550 \text{ flats} = 110 \text{ kgs./hr.}$

The Bulk Storage can be provided by a LPG tank or Cylinder Bank Manifold. A Storage Tank of 2200 kgs is not practical and the number of Cylinders required for the Storage could be more than 40. Providing more number of Cylinders is not advisable and is also unsafe. In such a situation we can have two installations in the same Complex to service 275 flats each or approx. equivalent. As discussed in the later chapter it will reduce capital expense as well.

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PIPING NETWORK

PIPING WORK

Fabrication & erection of above Ground and Underground Piping.

Fabrication, installation / erection and assembly shall be done as indicated in the piping layout drawings.

CODES AND STANDARDS:

The following standards and Codes with the latest issues shall be applicable.

ANSI B 31.3	:	Code for Petroleum Refinery Piping.
API 1104	:	“Standard for Welding Pipeline and Related Facilities”
ASME SECTION IX	:	Code for Welding Qualification
IS : 823	:	Standards for Procedure for Manual Metal Arc Welding of MS.

FABRICATION :

The piping drawings specify the shape and dimensions of pipe and piping components sufficient for fabrication.

The dimension indicated on the drawings are true and contain no allowance for weld gaps.

Pipe cutting shall be accurate, smooth and true to template, Slag & cutting dross shall be removed before fitting.

Installation & protection during fabrication of the components shall be in accordance with the manufacturer's installation instructions.

Branch connections shall be made by Site Fabricated intersections, couplings etc.as indicated in the drawings and as directed by Engineer-in- charge.

Material which have been damaged or found to have defects shall not be used in fabrication except that minor surface marks may be dressed provided that the nominal wall thickness is not encroached upon after considering the manufacturing tolerances defined in the appropriation material codes. Insert patching or cuts or dents or pounding of dents shall be prohibited.

Fabrication piping, valves, fittings, sections of piping etc. shall be thoroughly cleaned. All sand, dirt or other foreign matter shall be removed. The ends of completed sections of pipeline shall be closed with suitable blinds, caps or other approved methods. All fabricated piping shall be protected against rust and corrosion pending erection.

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PIPING NETWORK

All welding machines, transformers / Diesel generators as may be required, line up clamps, beveling machines and other equipment used in connection with the welding work must be satisfactory and must be kept in good mechanical condition so as to produce sound welds.

TOLERANCES:

In addition to tolerances contained within the applicable codes or standards of the respective material the following shall also apply.

For pipes subjected to internal pressure, the difference between maximum and minimum outside diameter at any section across the axis of bent portions shall not exceed 5% of the nominal outside diameter. Wall thickness of the pipes after bending shall not be less than 87.5% of the nominal wall thickness.

All linear dimensions involved in the relative position of branches, bosses, flanged ends, instrument tapping and change in the direction to each other, shall be maintained with ± 3 mm ($\pm 1/8$ ").

All angular dimensions of bends and branches shall be maintained within $\pm 1/4$ degree.

Misalignment of flanges from the indicated position shall be within 1.5 mm ($1/16$ ").

Alignment of flanges and branch welding ends measured across any diameter shall not deviate from the indicated position more than 2.5 mm per meter ($1/32$ " per foot) of diameter.

Flange faces shall be perpendicular to the axis of the pipeline.

PREPARATION OF PIPES AND OTHER FITTINGS :

Prior to aligning pipe for welding, the ends of the pipe shall be machine beveled. Bevel dimensions shall be as per applicable codes.

The bevelled ends of each joint of the pipe shall be thoroughly cleaned of paint, rust, mill scale, dirt or other foreign materials to avoid defects.

Any foreign matter or obstruction remaining inside the pipe shall be removed by appropriate means.

Coupling and half coupling shall be accurately shaped and set on to suit the contour of the run pipe.

Pipes shall be properly supported and aligned by jigs or clamps as required in order to preclude extraneous loads and minimise strains during taking.

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PIPING NETWORK

Small tack welds i.e. between 12.5 mm (1/2") and 18 mm (3/4") in length penetrating to the bottom of the groove may be used in fitting up.

Unless otherwise specified all pipe to pipe joints shall be butt welds.

Pipes with a wall thickness less than 6 mm (1/4") shall not have internal misalignment of pipe wall exceeding 25% of pipe wall thickness.

WELDING :

Welding Process :

Welding under this specification shall be done with following welding process subject to the approval of Engineer-in-charge / representatives.

a) Manual Metal Arc Process.

Roots Pass:

Root Pass shall be made with respective electrodes mentioned in the electrodes specifications. The size of the electrode shall not be greater than 3.25 mm (10 SWG). Welding may be done with direct current with due regards to polarity and current values recommended by the electrode manufacturers. Upward techniques shall be adopted for welding pipes horizontally fixed in position. For thickness less than 3 mm and pipe size 50 mm NB and below Oxy-acetylene welding is recommended.

The soundness of weld depends to a large extent on complete fusion of the root edges. Hence the root pass of butt joints shall be such as to achieve full penetration. The depth of incomplete penetration shall not exceed 0.8 mm or 0.2 times wall thickness. The total length of such imperfections shall not exceed 38 mm in any 150 mm of weld length.

Welding shall not be interrupted during the root-pass, other than change of electrode or change of welder's position.

During the process of welding, displacements, shocks, vibrations or stresses shall be carefully avoided in order to prevent weld cracks.

Filler welds shall be made by shielded metal arc process regardless of the thickness and class of material. Electrode size shall not exceed 3.25 mm.

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PIPING NETWORK

Joints Finishing:

When the welding is completed, butt joints shall have a capping (cover pass) so as to have gradual notch-free finish and good fusion at the joint edges.

The welds shall be free from undercuts and any other defects and shall have regular appearance.

Welder's number shall be stamped clearly on each and every joint, adjustment to the weld in order to identify the welder if defects are found after tests.

Inspection and Test :

All prefabricated as well as field welded joints shall be subjected to visual examinations. Dye penetrant test will be done on all the joints of seamless pipelines which shall be followed by 10% radiographic examinations.

Visual examination shall be 100% on all the joints and shall reveal surface defects such as misalignment, excessive reinforcement, concavity of the welds, shrinkage, cracks, inadequate penetration, undercuts and surface porosity.

Qualification of Welders and Procedure Tests:-

Only skilled welders shall be employed.

Welders shall be properly qualified in accordance with the requirements of API 1104/ASME Section IX or IS:823.

Test specimens, 2 1/2 cm in width, shall be cut from the nipple at right angle to the weld., The test specimens shall be subjected to tensile, root bend, face bend and neck break tests. These tests shall be witnessed by Engineer-in-charge or his representative.

The manner of performing the test and the results required shall be in accordance with the code API-1104.

In the event that satisfactory results are not obtained the welder shall not be employed on the job.

Welding Procedure qualification tests shall be carried out in accordance with job requirements and the relevant requirements laid down in the above said Codes.

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PIPING NETWORK

Stencilling of Welds :

All welds shall be marked by the welders according to number assigned to them by the Contractor who will furnish to the Engineer-in-charge a record of all number assigned. Should any welder leave during the course of the job, his stamp shall be avoided and shall not be duplicated on the job.

No punch or steel stenciling will be permitted.

WELDING PROCEDURE :

The pipe shall be aligned so that the longitudinal mill weld in the pipe is on the top 90 Degree of the pipeline (except on vertical bends) and in such a way that the longitudinal mill welds are staggered not less than 45 degree.

Welding surfaces shall be thoroughly cleaned so as to be dry and free from paint, oil, rust, scale and other materials detrimental to weld quality. Each bead shall be cleaned of scale, oxides, dirt, slag and other impurities before any succeeding weld passes are made.

DEFECTS :

Defects revealed by visual inspection, D.P. Test & Radiographic inspection of welds shall be repaired/rectified. The repaired portion shall be re-examined by radiography. The repairs carried out shall meet the approval of the Site Engineer.

WELDING CONSUMABLES

The welding electrodes to be used shall be as given below:

TABLE – 16

Material	Filler Metal	
	Root	Final
Pipe (LPG Service)	E 6010	E 6013 Medium
Flanges	E6010	E 6013 Medium

Only reputed makes like Advani, Esab, D & H. Etc are to be used for electrode.

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PIPING NETWORK

Welding Rods and Electrodes:

The electrodes shall be stored properly by the contractor to prevent moisture absorption and shall be handled in such a manner as to avoid damage to the coating. Manufacturer's instruction in this connection shall be strictly followed.

Electrodes, wire and flux, when used shall be free of rust, oil, grease, earth or any other matter, which could be harmful for the quality of welding.

The welding consumables used shall meet requirements of the relevant codes and shall produce a deposit which is compatible in chemical analysis and similar in mechanical properties to the parent material.

Inspection of Pre-Fabricated Piping :

Pipe work that has been done shall be checked with the relevant drawings and other related documents to verify that it, as fabricated, complies with dimensions and specifications.

Fabrication shall have dimensions falling within the tolerances defined earlier.

All welds shall be visually examined and shall also be subjected to radiographic inspection.

PROTECTION:

When necessary the external surfaces of all fabricated pipe work shall be painted with rust preventor or base primer to provide a protective coating against rust during transit or storage.

Flanges and pipe ends, fitting, other components are to be protected by blank flanges and plastic caps against mechanical damage and ingress of dust, dirt and water, wherever necessary.

While lifting externally coated pipes properly constructed webbing or fabric slings must be used so as to avoid mechanical damage to the coating.

ERECTION:

The gaskets used during testing provided by the Contractor and these shall be removed after the hydrostatic testing and new gaskets for permanent retention shall be fixed only after flushing of the lines.

All shop fabricated piping shall be routed and located in accordance with the approved piping drawings. Utmost care shall be taken so that during erection no damage will be done to the adjacent, valves etc.

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PIPING NETWORK

Stud bolts and nuts for the LPG line flange joints shall be as per following standards:

Studs: A 193, Grade 87

Nuts: A 194, Grade 2H,

While bolting gasketed flanged joints, the gaskets shall be properly located to remain on the gasket sealing and tightened by hand to ensure that the gasket is centered. Tightening by tools must be in diagonally and clockwise in increments of 1/4, 1/2 of total load.

All bolts shall extend completely through their nuts by a least 2 threads to a maximum of 3 mm projection.

All screwed connections will be secured by teflon tapes. Minimum length of engagements for pipe threads shall be as per the requirements of relevant standards.

Mismatch and Prefabricated Piping :

Any mismatch found from shop welded piping, such as flange joints falling on pipe supports (rack) or flanged joint of an adjacent piping interferes, drain point falling on supports etc. shall be promptly rectified.

Field supports, 'U' clamps and any special support if required are to be provided.

CLEANING & FLUSHING:

Cleaning of Fabricated/Erected Piping :

All piping, valves and fittings shall be cleaned thoroughly inside and outside using detergent before erection.

All field fabricated piping shall be cleaned at the completion of fabrication. Care shall be taken to see that all burrs, welding icicles, and weld spatter are removed by reaming, chipping, filing or to her means. All foreign materials such as cement, mortar, sand, heavy oil film and loose scale shall be removed from the interior of pipe by thoroughly flushing with water.

All equipment, on-line instruments etc. shall be isolated by closing of valves or slip blinds to protect such items before flushing and cleaning operation is started.

Strainer baskets and similar items shall be removed from the lines before cleaning and replaced immediately after cleaning/flushing.

Protection & Cleaning of Valves :

All possible precaution shall be taken to prevent dirt, grease, or other foreign matters entering the valve.

All foreign particles shall be removed by wiping with clean linen cloth and protected with suitable blinds till the valves erected. 270

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PIPING NETWORK

HYDROSTATIC TEST AND PROCEDURE:

Before carrying out the hydrostatic testing all line shall be thoroughly cleaned. The pressure gauges to be used in testing shall be checked at instruments shops or with any other outside agency designated by Owner/Contractor. It shall be the responsibility of the Contractor to get the calibration of pressure gauges done.

Line shall be slowly filled with water. It shall be ensured that no air pockets will be left over in the line. All equipment such as pumps, vessels, relief valves, pressure gauges etc. shall be disconnected from the piping or isolated by blinds or blanked off during the test.

All prefabricated and field welded lines shall be tested to the specified pressures. Lines should hold the pressure for at least half an hour prior to inspection. All butt joints shall be inspected for leaks under pressure.

When an existing line or portion thereby modified, cut or welded, this shall be tested once again. The nature of the test and test pressure shall be same as above.

Valves installed on field welded line shall be considered as a part of piping and the whole system shall be tested to the specified test pressure. One side of the valve in shut-off position shall be unbolted during the test in order to inspect the valve seating from the open end.

All lines shall be drained fully after hydrostatic, testing and closed with suitable blinds to prevent entry of dust or any foreign particles.

TEST RECORDS:

Records shall be maintained for each piping system after testing. These records shall contain the following information:

- Date of Test.
- Identification of Piping Tested (Line Number).
- Test Fluid.
- Approval by Owner/Consultant/Representatives.

FLANGE BONDING & GROUNDING:

On all LPG Lines, provision for electrical bonding shall be provided on all flanged joints. Copper flat strips of suitable width shall be used for bonding.

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STATUTORY REQUIREMENTS & APPROVALS

The Reticulated System consists of Storage of LPG in Bulk and Piping Network in a Residential Complex. There is no common regulation or guidelines for Reticulation in India. However the following are applicable:

A. Bulk Storage of LPG:-

- Cylinder Bank Manifold - No Approval
- Storage of LPG in Bulk LPG Storage Tank.
The Explosive Department have framed the Static & Mobile Pressure Vessels Rules. A licence is granted for the Storage of LPG in LPG Storage Tank.
- For Storage of LPG in tanks, for grant of licence from The Chief Controller of Explosive Office a No Objection Certificate in writing is required from The District Authorities. This is a condition of approval and final licencing under the SMPV Rules.

B. Piping Network & Metering:-

- The complete Reticulated System is required to be approved by the Local Fire Brigade Office. This is to ensure satisfactory Safety Procedure have been adopted.

(A) APPROVAL FROM CHIEF CONTROLLER OF EXPLOSIVES

All the Equipments, such as Tanks, Flame Proof Equipment, LPG Vapourisers shall have the approval of CHIEF CONTROLLER OF EXPLOSIVES, NAGPUR, INDIA.

1) Initial approval from Chief Controller of Explosives.

- Layout approval showing the LPG facility with safety distances in the Yard layout.
- Piping and instrumentation drawing
- Tank & installation drawing
- Civil drawing

The LPG tank should be fabricated by manufacturer approved by CCOE after approval of initial fabrication drawing by CCOE. The fabrication should be carried out under stage wise inspection by any of the third party inspection agency recognized by CCOE.

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STATUTORY REQUIREMENTS & APPROVALS

2) Final Licencing

After installation of the facilities, following documents are to be submitted to CCOE, Nagpur for obtaining Licence in form – II of SMPV Rules 1999.

- Application in Form I.
- Four copies of "As Built" Site layout, P & I D, Civil Works including Tank Foundation Drawing and Fabrication drawings of the LPG tank.
- 3 copies of the Test & Inspection Certificate (Certificate of Control) of LPG Tank issued by the recognized third party inspection agency.
- 3 copies of Safety Certificate under Rule 33 issued by recognized Third Party Inspection Agency giving details of Tank, Tank Fittings, ROV's, and other safety devices.

(B) LOCAL APPROVALS

- Local Municipal Approvals for construction of the Reticulated System is not required.
- Pollution control / Environment approvals is not required.
- Fire brigade approvals for fire fighting requirements or equivalent approving authorities is a required.
- For a new Site approval from District Magistrate is required in case of Bulk Installation.

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STATUTORY REQUIREMENTS & APPROVALS

APPLICATION FOR SAFETY DISTANCES ARE

SAFETY DISTANCE AS PER SMPV RULES (INDIA)

LPG Layout Facilities:

Storage vessels between each other and from boundary line of the Dispensing Station shall observe the separation distances in Table A and B

TABLE - 17
Minimum Safety distances for Liquified Flammable Gases

Ref : Static & Mobile Pressure Vessels (Unfired) Rules, 1981

Sr. No.	Water Capacity (in Litres)	Minimum distance from line of adjoining property OR group of building not associated with storage and operation.		Minimum distance between vessels	
		Above ground vessel	Underground OR above ground vessel covered with earth (mound)	Above ground vessel	Underground OR above ground vessel covered with earth (mound)
1	Not above 2,000	5 metres	3 metres	1 metre	1 metre
2	Above 2,000 but not above 7,500	10 metres	3 metres	1 metre	1 metre
3	Above 7,500 but not above 10,000	10 metres	5 metres	1 metre	1 metre
4	Above 10,000 but not above 20,000	15 metres	7.5 metres	1.5 metres	1 metre
5	Above 20,000 but not above 40,000	20 metres	10 metres	2 metres	1 metre
6	Above 40,000 but not above 3,50,000	30 metres	15 metres	2 metres OR $\frac{1}{4}$ th of the sum of diameters of adjacent vessels OR $\frac{1}{2}$ the diameters of two adjacent vessels, which ever is greater	1 metre
7	Above 3,50,000 but not above 4,50,000	40 metres	15 metres		1 metre
8	Above 4,50,000 but not above 7,50,000	60 metres	15 metres		1 metre
9	Above 7,50,000 but not above 38,00,000	90 metres	15 metres		1 metre
10	Above 38,00,000 and above	120 metres	15 metres		1 metre

NOTE The distances specified above are required to be measured from the nearest point on the periphery of the vessel.

STATUTORY REQUIREMENTS & APPROVALS

Area requirement for Storage of LPG in Bulk, we have tabulated herewith the specific area requirement. The required area to be earmarked and fenced and which shall be licenced.

TABLE – 18

No. of Tanks	TANK CAPACITY	ABOVEGROUND		UNDERGROUND / MOUNDED	
		Length in mtr	Breadth in mtr.	Length in mtr	Breadth in mtr.
1	7500 Litrs.	32	22	20	10
1	10000 Litrs.	32	22	22	15
1	20000 Litrs.	36	35	25	17
2	7500 Litrs.	32	25	20	15
2	10000 Litrs.	32	25	22	18
2	20000 Litrs.	37	36	25	20

TESTING OF RELIEF / PROTECTION SYSTEM

A schedule for testing of Relief valves and Protection System of various equipment shall be as under :

Equipment/Facility	Frequency	Agency
Safety Relief Valve	Once in a year	Competent person CCOE approved TPJA and issuance of certificate in Form 18.
Earth Pits	Once in 6 months	By Licensed Electrical Contractor
Thermal/Hydrostatic relief valves	Once in 5 years	Competent Person
Excess Flow Check Valve	Once in 5 years	Competent person except for Excess Flow Valve fitted on the LPG tank inlet.
High Level Alarm of storage vessel	Once in 6 months	Authorised Person
Remote Operated Valves	Once in 6 months	Authorised Person
LPG Pump	Once in 6 months	Authorised Person
Cathodic Protection System	Once in a year	Authorised Person
LPG hoses both of LPG Dispenser and bulk LPG unloading hoses.	Once in a year	Authorised Person
Fire Extinguishers	Once in a year	Authorised Person

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LIST OF REFERNCE

Reference Books, Codes of Practice:

SR. NO.	DESCRIPTION
1	INDIAN STANDARD - 6044 PART - I
2	INDIAN STANDARD - 6044 PART - II
3	SMPV GAS CYLINDER RULES, 1981
4	GAS CYLINDER RULES, 1981
5	NFPA, 68
6	GUIDANCE OF INSTALLATION, CS LEVEL, UK
7	HEALTH AND SAFETY / G 34, UK