



FORK LIFT TRUCKS TECHNICAL GUIDE





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LIQUEFIED
PETROLEUM
GAS (LPG)



LIQUEFIED PETROLEUM GAS (LPG)

WHAT IS LPG?

Liquefied Petroleum Gas (LPG) is a term used for Hydrocarbon gases that exist as vapour under ambient conditions of temperature and pressure, but which can be liquefied by the application of moderate pressure or refrigeration.

LPG is a very versatile, portable and manageable fuel. The two most common LPG gases are known as Propane and Butane. Calor Propane is used to power fork lift trucks.

CHECKLIST:

- Fork lift truck gas cylinders must be stored in a well ventilated area.
- Refillable fork lift truck gas cylinders must be refurbished or replaced after 10 years of use.
- Fork lift truck cylinders and valves should be inspected on a regular basis for damage (at least each time the cylinder is filled). Damaged cylinders must not be used and should be replaced.
- Check liquid hoses on your fork lift truck for damage and if found, the hose should be replaced by a competent person.
- Liquid LPG hoses should be replaced after 5 years. The year of manufacture is printed on the hose.
- Installation and maintenance of any electrical components on the fork lift truck LPG installation unit is the responsibility of the site operator and should be undertaken by a suitably qualified electrician in compliance with the ETCI and ATEX regulations.

It is the responsibility of the site operator to ensure all personnel involved in the operation and dispensing of LPG are suitably trained. Calor Gas can provide such training - see page 9 for details.

LIQUEFIED PETROLEUM GAS (LPG)

PROPERTIES AND CHARACTERISTICS

VAPOUR PRESSURE

The pressure LPG exerts in a vessel varies with temperature, the higher the temperature of the liquid the higher the vapour pressure, conversely the lower the temperature the lower the pressure.

This means LPG vessels must be protected from heat sources and protective safety distances are imposed on the siting and storage of LPG.

Propane has a vapour pressure of approximately 7bar (100psi) at 15°C. (Similar to the pressure found in a lorry tyre).

EXPANSION

When LPG in its liquid phase is heated, it expands rapidly. In order to allow for expansion LPG vessels are only filled between 80-87% of their capacity (by volume).

BOILING POINT

The boiling point is the temperature at which LPG boils and changes from its liquid to vapour state. The boiling point of Propane at atmospheric pressure is approximately -42°C.

COLOUR

LPG as a liquid is colourless and as a vapour cannot be seen.

SMELL

Pure LPG has no smell but for safety reasons a stenching agent is added (ethyl mercaptan) during production to aid detection by smell at very low levels.

VAPOURISATION

One volume of liquid will produce approximately 250 volumes of vapour.

LIQUID DENSITY

LPG liquid is lighter than water and therefore floats on top of it in a similar way to oil and petrol. Consequently, LPG vessels must be sited away from drains and gullies.

VAPOUR DENSITY

LPG vapour is heavier than air. Any escape will find its way to the lowest level where it can remain and form a flammable mixture.

FLAMMABILITY

When LPG is mixed with air, a highly flammable mixture is produced. The flammability range is between 2% to 11% by volume of gas in air. Outside this range any mixture is either too weak or rich to propagate flame.

TOXICITY

LPG is non-toxic but at very high concentrations in the air, LPG vapour is anaesthetic and subsequently can asphyxiate by diluting or decreasing the available oxygen.

SEARCHING

LPG in both its liquid and gaseous state has a very low viscosity and will flow easily, in a manner similar to water or petrol etc. As a result, special-jointing compounds are used for LPG installations.

CHEMICAL REACTION

LPG is aggressive to certain non-metallic materials like natural rubber and many plastics; therefore equipment and hoses must be suitable for LPG.

PERSONAL SAFETY AND TRAINING

CALOR

PERSONAL SAFETY AND TRAINING

TRAINING

Any person responsible for, or involved with the operation and dispensing of LPG, should have an understanding of the physical characteristics of the product and be trained in the operation of all ancillary equipment.

At Calor we are committed to ensuring both new and existing customers are trained to the highest possible levels and aim to work in partnership with them to ensure safe refuelling procedures are followed every time.

Calor have developed a formal 'LPG Fork Lift Trucks Refuelling Training Course', which new and existing customers can take advantage of. To find out more, or to arrange a training session, contact your Calor sales representative or Calor Customer Support on: ROI: 1850 812 450 NI: 028 9045 5588

Alternatively, simply visit our website www.calorgas.ie/lpg-vehicles/lpg-training/ and complete the contact form.

PERSONAL PROTECTIVE EQUIPMENT (P.P.E.)

Owing to its rapid vaporisation and consequent lowering of temperature, LPG, particularly liquid, can cause severe frost burns if brought into contact with the skin.

P.P.E. appropriate for use with LPG must always be worn when the refuelling operation is taking place:

- Neoprene gloves, preferably gauntlets (or similar, impervious to LPG liquid)
- Goggles or face shield
- Long sleeved cotton overalls
- Safety footwear.





FORK LIFT TRUCK
REFUELLING

FORK LIFT TRUCK REFUELLING

BULK TANKS

The LPG storage vessel is the property of Calor Gas. Any fault or damage occurring to the storage vessel or components should be reported to Calor Gas immediately.

| | |
|------------------------------|-------------------------------|
| During business hours phone: | Outside business hours phone: |
| ROI: 1850 812 450 | ROI: 01 291 6229 |
| NI: 028 9045 8466 | NI: 0845 075 5588 |

SITING OF LPG STORAGE VESSELS

For safety reasons, minimum separation distances are required between the storage vessel and potential hazards. Storage areas should be a safe distance from boundaries, buildings and fixed sources of ignition.

Storage of bulk tanks should be secure to prevent tampering by unauthorised persons.

Signage should be on display around the storage area to prohibit smoking and the use of naked flames.

SEPARATION DISTANCES FOR ABOVE GROUND BULK TANK SITING

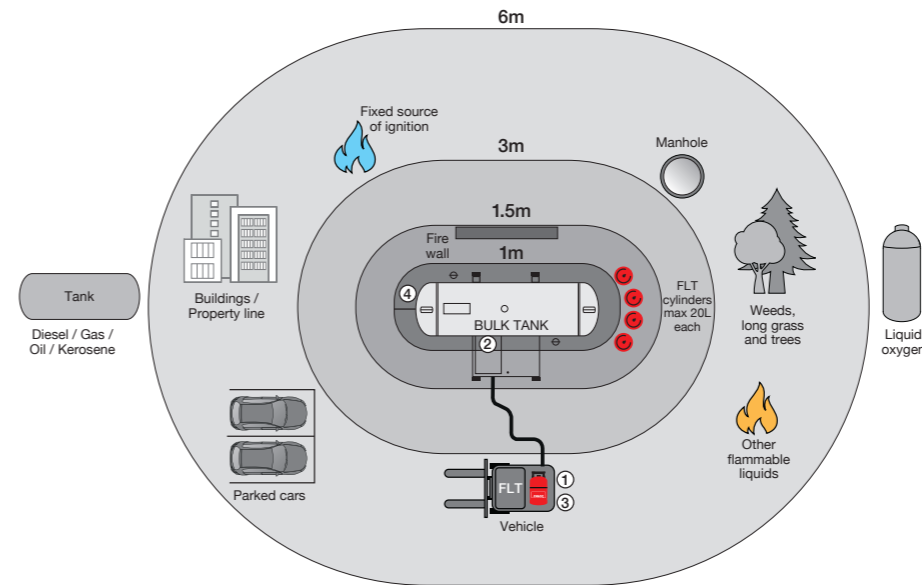
| LPG capacity (tonnes) | Distance from buildings, boundaries, property lines or fixed source of ignition | | Minimum distance between vessels (metres) |
|-----------------------|---|-------------------------|--|
| | Without fire wall (metres) | With fire wall (metres) | |
| 0.05 to 0.25 | 2.5 | 0.3 | (0.3*) |
| Up to 1.1 | 3 | 1.5 | 1 |
| Up to 4 | 7.5 | 4 | 1 |
| Up to 60 | 15 | 7.5 | 1.5 |
| Up to 150 | 22.5 | 11 | ¼ of sum of the diameter of 2 adjacent vessels |
| >150 | 30 | 15 | ¼ of sum of the diameter of 2 adjacent vessels |

*This is increased to 1m in NI.

Additional notes:

1. Overhead cables with a voltage of less than 1.0KV should be sited at least 1.5m from a plane drawn from the edge of the vessel. This distance shall be increased to 10m for cables rated above 1.0KV.
2. The separation distances are measured from the edge of the vessel.
3. Adequate crash protection is required to prevent damage to any part of the installation.

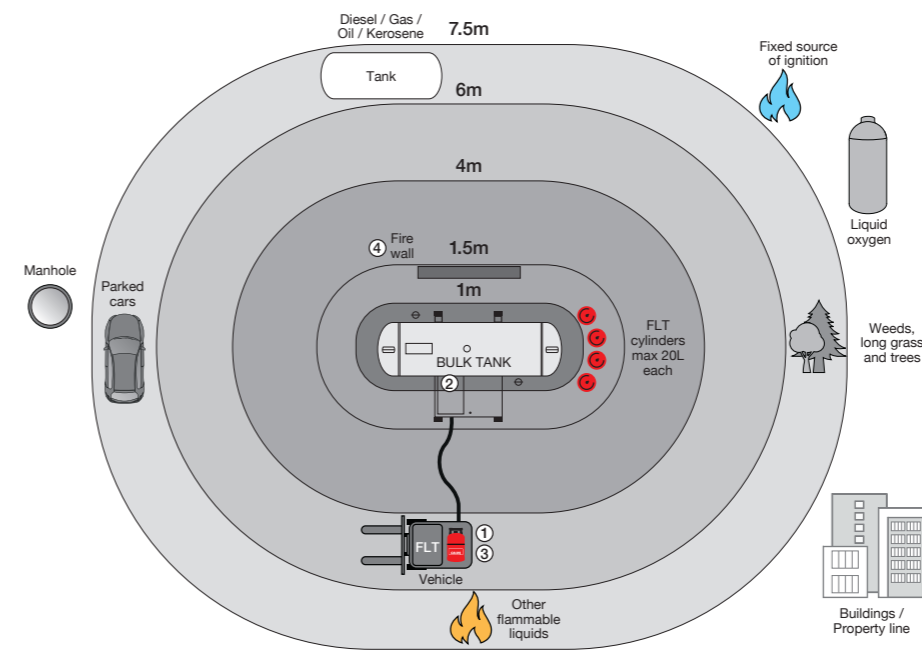
SEPARATION DISTANCES FOR BULK TANKS OF UP TO AND INCLUDING 2,000L CAPACITY



Notes:

1. The vehicle must be at least 3m from any manhole during filling.
2. The pump assembly must be at least 4.5m from buildings, boundary, property or fixed source of ignition.
3. The vehicle must be at least 4m from buildings, boundary, property or fixed source of ignition during filling.
4. With a firewall in place, the distance from the tank to buildings, boundary, property or fixed source of ignition may be reduced from 3m to 1.5m. Firewalls should be sited between 1m and 1.5m from the nearest point of the tank.

SEPARATION DISTANCES FOR BULK TANKS OF GREATER THAN 2,000L CAPACITY*



Notes:

1. The vehicle must be at least 3m from any manhole during filling.
2. The pump assembly must be at least 4.5m from buildings, boundary, property or fixed source of ignition.
3. The vehicle must be at least 4m from buildings, boundary, property or fixed source of ignition during filling.
4. With a firewall in place, the distance from the tank to buildings, boundary, property or fixed source of ignition may be reduced from 7.5m to 4m. Firewalls should be sited between 1m and 1.5m from the nearest point of the tank.

*A Calor energy advisor will advise on the requirements for individual circumstances where the bulk tank capacity exceeds 9,000L.

FORK LIFT TRUCK REFUELLING REFILLABLE CYLINDERS

SAFETY AT REFUELLING LOCATION

- No smoking, naked flames or source of ignition should be permitted in the vicinity.
- Warning signs to this effect must be displayed.
- Suitable fire extinguishers (dry powder 9kg) should be sited adjacent to the installation.
- Ensure vehicle parking minimum distances are adhered to.
- Protect vessels and equipment from damage caused by impact.
- P.P.E. – protective gloves and safety goggles must be available.

SAFETY - OPERATING CONDITIONS

1. Ensure the cylinder is in test date. For Calor cylinders, check the marking inside the cylinder shroud or on coloured ring under service valve - (V Indicates Visual Test Date, H indicates Hydraulic Test Date). If beyond test date year they MUST NOT be filled.
2. Ensure the cylinder to be filled is identified as an LPG cylinder for fork lift truck use. A Calor Gas Cylinder can be identified by either the appropriate embossing or labelling.

3. Ensure the cylinder has been designed and manufactured to a recognised specification and subsequent to 1989, BS 5045:Pt2.
4. Ensure that cylinders supplied with a bulk installation are fit for filling. Users should ensure that damage or maltreatment does not take place.
5. Damaged cylinders must be set aside and not used. Contact Calor Customer Support to source a replacement.
6. The filling hose should be inspected prior to use on every occasion as damaged hoses can result in serious accidents. Hoses should be maintained and in good condition. If damaged or out of date (5 years from manufacture date on hose), they should be replaced by a competent person.
7. The appropriate P.P.E. must be worn when refuelling.

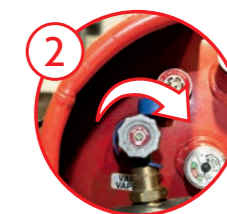
Note: Nylon overalls/jacket can produce static electricity, which could be a source of ignition.

FORK LIFT TRUCK REFUELLING PROCEDURE

LPG FORK LIFT TRUCK REFUELLING PROCEDURE

1. Park fork lift truck 3 metres from storage vessel and switch 'OFF' engine. Engage hand brake. Put on P.P.E. – gloves and goggles.
2. Close 'OFF' cylinder service valve by turning valve fully clockwise.
3. The cylinder can be filled on the truck or removed. If the cylinder is removed for the filling procedure, it must be in a horizontal position with the locating pin at the six o'clock position.
4. Check contents gauge (A) and fixed liquid level valve (B) to ensure cylinder is not already full.
5. Remove cylinder filler valve dust cap. Check that the filler valve neoprene-sealing ring is in place and is undamaged.
6. Connect dispenser gun nozzle to cylinder filler valve. Tighten by turning valve union fully clockwise. Open dispenser gun nozzle by depressing the gun lever and locking into place by pulling latch back.
7. Slacken cylinder fixed liquid level valve by turning anti-clockwise. An audible 'hissing' sound will be heard. This is gas vapour venting. (If white vapour cloud present, do not attempt to fill. Re-check contents gauge.)
8. To commence filling:
 - 8A. **MANUAL / HAND PUMP** – crank pump handle back and forth. Monitor contents as filling.
 - 8B. **ELECTRIC PUMP** – switch on pump by pressing the push button.
9. When white vapour cloud appears at fixed liquid level valve:
 - 9A. **MANUAL / HAND PUMP** – stop cranking
 - 9B. **ELECTRIC PUMP** – release push button to stop the pump.
10. Close 'OFF' fixed liquid level valve by turning valve fully clockwise. Close 'OFF' dispenser gun nozzle valve by depressing lever and releasing the latch. White vapour trapped between the nozzle and the filler valve is vented to atmosphere.
11. Disconnect filler gun nozzle from cylinder filler valve and stow safely. Replace dust cap. Ensure all valves on the storage tank are closed at all times when the installation is not in use.

Note: DO NOT disconnect dispenser gun from filler valve if gas vents continuously. **CAUSE:** Filler valve seating is open because of ingress of dirt or grit or seal damaged. **CURE:** Attempt to dislodge dirt by tapping valve firmly with a rubber or wooden mallet until gas stops.





CALOR
LIGHTWEIGHT
CYLINDER





CALOR LIGHTWEIGHT CYLINDER 13KG PROPANE - INSTRUCTIONS FOR USE

1. Park truck in a well-ventilated area outdoors, away from any source of ignition, apply handbrake and turn off ignition. Ensure you are wearing suitable P.P.E. – gloves/goggles/safety boots.
2. If replacing an empty cylinder:
 - Close outlet valve on cylinder. Turn clockwise to close.
 - Turn black handle on the hose adaptor 90° to stop gas flow.
 - Turn handle a further 90° to unlock and remove adaptor from the cylinder.
3. Secure new full cylinder in place, with arrow pointing down.
 - Check valve on the cylinder is closed. (Turn clockwise to close.)
 - Ensure black handle on the adaptor is in the unlock position. (Fig. 1 - small arrow on handle of adaptor pointing towards cylinder valve).
4. Push adaptor onto the valve and turn the handle 90° to lock in place. (Fig. 2)
 - Turn handle a further 90° to open gas valve. (Fig. 3)
 - Open the cylinder valve slowly to establish gas flow. (Turn anti-clockwise.)



LPG CYLINDER STORAGE

LPG CYLINDER STORAGE MINIMUM REQUIREMENTS

- LPG cylinders must be stored in an upright position in a well-ventilated area, preferably in the open air.
- The storage area surface should be load bearing.
- Storage of cylinders should be secure to prevent tampering by unauthorised persons.
- Appropriate signage should be on display around the storage area to prohibit smoking and the use of naked flames.



Extremely flammable
LPG



No smoking
No naked lights



- LPG cylinder storage areas must be at least 2 metres (NI) / 3 metres (ROI) from openings to cellars, drains or basements.
- The whole of the storage area must be maintained at ALL times and be free from weeds, long grass and non-combustible materials.
- Storage areas should be a safe distance from boundaries, buildings and fixed sources of ignition.
- Stored cylinders should not impede or endanger a means of escape.
- Electrical equipment within 2 metres of storage must be flameproof to the required standard.
- Suitable fire extinguishers (dry powder) should always be available in the storage area.

LPG CYLINDERS SHOULD NOT BE STORED:

- In areas where combustible materials are stored.
- Below ground level in basements or in cellars.
- In close proximity to an LPG bulk tank.

IF A CYLINDER IS FOUND TO BE LEAKING:

- If a leak is detected from a cylinder do not continue to use the cylinder.
- Remove the cylinder to an open-air ignition free area.
- Contact your gas supplier immediately – any faults with cylinders must be reported to your Calor supplier.

EMERGENCY INFORMATION

ACTION IN CASE OF AN LPG FIRE:

- Raise the alarm. The Fire Brigade and Calor Gas should be notified immediately.
- Fires should normally be controlled but not extinguished until any source of gas escape can be cut off.
- If it is safe to do so, close tank valves in circumstances where a leak in pipework has ignited. Isolate all valves upstream and downstream to starve the fire of gas.
- A small fire can be dealt with using a dry powder fire extinguisher. Do not use water to attempt to extinguish LPG fires.
- Vessels should be cooled with water to prevent a pressure build-up.

ACTION IN CASE OF A GAS LEAK:

- Raise the alarm. The Fire Brigade and Calor Gas should be notified immediately.
- Evacuate all persons, except those necessary to deal with the emergency.
- Whenever possible, and if it is safe to do so, turn off all isolation valves necessary to cut off or reduce the source or sources of escaping gas.
- Remove sources of ignition.
- Do not move vehicles.
- Keep everyone away from the area in which the gas vapour is spreading.
- Alert neighbours to the danger especially if there are nearby cellars or basements.

CALOR CONTACT

During business hours phone:

ROI: **1850 812 450**

NI: **028 9045 8466**

Outside business hours phone:

ROI: **01 291 6229**

NI: **0845 075 5588**

REFERENCES

LIQUEFIED PETROLEUM GAS CODES OF PRACTICE

UKLPG CoP1 Pt1 Installation & maintenance of fixed bulk LPG storage at consumer premises.

UKLPG CoP3 Recommendations for prevention & control of fire involving LPG.

UKLPG CoP7 Storage of full and empty LPG cylinders and cartridges.

UKLPG CoP11 Recommendations for the safe handling of LPG used as an internal combustion engine fuel for motor vehicles.

UKLPG CoP20 Automotive LPG refuelling facilities.

REGULATIONS

Republic of Ireland: Safety, Health and Welfare at Work Act 2005.

Northern Ireland: Health & Safety at Work (Order) NI 1978.

IRISH AND EU STANDARDS

IS3213 Code of Practice for the Storage of LPG Cylinders and Cartridges.

IS3216 Code of Practice for the Bulk Storage of Liquefied Petroleum Gas.

IS291 The Use, Siting, Inspection and Maintenance of Portable Fire Extinguishers.

ISEN13760 Automotive LPG Filling System for Light and Heavy Duty Vehicles – Nozzle, Test Requirements and Dimensions.

ISEN60079 Electrical apparatus for explosive gas atmospheres.

ETCI ET 105 National Rules for Electrical Installations in Potentially Explosive Atmospheres (including amendments No. 1 and No. 2).

BRITISH STANDARDS

BS4089 Specification for hoses & hose assemblies for LPG.

BS 7671 Requirements for electrical installations.

BSEN 1762 Rubber hoses and hose assemblies for LPG.

BSEN 60079 Electrical apparatus for explosive gas atmospheres.

Note: All specified documents are current editions.



Calor contact:

For information, advice and support on all Calor products and services, contact our Customer Support Team.

ROI: 1850 812 450
NI: 028 9045 5588

In the event of an emergency outside office hours, please dial:

ROI: 01 291 6229
NI: 0845 075 5588

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