ALL IN ONE
HAND BOOK

Indian Guidelines + Safety Practices+Function of Equipment + Periodic Check Points.
in
Commercial & Industrial Installations
for LPG

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REQUIREMENTS OF LIQUID OFF TAKE VALVE MULTI CYLINDER INSTALLATION

A-1 GENERAL

a) The liquid withdrawal or liquid off take (LOT) valve (see IS 16484) multi cylinder installation shall meet the requirements given in IS 6044 (Part 2) and this standard. .
b) The cylinder and valve used for liquid off take shall be approved by statutory authority.
c) For any additional cylinders which are to be kept loose, the customer can store them within stipulations as provided for in Gas Cylinders Rules, 2016.
d) The manifold and the LOT valve installation shall be certified by the officer of the distributing company or third party inspection agency recognized by distribution company prior to commissioning.

A-2 LAYOUT

a) The site for LPG cylinder manifold shall be located away from the furnaces, any source radiating heat like steam pipes and boilers, etc. to prevent cylinders from getting affected due to radiant heat.
1) be a segregated area with all round fencing as per 5.1.13c) and plain cement flooring/paver block shall be raised by minimum 100 mm from the natural ground and
2) have mastic flooring inside the shed, raised by minim um 100 mm from plain cement flooring/paver block. The cylinders shall be stored in dry, cool and wall ventilated shed.
c) The cylinder installation area and the area where vaporizer is installed shall be a covered shed with sides open for ventilation. Flammable materials like wood and plastic shall not be stored in this area. Flame proof (FLP) light fitting approved by the Statutory Authority for lighting

with armoured. Aluminum/Copper PVC extruded cable with fire retardant properties conforming to relevant Indian Standards shall be provided.

d) The cylinder shall be installed in upright position with the valve pointing upwards.

e) The cylinder installation should be so located so as to facilitate the following.

1) Full and empty cylinders can be easily changed, disconnected and removed quickly at the time of normal operation or emergency.

2) It is easy to operate and maintain the valve provided between the manifold and the cylinder.

3) Manifold maintenance is easier.

4) Cylinders shall not be installed below ground level in cellars or basement or at a place where they are likely to cause obstruction, suffer damage or be exposed to conditions likely to affect safety .

f) Since LPG is heavier than air, proper ventilation shall be provided at floor level open to atmosphere.

g) main Shut off valve (Plug or ball type) on the pipeline emerging out of cylinder installation area shall be located in such a manner that it just falls outside the cylinder installation area and shall be easily accessible at all times. At the point of entry of each work place, the line shall have a quick shut off valve (plug or ball type).

h) Wherever the pipelines are passing through walls, slacks shall be provided so that the pipeline does not get a braised.

J0 A minimum distance of 1 m shall be maintained between the cylinder installation and the surface water drain, if any.

A-3 INSTALLATION

Following provisions in addition to requirements given in IS 6044 (part 2) and this standard are to be made for LOT valve installation.

a) A safety valve, thermal relief valve, excess flow check valve and non return valve shall be provided on liquid line , SRVs may be inter connected through a common vent flow which shall be at a height of minimum 1.5 m above eaves and of the shed.

b) The safety relief valves shall be as per IS 12992 (part 1) and have adequate capacity.

c) The vent of the safety valve thermal relief vale shall be at a height of minimum 1.5 m above eaves end of the shed. It shall be adequately supported. A thermal relief valve is required to be provided between two isolation valves in the liquid pipeline.

d) The name plate shall be provided on the piping manifold assembly containing the following information.

1) Name of the owner.

2) Type of installation.

3) Installation date.

4) Date of test and test pressure, in kg/cm2 and

5) Manufacture's identification symbol.

e) The typical installation layout, piping and distance is provided in Drawings supplied by Installer, as directional guidelines for installation up to 8000 kg capacity. Any medications and changes shall be as accepted by the distribution company.

A-4 PIPE AND PIPE FITTINGS FOR PIPING MANIFOLD AND HEADER UP TO PRV

a) The pipe fittings used for Manifold shall be forged fittings of SCH 80, as per specifications -IS:6044-Part-1

b) All fittings of less than 50 NB shall also be forged fittings of 300 class rating.

c) The pipe used for liquid line that is up to vaporizer shall be seamless steel pipes as per specifications of IS:6044-PART-1, Pipes of below 50 NB shall be of SCH 80 and pipes of 50 NB and above shall be of SCH 40, Copper tubing manifolds shall not be allowed. The pipe used for vapour services (After vaporizer) shall be as specified in 8.

d) No screwed connection shall be allowed. In case due to any reason screwed connection is used, the pipe used shall be of SCH 80 only.

e) The valves , thermal relief valves, NRV etc, shall be of 300 class rating. Only cast steel ball valves with fire safe feature shall be used.

f) All flanges used shall be of cartoon steel, SA105, 300 class rating with dimensional standard as per specifications approved by distribution company. No screwed connections should be provided.

g) All weld joints provided on the Manifold shall be accessible and shall be hydro tested for 25kgf/cm2 pressure. The welding shall be fusion welding.

h) Only metallic/spiral wound metallic gaskets/Teflon Gasket shall be used for liquid line that is up to vapourizer and also downstream of vaporizer.

i) Each arm of the manifold shall have a control valve. To each arm of the cylinder manifold, cylinders shall be connected through a pigtail. A check valve and an isolation valve shall be provided with each cylinder pigtail connection to protect the system from back flow of LPG in event of any flexible pigtail rupture.

j) Cylinder manifold is subjected to full cylinder pressure at all times. The fabrication welding of the manifold should be of the best available quality. All such manifolds shall be designed to a pressure equivalent to the maximum developed cylinder pressure (assessed at 65"C) of LPG that is 16.87 Kgf/cm2 The test pressure should be 1.5 times the maximum pressure (assessed at 65"C) that is 25 Kgf/cm2 for a period of 30 min.

k) Painting Piping manifolds and the supporting structure shall be painted with two coats of red oxide primer and with two coats of first quality synthetic enamel paint. The colour of the LPG lines shall be as per IS 2379.

A-5 VAPOURIZER

a) The vapourizer used shall be approved by statutory authority. Vapourizers may be low pressure steam heated, not water heated, electrically heated type or heater less. In case electrical vapourizer is used, it shall have FLP connections.
b) A minimum distance of 2 m of vapourzier for cylinder installation shall be maintained.
c) The vapoourizers shall be provided with suitable automatic means to prevent liquid LPG passing from the vapourizer to gas discharge piping.

A-6 FLEXIBLE HOSE

a)The hoses connecting cylinder with manifold shall be in line with IS 6044 (Part 2) and shall be used for connecting the cylinder to manifold. The hoses shall be as per IS 9573 (part 1) The hoses shall be hydro tested at 25 kg/cm2 pressure once in six months.
b) The design material and construction of hoses shall be suitable for grade of LPG Currently, it is envisaged that LPG as per IS 4576, shall be supplied.
c) The flexible hose/pigtail shall be in same room and its length shall not exceed 2 m. Flexible hose/pigtail shall not pass through doors windows, walls, ceiling (or) floors. The pigtails shall be accessible for inspection.
d) In case the ambient temperature exceeds 52" C, flexible hose shall not be used.
e) The flexible hose shall not be twisted, looped or kinked. It should not be subject to any external pressure.

A-7 MAINTENANCE OF CYLINDER MANIFOLD

Maintenance of the cylinders manifold and the equipment's shall be undertaken regularly and the periodicity of the maintenance shall be as under.

A-8 Periodicity of checks and maintenance

a) Valves

1) All the valves that is safety valves. TRV shall be checked once a year.

2) All the other valves should be checked once a year for free and full range of movement, positive shut off, mechanical damage, etc.

b) Piping and manifold

1) It should be checked once a year visually for corrosion, any physical damage. All supports of manifold should also be checked for any corrosion, etc.

2) The manifold should be internally cleaned once a year and should be free from contaminants.

3) Hydro testing of manifold and pneumatic testing of pipelines should be done once in 5 year.

c) Vapourizer shall be checked as per maintenance schedule.

d) The burners shall be regularly cleaned.

e) Pigtails shall be checked every time empty cylinder is replaced by a filled cylinder and replaced in case of any physical damage.

f) The PRV should be checked once in a year for correct settings and performance as well as for corrosion and mechanical damage.

g) The pressure gauges should be calibrated once in a year and proper records should be maintained. The dial of the gauge should be clearly visible.

A-9. INSPECTION

a)All the manifold installations shall be checked once in a Year by the authorized agency or the LPG distributing company and record to be maintained at the installation location.

b) The installation shall be checked once in a year by the sales officer of the LPG distributing company or by their authorized third party inspection agency.

c) The area of LOT installation should be free of any uncontrolled weed growth and accumulation of waste products.

A-10 LEAK TESTING

a) It shall be ensure that the manifold provided has been subjected to the hydro test pressure of 25 kgf/cm2 at least for a minimum period of 30 min
b) It shall be ensured that the fire extinguishers and sand buckets are provided and installations are adequately protected from weather conditions.
c) Naked flames shall never be used for checking gas tightness of the installation.
e) Leak detection should be done using soap solution or similar material.
f) All defective pipes should be replaced and no repair should be carried out in site.

A-11 WARNING SIGNALS

a) Smoking or naked flames shall be permitted within the Safety Zones of the installation. NO SMOKING HIGHLY INFLAMMBLEGAS" DANGER" boards shall be provided.
c) instruction board with emergency telephone numbers and important telephone numbers shall be provided.
d) Instruction board prohibiting unauthorized entry shall be provided.
e) it shall be ensued that all signage are in place and are legible.

A-12 SOURCE OF LEAKAGES

a. Cylinders
1. Welded seams.
2. The cylinder / valve connection bung joint and.
3. Cylinder valve
b. Check leakage from PRV at :
1. Near the joints.
2. In the prv itself.
3. Check leakage from the piping and manifold prv.

A-13 ACTION TO BE TAKEN WHEN LEAKAGE IS DETECTED

a)Leakage of Cylinder Any cylinder which develops a leak should be promptly removed to an isolated open place away from any source of ignition.

b) In case of leakages of piping, appliances or pressure regulators, close the valves and isolate the part, disconnect the cylinders and place the safety cap on the valve of the cylinder. Never repair the appliance or any other part of system when in use.

c) The matter should be immediately reported to the in charge and the officer of distribution company.

A-14 FIRE EXTINGUISHERS :-

Sr. No.	Capacity of LPG Installations	Number of Fire Extinguisher	Type	Capacity in kg.
i)	For installations with LPG 40 kg to 200 kg	2	Dry powder	10
ii)	For installations with LPG more than 200 kg and up to 320 kg	3	Dry Powder	10
iii)	For installations with LPG more than 320 kg an dup to 1000 kg	4	Dry powder	10
iv)	For installations with LPG more than 1000 kg	2 numbers for each additional 1000 kg	Dry powder	10
NOTE :- For electrical installation 1 No. carbon dioxide (Co2) (4.5 kg capacity) fire extinguisher shall be provided.				

A-15 EARTHING AND ELECTRICAL PROTECTION

a) The cylinder manifold installation, the vapourizer installation and the downstream installation shall be earthed at two places. Two earth pits as

per IS 3042, shall be provided and the earthling resistance should not exceed 1Ω .

b) The system should be tested for electrical continuity and resistance to earth.

c) The earthing resistance shall be checked twice a year once during the summer season and once during winter and records for same shall be maintained.

d) Only flame proof electrical fittings approved by statutory authority shall be used in the area segregated for LOT installation. These shall be earthed at two points.

1) Only flame proof hand torches shall be used, and

2) Copper jumpers shall be proved at flange.

A-16 INSTRUMENTS IN LPG SYSTEM

1. Pressure Reducing Station (PRS) or Gas Train @1st Stage & 2nd Stage.

- In order to ensure a sufficient degree of safety & reliability of gas supply, gas pressure reducing station (PRS) are used. It is recommended to sue Twin/Dual stream Pressure Reducing Station, so that in case of working line failure /under maintenance the stand by line can take over the supply function.
- A gas train consists of Filter, Slam –shut off valve pressure regulator, safety relief vale and flame arrestor. Filter helps to remove the dust / dirt particles in the gas which may damage the regulator parts.

➢ The slam shut off valve normally remains open. In case the outlet pressure of the regulator exceeds the permissible limits the slam shut off valve senses it through the impulse line & instantly shuts off the supply to the downstream system. The safety relief valve is provided for additional safety.

➢ If is to be set at higher pressure than the slam shut off valve pressure so that the safety relief valve will operate only when slam shut off valve fails to operate.

➢ The outlet of the safety relief valve is vented well above the PRS.

2. FILTERS.

➢ Filter must be fitted prior to the regulators on the upstream side, to ensure that only clean / dust free gas is entering the regulator. The presence of dust / dirt in pipeline results in malfunctioning of the regulator because of damage caused to the regulator seat and rubber sealing pad.

➢ The movement of the linkage is restricted due to the deposition of dust / dirt on the moving parts and affects performance of the regulator. Hence the use of filter is strongly recommended.

3. PRESSURE REGULATOR.

Pressure regulator are devices used to regulate the delivery pressure to the appliances for safe operation.

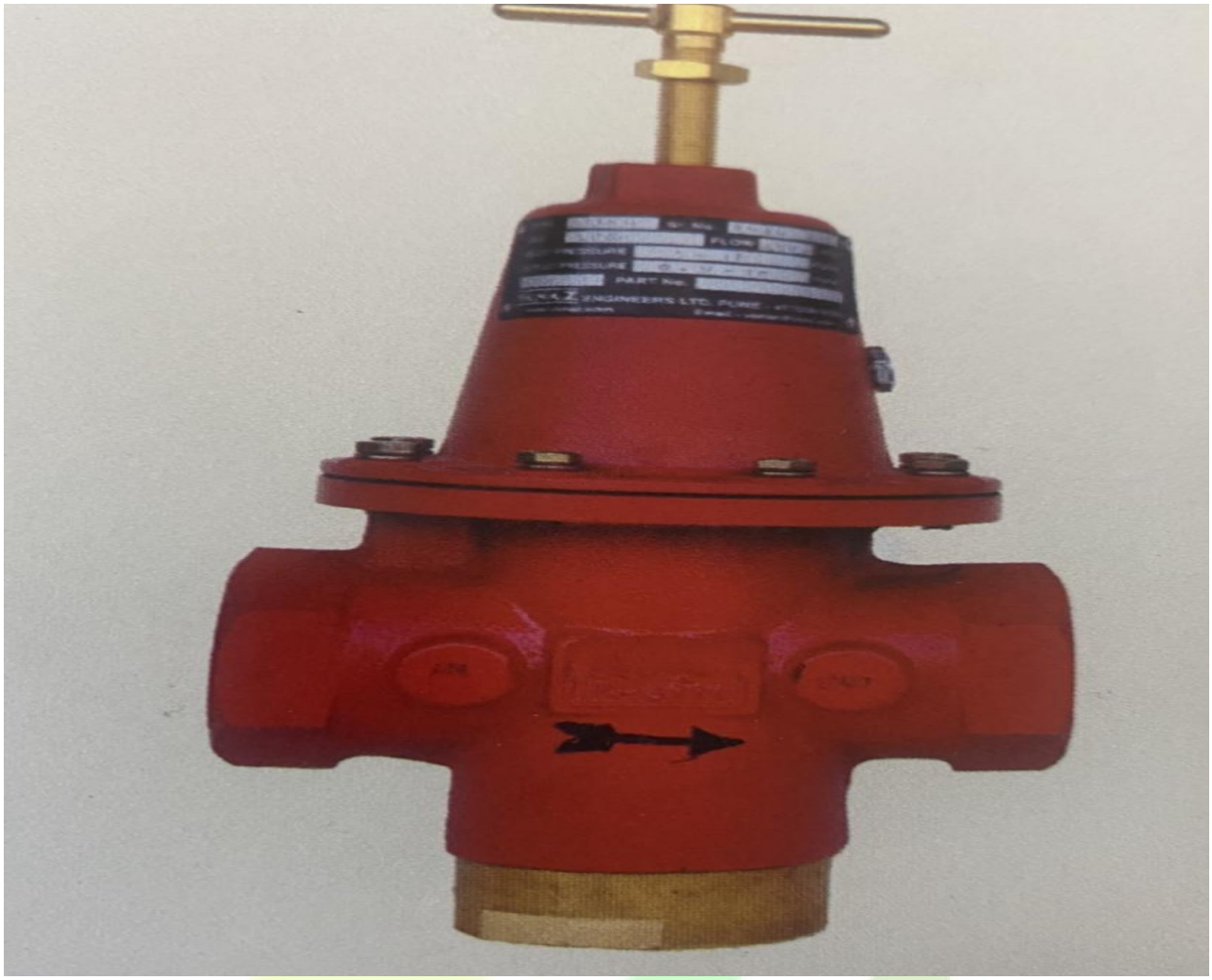
Adequate attention should be given to the pressure regulator selection and it must be chosen with due care.

It shall have sufficient capacity to handle the volume of the gas required to supply maximum demand

4. Over Pressure Shut off Valve (Slam Shut off Valve).

- Slam Shut Off valve is installed immediately after the filter & prior to the pressure regulator.
- It normally remains open in case the outlet pressure of the regulator exceeds the permissible limits, the slam shut off valve series it through the impulse line & immediately shut off the flow to downstream.
- When the regulator is repaired or reset, the slam shut off valve is to be opened manually by pulling the knob.
- Once the flow starts through the slam off valve it will remain open till the outlet pressure of the regulator is within limits.

5. SAFETY RELIEF VALVE :



- Safety relief devices remain closed during normal service operation & have been designed to automatically release a certain gas flow out of the pressurized line through the safety relief valve, as soon as the pressure within the section to be protected will have risen to the pre-set pressure.
- Safety relief valve closes automatically as soon as the pressure deceases below the set limit.

6. FLAME ARRESTOR :

➢ Flame arrestors are use dot arrest the flame from reaching the highly dense area of fuel, in case of backfire & thus avoid accident & explosions.

7. PRESSURE GAUGE : -

➢ A good quality pressure gauge with a suitable range shall be provided in the pipeline afte the first stage PRV.

➢ The joint at which pressure gauge is fixed shall be thoroughly checked for leakage.

➢ Millibar pressure gauges (0-500 mili bar) shall be provided in the pipelines after second stage PRV.

7. GAS LEAK DETECTION IN LPG BANK AREA./BURNER ROOM

- A gas detector is a device that detects the presence of gases in an area, often as part of a safety system.
- This type of equipment is used to detect a gas leak and interface with a control system so that the flow of the gas can be automatically shut down.
- The gas detector system will sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to address the situation.

9. VAPORISER.

- The vaporizer used shall be approved by statutory authority, Vaporisers may be low pressure steam heated, hot water heated, eclectically heated type of heater less. In case electrical vaprosier is used, it shall have FLP connections.
- A minimum distance of 2 m of vaproriser from cylinder installation shall be maintained.
- The vaporizers shall be provided with suitable automatic means to prevent liquid LPG passing from the vaporizers to gas discharge piping.
- Only for bulk installation vaporizer must be approved by CCOE for LOT no approval is required.

HANDLING AND USE OF CYLINDER

- Cylinder shall be adequately supported during handling.
- The cylinder shall be handled carefully and not allowed to fall upon one another or otherwise subjected to any undue shock.

- LPG cylinders and cylinder contain liquefiable gases shall always be kept in an upright position and shall be so placed that they cannot be knocked over down.
- Open flames, lighting of fire, lights, welding and smoking shall be prohibited on close proximity to any cylinder containing flammable gases except those whole in use for welding, cutting and hating
- Working places shall not be classified as storage places for the purpose of licensing.

PROCEDURE FOR CHANGING THE CYLINDERS

- Close the isolation ball vales of the hose of the cylinder to be replaced.
- Depressurize the hose by allowing LPG bleeding by loosening the joints.
- Check the flexible house for any crack by twist and kinks etc and replace it if necessary
- Do not repair any damaged part
- Replace the empty cylinder by filed cylinder and refit the flexible hose on the same after the deflating airlock in hose.
- Check the flexible hose connection for leakage due to cracks after opening the isolation valve
- Cap the empty cylinder and store it in cool dry place as it is still filled with gas vapour, leakage of same can also cause fire.
- The operator shall wear cotton clothes only, use of synthetic clothes may generate static charge and should therefore be avoided.
- Operator shall use cotton/rubber hand gloves to prevent the skin from cold burn in case of any accident LPG leakage.

OPERATING PROCEDURE OF WATER BATH TYPE VAPORIZER

- Switch on the vaporizer
- Ensure the sufficient water in vaporizer
- If water level is low top up the water
- The solenoid valve on the inlet of the vaporizer will open when the vaporizer temperature reaches 50-60 degree Celsius.
- Normally the solenoid valve opening temperature set at 55 degree

- Open inlet liquid LPG line to vaporizer after the water temperature reaches at temp 55 degree Celsius
- Open the vaporizer outlet valve from vaporizer to pressure regulating system.
- Keep the valve on upstream and downstream of pressure regulating system in open condition of LPG to user point.
- Monitor LPG pressure upstream and downstream of the pressure regulating system and the water temperature in the LPG vaporizer.
- The water temperature should not drop
- The LPG pressure upstream and downstream of vaporizer and pressure control valve should be maintained at constant value.
- There should not be any fluctuations in LPG pressure, irrespective of the flow
- The high temperature of cut of heater should be set at 85 degree Celsius maximum
- Replace the water of vaporizer every week
- Use soft water only. .

LPG GAS EMERGENCY PROCEDURES

- Check the entire system for ANY indication of gas leak, such as smell or hiss
- Test with soapy water solution which will bubble at any point where gas escapes
- Never use a match flame or plain water to test for a leak or use portable leak tester
- If the leak has been indoors fully ventilated the room before further ruse of appliance
- Do not interfere with any part of a fixed installation.

LEAK DETECTED NOT ON FIRE

- If possible stop the leak by shutting the cylinder valve.
- Ventilate the area thoroughly until the air is clear. .
- If its not possible to stop the leak remove the cylinder carefully to safe outdoor location
- Keep the leak uppermost so that only vapour and not liquid escapes.

- Keep hands and face clear of any stream of escaping liquid and where possible wear thermally insulated gloves.
- If the cylinder cannot be remove, disperse gas with fine water spray and provide maximum ventilator
- Keep possible ignition sources at least 20 meters away until cylinder is empty
- These sources could include open fires, non flameproof electrical appliances camera flash
- Telephone radio, vehicle engines, and any other equipment that can generate a spark

LEAKING CYLINDER OR APPLIANCE ON FIRE

- If the valve is undamaged and its safe to do so, close it and let the fire go out. Do not use again until inspected.
- If the valve cannot be closed call the fire brigade maintenance team or gas dealer, advising location that it is LPG and cylinder size.
- Keep cylinder cool by water hose but Do NOT attempt to extinguish flame.
- Unbrunt gases in confined space may explode if reignited.
- Keep clear and await assistance.
- In there is any possibility of cylinders(s)being engulfed by fie, evacuate the adjacent area. Avoid cylinder Exposure to Excessive Heat.
- Remove from heat source if safe and possible to do so.

The Don'ts that you should not.

- Don'ts keep cylinders in a horizontal position. Always keep the cylinder in upright position Don't hear the cylinder directly or indirectly.
- Check the cylinder for any leakage form "O" ring and valve before connecting Don't keep unconnected cylinders.
- Turn of the valve when cylinder is not in use.
- Restrict entry to authorized persons only.
- Don't store any extra material in the LPG shed.
- Don't allow battery operated instruments inside the LPG shed.
- Don't use any non flame proof electrical items inside the LPG shed.

- No smoking in the LPG Shed or area.
- NO naked flame anywhere inside the LPG shed or area .
- In case of a fire, customers must only use a D.C.P. type of a fire extinguisher or call the fire station.
- In case leakage cannot be controlled, the fire department must be notified.

SAFETY TIPS ON USING THE LPG INSTALLATION.

- Everyone involved in handling and using LPG should be given training on basic LPG product. Knowledge and safe handling to increase safety awareness and avoid bad practices which can result in accidents. Below are some safety tips consumers should be aware of.
- LPG is stored under pressure and any small gaps and pinholes can cause LPG to leak out. Pipes must never be stepped on or sued to hang kitchen equipment or other objects that may create undue force on it.
- The boiling point of LPG is low and any contact with bare skin can cause cold burns. People handling liquid LPG i.e. during bulk delivery should wear proper personal protection equipment (PPE) that includes suitable gloves, long sleeves ad eye goggles.
- LPG can be detected by means of its rotten egg odour. It is odorized in such a concentration that even the presence of a small amount of LPG is discernible by smell. Gas valves should be closed immediately once LPG is detected by smell and all ignition sources should be put out.
- Use leak detection fluid or soapy water to check for leaks on the piping system. Apply on all joints and hoses and check for bubbles which indicate a source of leak a source of leak. Never use naked flames.
- When appliances are disconnected from the gas piping for servicing or, removed to clean the area, the connection should be checked for vapour tightness when they are reconnected.
- Appliance gas valves should always be closed when the appliance is not being used. When LPG will not be used for an extended period of time, the main gas valve and LPG container valves should be shutoff for safety reasons.

➢ Never shake the cylinder or turn it upside down to draw out residual LPG. This may result in heavy ends clogging the valve and/or regulator.