CALOR

# Calor for Forklift Trucks

## Technical Guide


CAI

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CALOR

# Liquefied Petroleum Gas
(LPG)

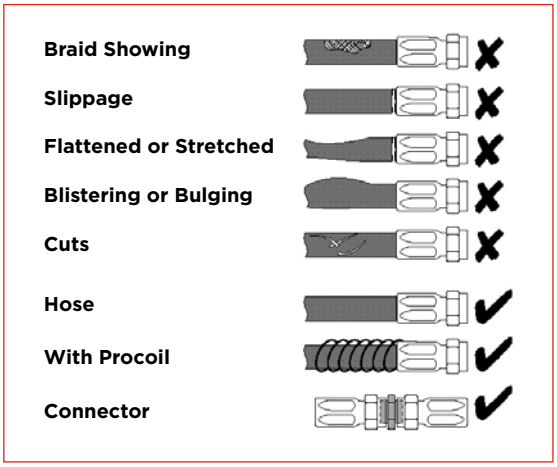
# What is LPG?

**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 forklift trucks.**

# Checklist:

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




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.

# 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 7 bar (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 to 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% and 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.


OPEN
CLOSE

# Personal safety and training

## Training

Any person responsible for, or involved with, the operation and dispensing of LPG must 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 standards and aim to work in partnership with them to ensure safe refuelling procedures are followed every time.

Calor have developed a formal 'LPG Forklift 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: 01 450 5000**
**NI: 028 9045 5588**

## 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 Anti-Static and Flame Retardant (ASFR) overalls
- Safety footwear.

# Forklift truck refuelling

# Forklift 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 must be reported to Calor Gas immediately.

| During business hours: | Outside business hours: |
|---|---|
| **ROI: 01 450 5000** | **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 must be a safe distance from boundaries, buildings and fixed sources of ignition. Storage of bulk tanks must be secure to prevent tampering by unauthorised persons. Signage must 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 must 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.

# Refillable Cylinders

## Safety at refuelling location

- No smoking, naked flames or source of ignition must be permitted in the vicinity.
- Warning signs to this effect must be displayed.
- Suitable fire extinguishers (dry powder 9kg) must 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 and used.

## Safety - operating conditions

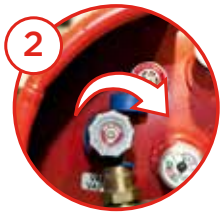
1. Ensure the cylinder is in test date. For Calor cylinders, check the marking inside the cylinder shroud or on coloured ring under service valve - (V Indicates Visual Test Date, H indicates Hydraulic Test Date). If beyond test date year, they MUST NOT be filled.
2. Ensure the cylinder to be filled is identified as an LPG cylinder for forklift 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 must 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 must be inspected prior to use on every occasion as damaged hoses can result in serious accidents. Hoses must be maintained and in good condition. If damaged or out of date (5 years from manufacture date on hose), they must be replaced by a suitably qualified person.
7. The appropriate P.P.E. must be worn when refuelling.

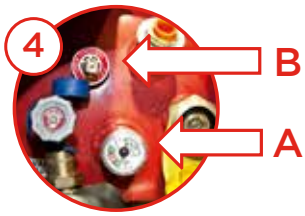
Note: Nylon overalls/jacket can produce static electricity, which could be a source of ignition.

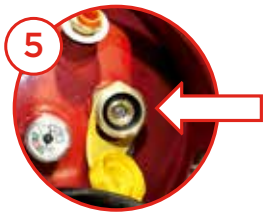
# Procedure

## LPG Forklift Truck Refuelling Procedure

1. Park forklift 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 anticlockwise. 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.


13kg Propan

# Calor lightweight cylinder


CALOR
13kg Propane

# 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.)

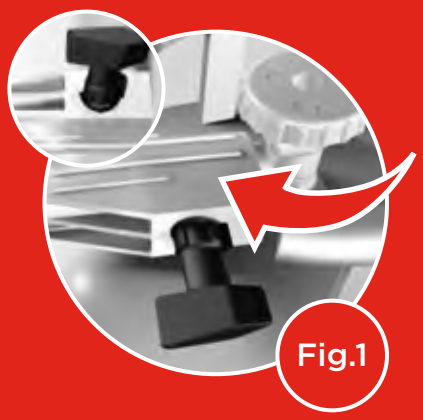


Fig.1

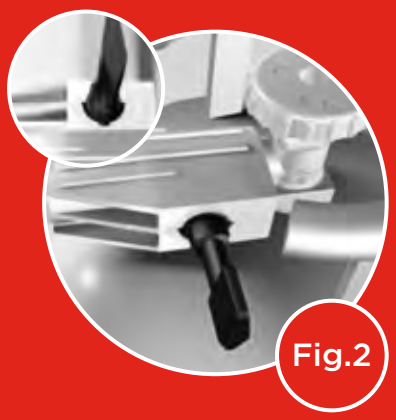


Fig.2

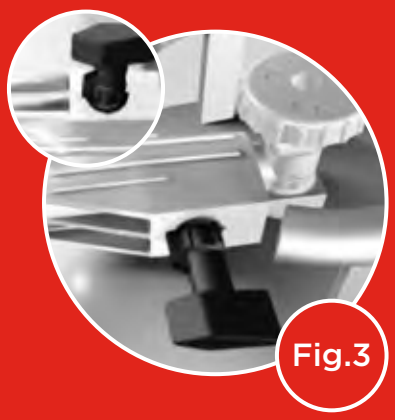


Fig.3


# 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 must be load bearing.
- Storage of cylinders must be secure to prevent tampering by unauthorised persons.
- Appropriate signage must be on display around the storage area to prohibit smoking and the use of naked flames.


- 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 must be a safe distance from boundaries, buildings and fixed sources of ignition.
- Stored cylinders must 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) must always be available in the storage area.

## LPG cylinders must 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 must 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 must 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 must 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:

**ROI: 01 450 5000**
**NI: 028 9045 8466**

Outside business hours:

**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.

IS 10101 National Rules for Electric Installations

## 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.

## Contact us:

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

**ROI: 01 450 5000**
**NI: 028 9045 5588**

In the event of an emergency outside office hours:

**ROI: 01 291 6229**
**NI: 0845 075 5588**

**Email: customerengineering@calorgas.ie**
**www.calorgas.ie**

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Calor complies with the International Organisation for Standardisation ISO 9001.