



LPG Power Fork-lift Trucks

A guide to safe refuelling

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Introduction

The following is a guide for safe refuelling of LPG powered fork-lift trucks (FLT).

This presentation has been produced as part of a training package that will aim to instruct a fork-lift truck operator in the correct and safe operation of the refuelling equipment necessary for refilling “Calor 29 litre” cylinders and “Calor Fixed Fuel Tanks” (FFT’s).

Note: Where non-Calor cylinders or tanks are used, please refer to the relevant manufacturers instructions for additional guidance.

This presentation covers relevant safety instructions and safety notes for the use on both electric pump dispensers and hand operated units. We recommend that all FLT operators are fully familiar with the contents of this booklet.

The contents of this booklet will be discussed during your training.

If you have any queries **ASK YOUR INSTRUCTOR/ TRAINER, SUPERVISOR OR MANAGER.**





Liquefied petroleum gas

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.

Liquefied Petroleum Gases originate from two main sources.

The first is from oil and/or natural gas fields where they are removed as condensable products from natural gas.

The second, and traditional source of LPG is from oil refineries where crude oil is processed.

The two most common LPG gases are known as Commercial Propane and Commercial Butane.

Commercial Propane (also known as Calor Propane) is used to power fork-lift trucks.

Liquefied petroleum gas properties

- **Behaviour:** LPG exists as a gas at normal atmospheric pressures and temperatures, but may be liquefied by the application of a moderate pressure. If the pressure is reduced the liquid will revert to a vapour.
- **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 sitting 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 during production to aid detection by smell at very low levels.
- **Vaporisation:** 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 air LPG vapour is anaesthetic and subsequently an 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

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.

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 faceshield.
- Long sleeved cotton overalls.
- Safety footwear.



Eye protection, such as goggles



Safety footwear



LPG resistant gloves



Hazardous places & Area classification

The requirements of the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) apply to LPG storage installations and their surroundings.

Hazardous places are defined as places in which an explosive atmosphere may occur in such quantities as to require special precautions to protect the health and safety of the workers concerned.

Hazardous places are classified into zones on the basis of the frequency and duration of the occurrence of an explosive atmosphere.

Within the hazardous places:

- Fixed sources of ignition (i.e. pilot lights, naked flames) should be prohibited.
- Smoking should be prohibited.
- All other potential sources of ignition should be controlled.
- Only vehicles associated with the product transfer and handling operations should be permitted.
- Only equipment suitable for use in zoned areas and constructed to a recognised standard (e.g. BS EN 50014) should be installed.
- Electrical equipment should be suitable for the zoned area in which it is installed.



Housekeeping

Housekeeping is one of the most important items influencing the safety of the Calor Gas Installation.

No smoking, no naked lights or other sources of ignition, including the use of mobile phones, pagers, or radio transmitters, are permitted in the vicinity of the installation.

- All emergency exits and gangways to be kept clear at all times.
- Do not ignore the hazard signs or remove them. (Or put your emergency sign here).
- The area must be kept free from long grass, weeds, rubbish, and other readily ignitable or hazardous materials.
- Do not park vehicles (except for during refuelling) inside the safety distances.



EMERGENCY SERVICE NUMBER
03457 444 999

Cylinder storage

Any faults identified on cylinders must be reported to your Calor Customer Operations Centre.

- LPG cylinders should always be stored upright on their bases in a well-ventilated position, preferably in the open air.
- Never store in cellars or basements.
- There should be no opening to cellars or drains within 2 metres of the storage area.
- Storage floor to be load bearing.
- Storage area to be free of combustible materials and sources of ignition.
- Access/exit should not be impeded to prevent means of escape.
- Storage must be secure.
- Suitable fire extinguishers (Dry Powder) to be available within the storage area.
- Appropriate warning notices must be displayed.

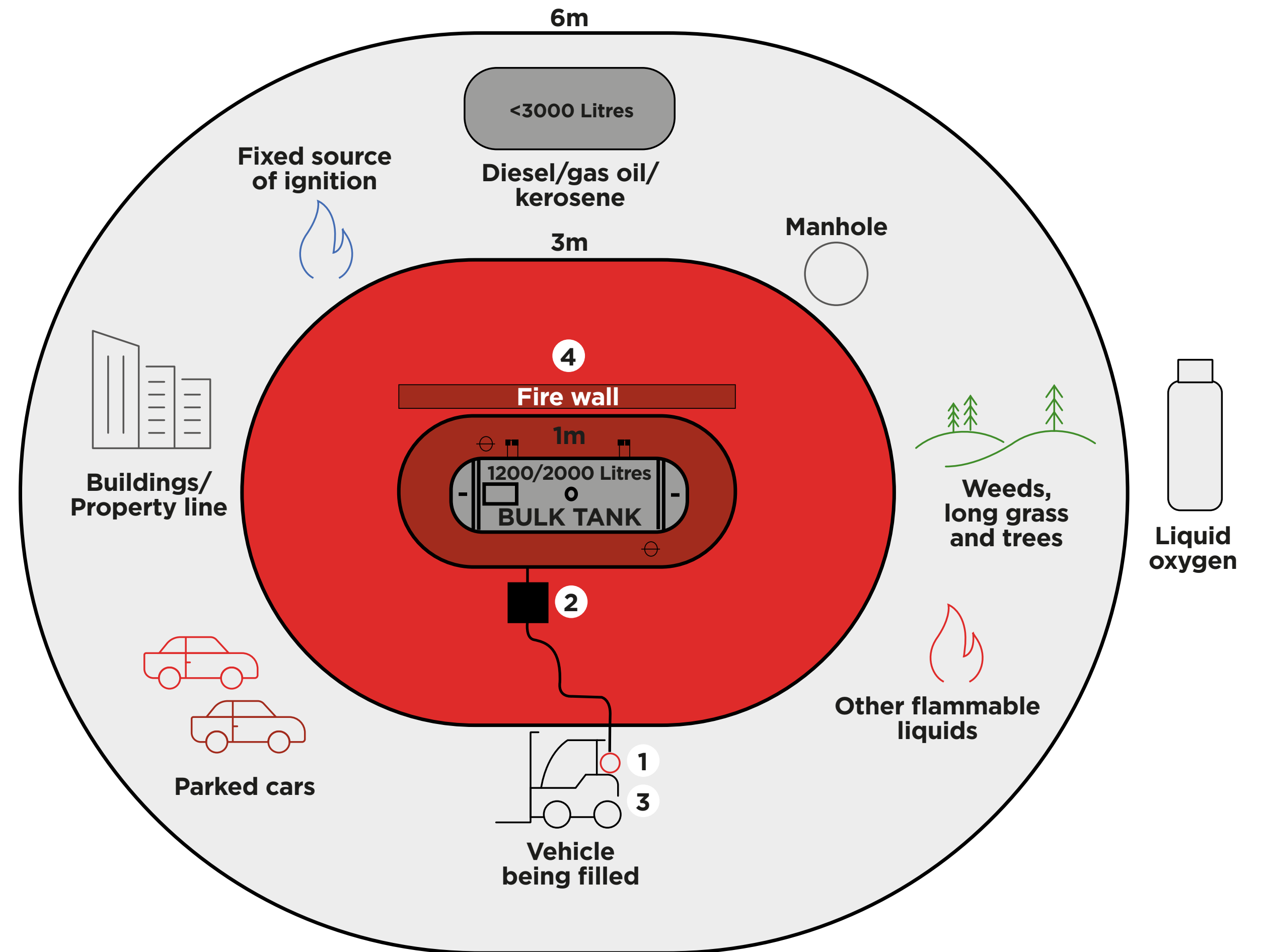


Bulk gas - Separation distances

Separation distances for 1200Ltr or 2000Ltr bulk tanks

Notes:

- 1** The vehicle must be at least 3m from any manhole during filling.
- 2** The pump assembly must be at least 3m from buildings, boundary, property or fixed source of ignition.
- 3** Dispensing hose anchoring point at least 4.1m from buildings, boundary or fixed source of ignition.
- 4** Fire walls should be sited a minimum of 1m from the nearest point of the vessel and should not be less than the height of the vessel. With the wall in place, the distance from the vessel to the buildings, boundary etc. may be reduced from 3m to 1.5m.



Bulk gas - Separation distances

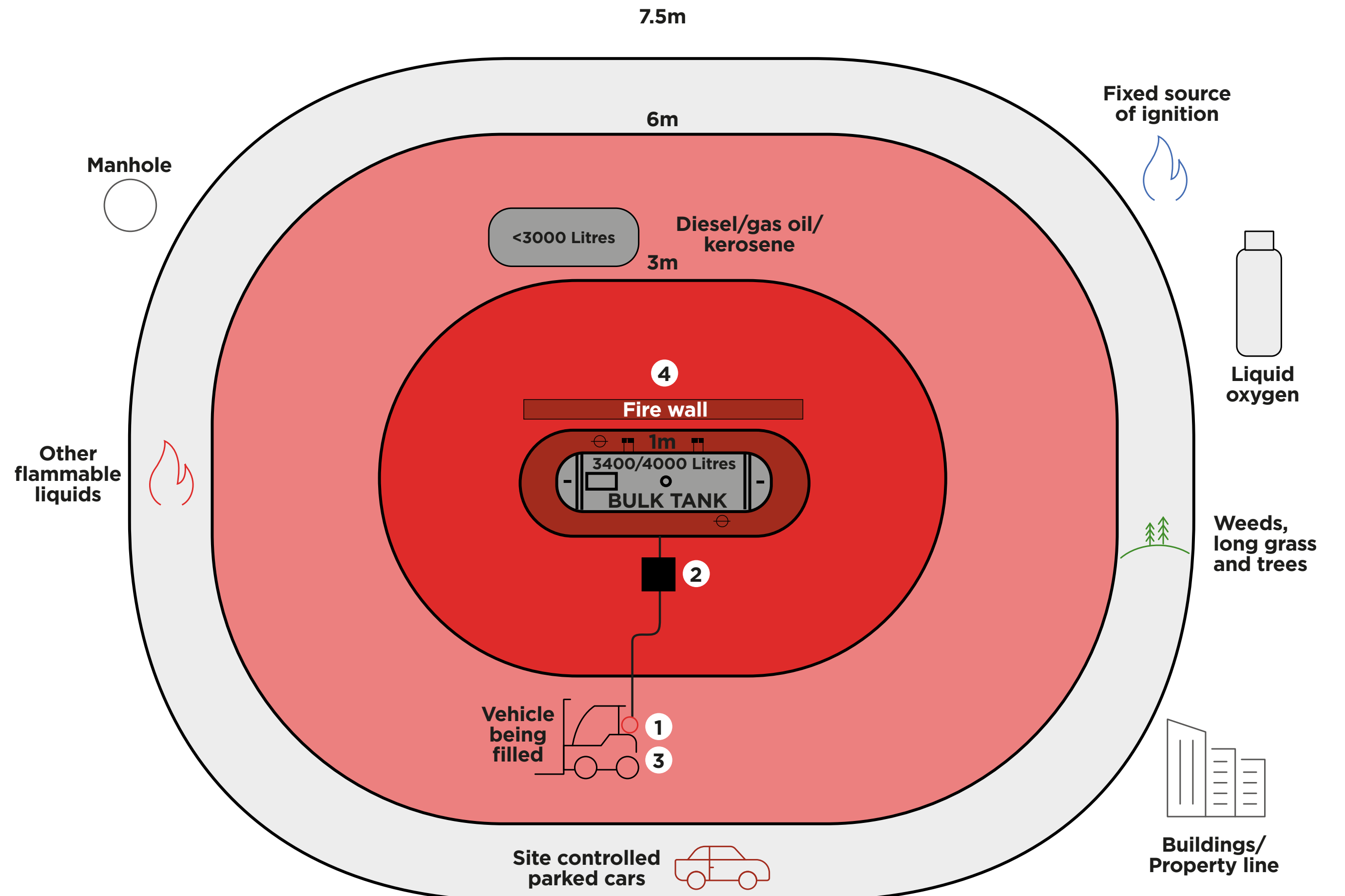
Separation distances for 3400Ltr or 4000Ltr bulk tanks

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** Dispensing hose anchoring point at least 4.1m from buildings, boundary or fixed source of ignition.
- 4** Fire walls should be sited between 1m & 1.5m from the nearest point of the vessel. With the wall in place the distance from the vessel to the buildings, boundary etc. may be reduced from 7.5m to 4m.

Other notes:

- A** 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.
- B** The separation distances are measured from the edge of the vessel.
- C** Adequate crash protection is required to prevent damage to any part of the installation.



Cylinder identification

29 Litre Automotive Cylinder Controls and Valves

- 1 Service valve
- 2 Fixed liquid level valve
- 3 Relief valve and dust cap
- 4 Contents gauge
- 5 Filler valve and dust cap
- 6 Location hole

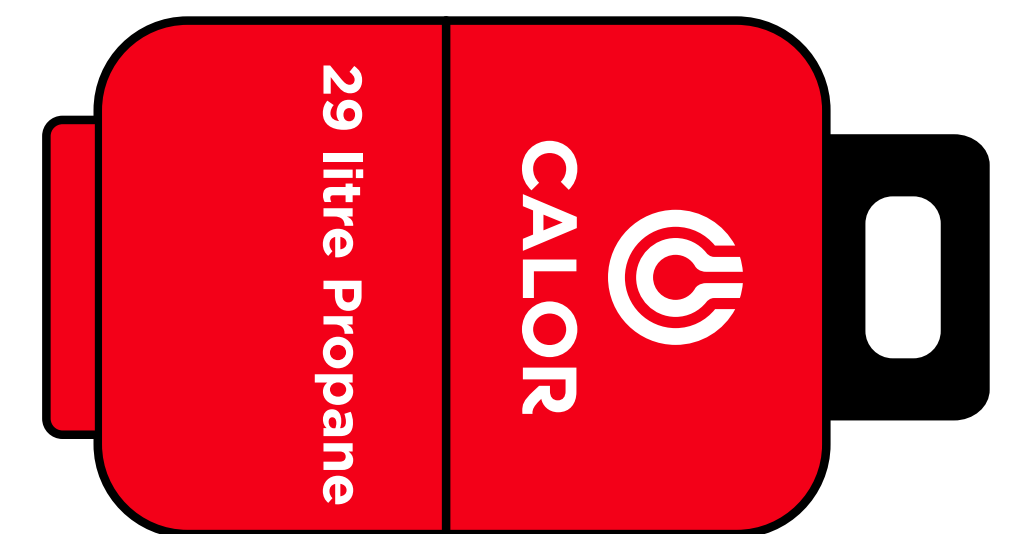
Valve locations may vary on some cylinders



29 litre automotive cylinders are identified by their red body colour and black shroud. They are designed to be used in the horizontal position.

Always ensure the cylinder is secured on the fork-lift truck using the brackets provided.

Propane capacity:	29 litres
Off-take:	Liquid
Mounted:	Horizontally
General use:	Fork-lift trucks
Dimensions:	710mm long 320mm dia.
Typical cylinder weight (empty):	25kg
Typical cylinder weight (full):	40kg



LIQUID OFF_TAKE
Horizontally mounted (BLACK TOP)



Fixed fuel tank identification



- 1 Service valve
- 2 3 Relief valve and dust cap
- 4 Contents gauge
- 5 Filler valve and dust cap
- 6 Location hole

Valve locations may vary on some cylinders.

FFT's are designed to be used in the horizontal position with the valves at 45° only (see above), otherwise they will not fill correctly and the float gauge will read incorrectly.

It is important to ensure the cylinder is placed on the fork-lift truck with the locating feet at the bottom, and secured using the brackets provided.

Water capacity:	55 litres	70 litres
Propane capacity:	44 litres	56 litres
Off-take:	Liquid	Liquid
Mounted:	Horizontally	Horizontally
General use:	Fork-lift trucks	Fork-lift trucks
Dimensions	650mm long	810mm long
	360mm dia.	360 dia.
Typical weight (empty):	27kg	31kg
Typical weight (full):	55kg	67kg





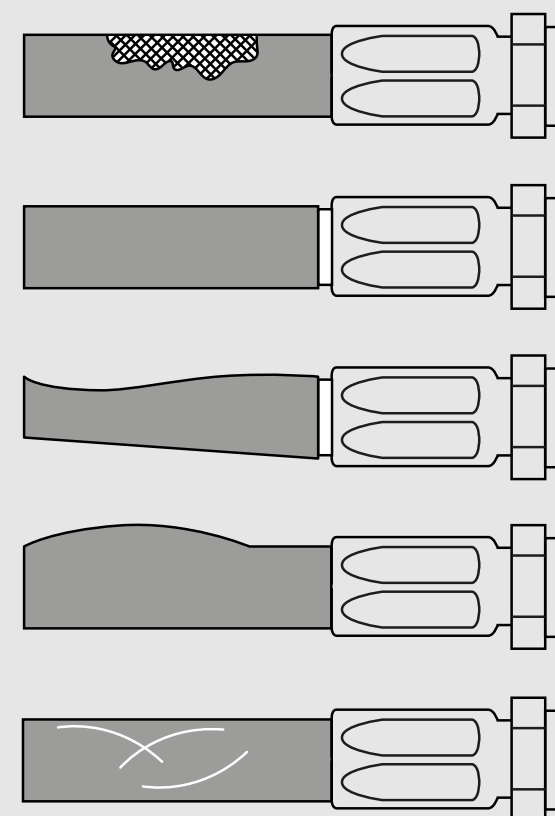
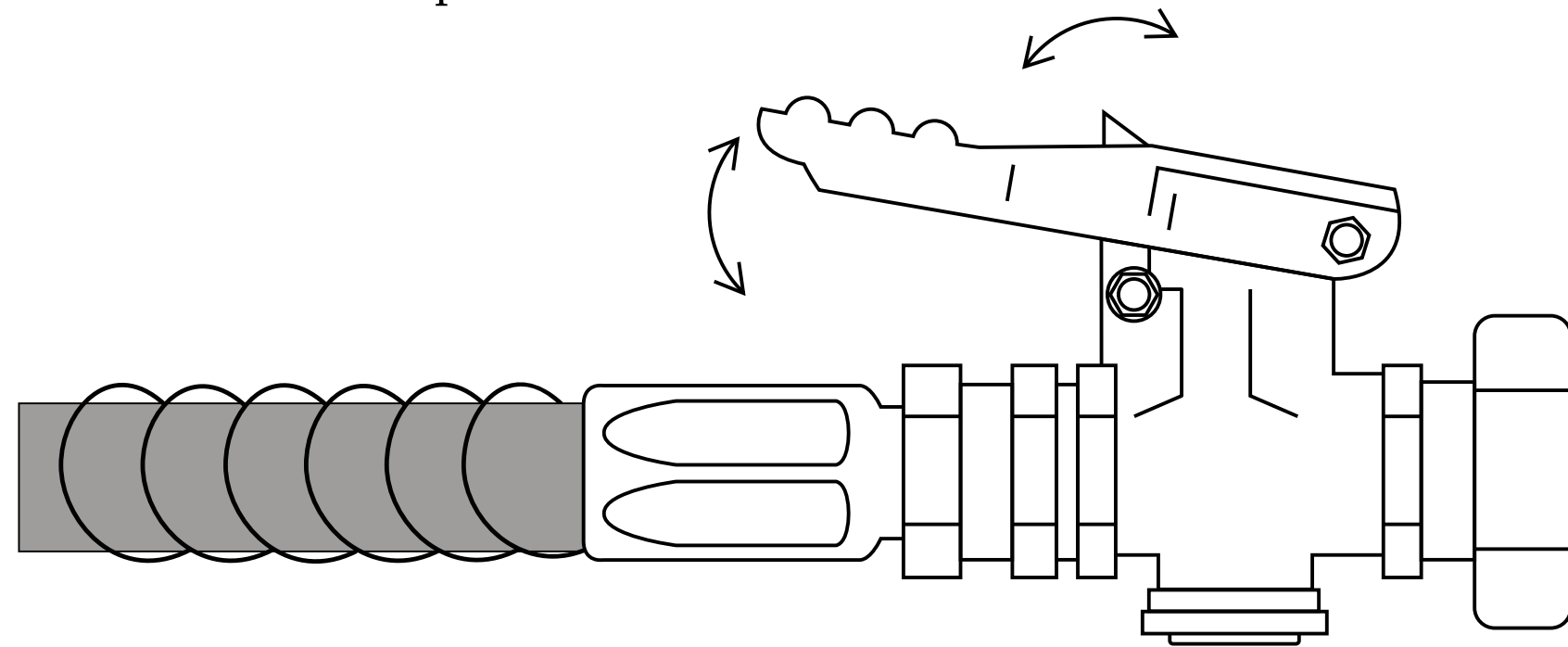
29 Litre cylinder & FFT installation

- Care must be taken to ensure LPG cylinders & FFT's are correctly positioned and secured on the fork-lift truck to avoid damage and ensure safety.
- The cylinder or FFT must not overhang the body of the FLT and must be secured to prevent movement.
- Cylinders or FFT's must always be fitted to the FLT in the correct orientation with the arrow located on the end pointing downwards (see below). For 29 litre cylinders this is with the location hole in the shroud at the lowest point.
- When handling or lifting a cylinder or FFT, consideration must be given to its weight and extreme care taken during its movement to prevent injury to the operative or damage to the cylinder.
- **Never fill 29 litre cylinders in the vertical position.**

Key installation equipment

It is important that the filling hose should be inspected prior to use on every occasion, as damaged hoses can result in serious accidents.

When the hose is fitted with a procoil, this should also be maintained in a good condition. If any damage is detected, do not use the hose and immediately contact your Calor Customer Operations Centre.



Braid showing

Slippage

Flattened or stretched

Blistered or bulging

Cuts

Typical Hose Defects

- Leakage from hose or end fittings.
- Evidence of kinking, flattening or stretching.
- Cuts or abrasions in the outer cover.
- Soft spots in hose – pay attention to 400mm length adjacent to end fittings.
- Damaged end fittings.
- Damaged, cut, flattened or detached.



Filler nozzle

- Do not drop the filling connection or drag along the ground. This will result in damage to the union connection and allow the ingress of foreign matter onto the valve seat which may result in a subsequent leakage.



Dead Man's Switch

- Do not wedge or lock the switch in the on position.
- Check the cable entries, glands and covers are in good condition and secure.

Key installation equipment

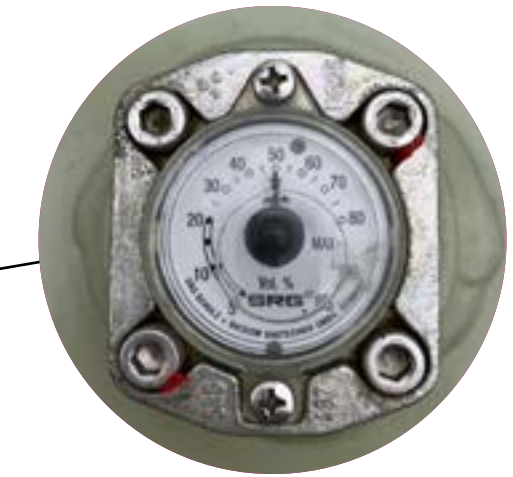
Typical Hand Dispenser Unit (HDU) Installation



Filler nozzle and holder



Shut off valve – for operational and emergency use



Vessel contents gauge



Hand dispenser unit complete with pullaway coupling

Key installation equipment

Typical Fixed Electric Dispenser Unit (EDU) Installation



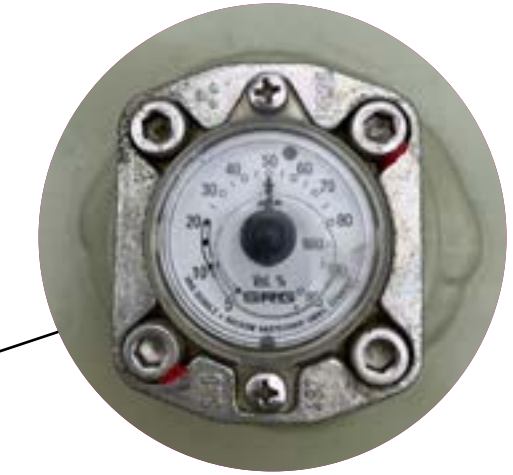
Filler nozzle and holder



Electric pump control switch



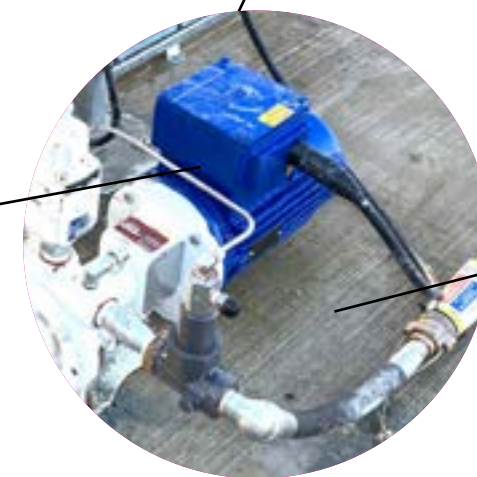
Bypass return and emergency isolating valve



Vessel contents gauge



Shut off valve for operational and emergency use



Hose pullaway coupling

Electric pump with fisher back pressure valve

Refuelling instructions

Operators must be trained to fill liquid off-take, Calor refillable 29 litre cylinders & Fixed Fuel Tanks (FFT). Ensure that suitable Personal Protection Equipment is used when the refuelling operation is taking place.

No smoking, no naked lights or other sources of ignition including the use of mobile phones, pagers, or radio transmitters, are permitted in the vicinity of the installation.

Preparation

1. When refuelling, the truck must be at least 3m (10ft) from the storage tanks.
2. Park the truck, apply the hand brake and SWITCH OFF THE ENGINE. Close service valve on cylinder or FFT.
3. Check by contents gauge that the cylinder or FFT is not already full.
4. Remove the filler valve dust cap. Ensure the rubber seal is in place and in good condition.
5. Check the connection on the filling nozzle to ensure that there is no dirt or debris, then connect to the filler valve on the cylinder by means of the union connection.
6. Ensure the storage tank pump supply valve (and bypass return valve on EDU & Skid installations) is open.



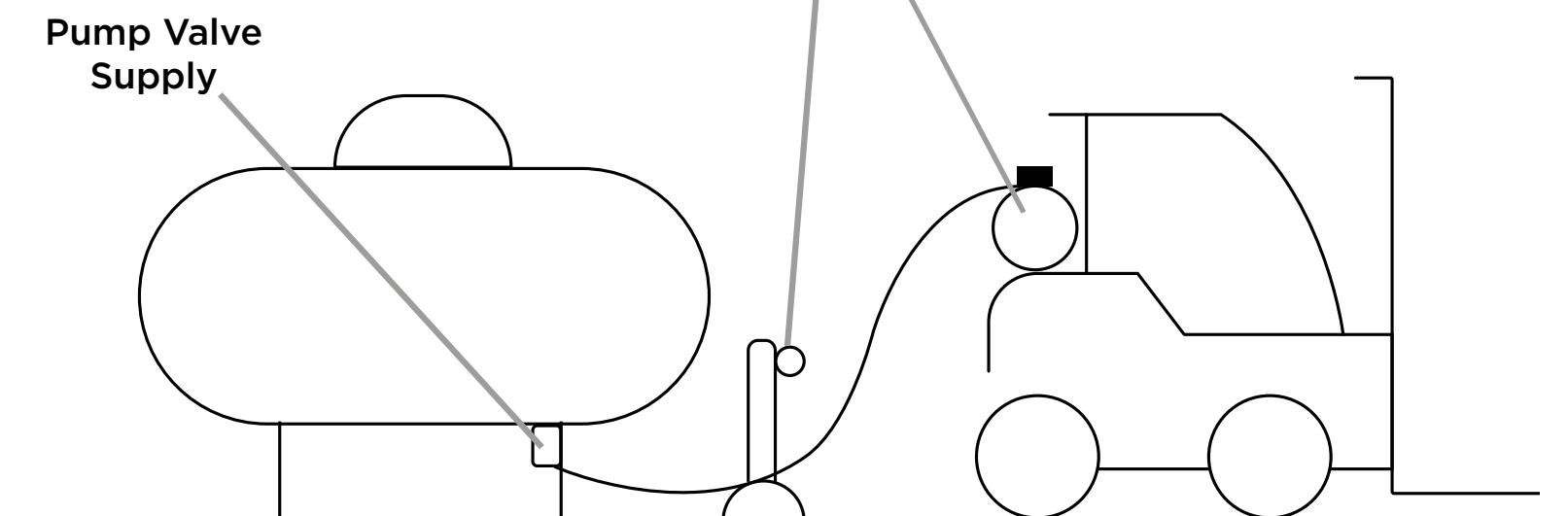
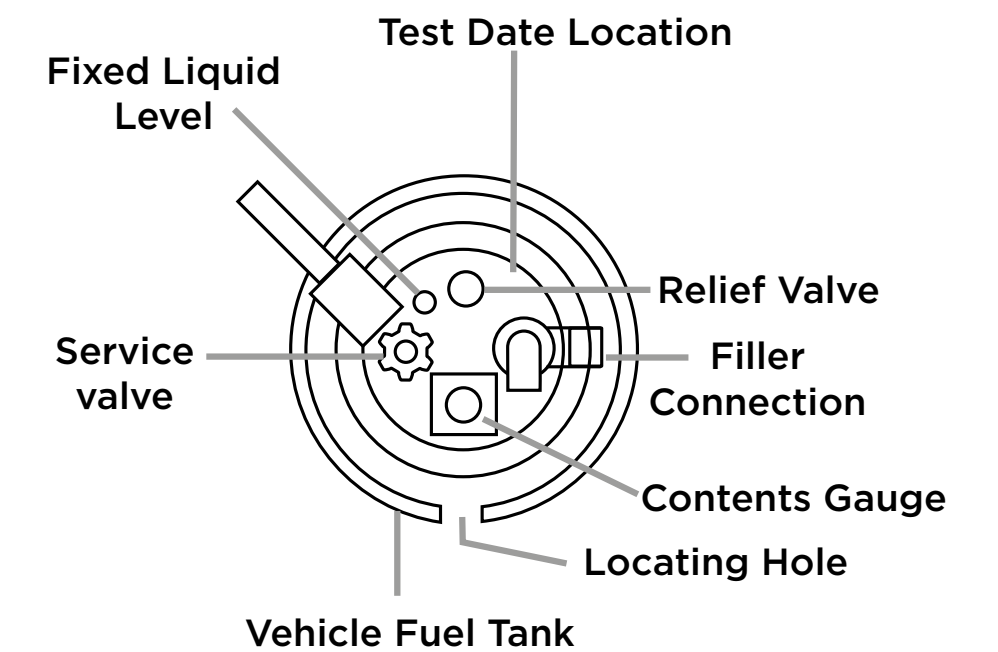
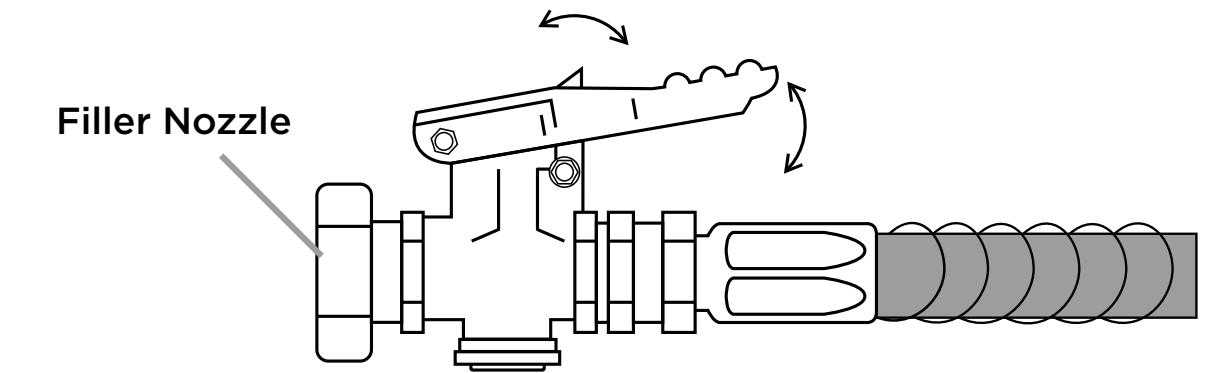
Refuelling instructions

For 29 litre cylinders

7. Open the filler nozzle fully by squeezing the trigger and latching open.
8. Open the fixed liquid level valve sufficiently to allow an audible flow of LPG vapour.
9. Operate and hold the “Dead Mans” switch to start the electric pump, or operate the hand pump to commence filling, observing contents gauge.
10. When a visible spray of LPG issues from the fixed liquid level valve, release the “Dead Mans” switch or cease to operate the hand pump.
11. Close the fixed liquid level valve immediately, as the cylinder is now full.
12. Vent gas trapped in the filler nozzle by releasing the trigger.
13. When gas has stopped venting, disconnect filler nozzle from cylinder and stow correctly. Replace the filler valve dust cap on the cylinder. Make sure the rubber seal is in place and in good condition.

For Fixed Fuel Tanks

7. Open the filler nozzle fully by squeezing the trigger and latching open.
8. Operate and hold the “Dead Mans” switch to start the electric pump, or operate the hand pump to commence filling, observing contents gauge.
9. When the FFT “Autostop” filler valve shuts off, release the “Dead Mans” switch or cease to operate the hand pump. The “autostop” should close when the contents gauge reads between 80% & 85% or Full. Should the tank continue filling after 85% or Full, stop and contact Calor.
10. Vent gas trapped in the filler nozzle by releasing the trigger.
11. When gas has stopped venting, disconnect filler nozzle from cylinder and stow correctly. Replace the filler valve dust cap on the cylinder.



NB. DO NOT attempt to disconnect the filler nozzle if the gas continues to flow. If the gas continues to flow, depress and latch the trigger to open the filler nozzle (this stops the gas venting) and call:

CALOR EMERGENCY SERVICE: 0845 7 444 999.

Refuelling instructions

When Finished

12. If site rules specify or if the storage tanks are not to be used until the next day or longer, close all valves on the top and bottom of the tank(s).
13. Before starting the fork-lift truck, slowly turn on cylinder or FFT service valve.

Never Overfill 29 litre cylinders.

Always stop filling when a visible spray of LPG issues from the Fixed Liquid Level Valve.

If, for any reason, the cylinder or FFT has been inadvertently overfilled, it is essential that the truck engine must be run to reduce the quantity of gas in the cylinder to a safe level at the refuelling site.

Ensure you wear appropriate Personal Protective Equipment when refuelling takes place.

NOTE:

Problems can arise if the cylinder or FFT service valve is opened too quickly – it will activate the excess flow valve. If this occurs turn off the service valve, wait a few minutes, then retry by slowly opening the service valve.

If the 29 litre cylinder is removed for refilling, the filling should be done with the cylinder in the horizontal position, with the arrow on the base pointing directly downwards. Consideration must be given to the weight of the cylinder and LPG contents (see manual handling of 29 litre cylinder). FFT tanks must not be filled when removed from the fork-lift truck.



Manual handling

Manual Handling of 29 Litre Cylinder

The weight of an empty 29 litre cylinder (Tare Weight) of between 20-30kg. When full, the cylinder will weigh between 35-45kg.

If a person is manually handling FLT cylinders regularly, they must be instructed in the best handling techniques by suitably trained and experienced Instructors.

Nominally empty FLT cylinders may be carried 2 at a time, one in each hand, arms straight to sides. When lifting nominally empty, part full or full cylinders, they should only be handled one at a time, using both hands. Keep back and neck straight, maintain a grip on the 'hand hold' of the shroud and base ring.

Avoid twisting movements of the upper body, move feet and whole body to turn.

Do not overreach when placing cylinders on a stack arrangement and release one hand at a time to prevent trapping fingers. Never lift cylinders above chest height.



General guidance when manual handling

The following points should be considered:

- Cylinders may be wet, dirty and slippery. Suitable gloves should be worn whilst ensuring a firm grasp on the handhold shroud and base ring if lifting. Protective footwear must be worn.
- Apparently 'empty' cylinders may contain an unknown quantity of gas. The cylinder should be 'tested' by 'rocking' the cylinder to feel liquid movement and take account of the potential additional weight.
- Cylinders may contain liquid which moves when handled. The grip on the cylinder should be maintained until the liquid movement reduces.
- Cylinders are heavy! People must be aware of their personal limits.
- Do not roll cylinders on their sides; in such conditions they are not under control which may result in damage or injury.
- Do not throw or drop cylinders from vehicles or platforms. They must be lowered or lifted in a controlled manner.
- Be aware that cylinders can topple if placed on a sloping surface.
- Be aware that damage can occur to shrouds and base rings. Damaged base rings may cause a cylinder to churn in an erratic manner or fall over while manoeuvring, or not stack evenly.
- Work at a steady rate, concentrating on the factors that could be hazardous and take precautions.



Action in an emergency

In the event of a substantial spillage of LPG or fire, the following steps should be taken:

- Shut off all storage tank isolating valves if possible.
- Remove or extinguish any source of ignition.
- Do not attempt to start engines of vehicles which may be in the vicinity.
- Summon the Fire Brigade.
- Contact Calor Emergency Service: **0845 7 444 999**
- Keep personnel and members of the public away from the general area in which vapour may be spreading.
- Alert neighbours if appropriate and advise of possible dangers, especially if there are cellars, basements or depressions in which vapour could collect.

For minor gas leaks or hose breakaway, immediately report to your supervisor or manager so they can contact the Calor Emergency Number.



NOTE: The above may be supplemented by your company's Safety Procedures relating to the Health and Safety at Work Act 1974. Be aware of them and follow the action indicated when an unsafe situation occurs.



First Aid

The following action should be taken upon contact with LPG.

Eyes

Immediately flush eyes with plenty of tepid water for at least 15 minutes. Hold eyelids apart while flushing to rinse the entire surface of eye and lids with water. Seek medical attention immediately.

Skin

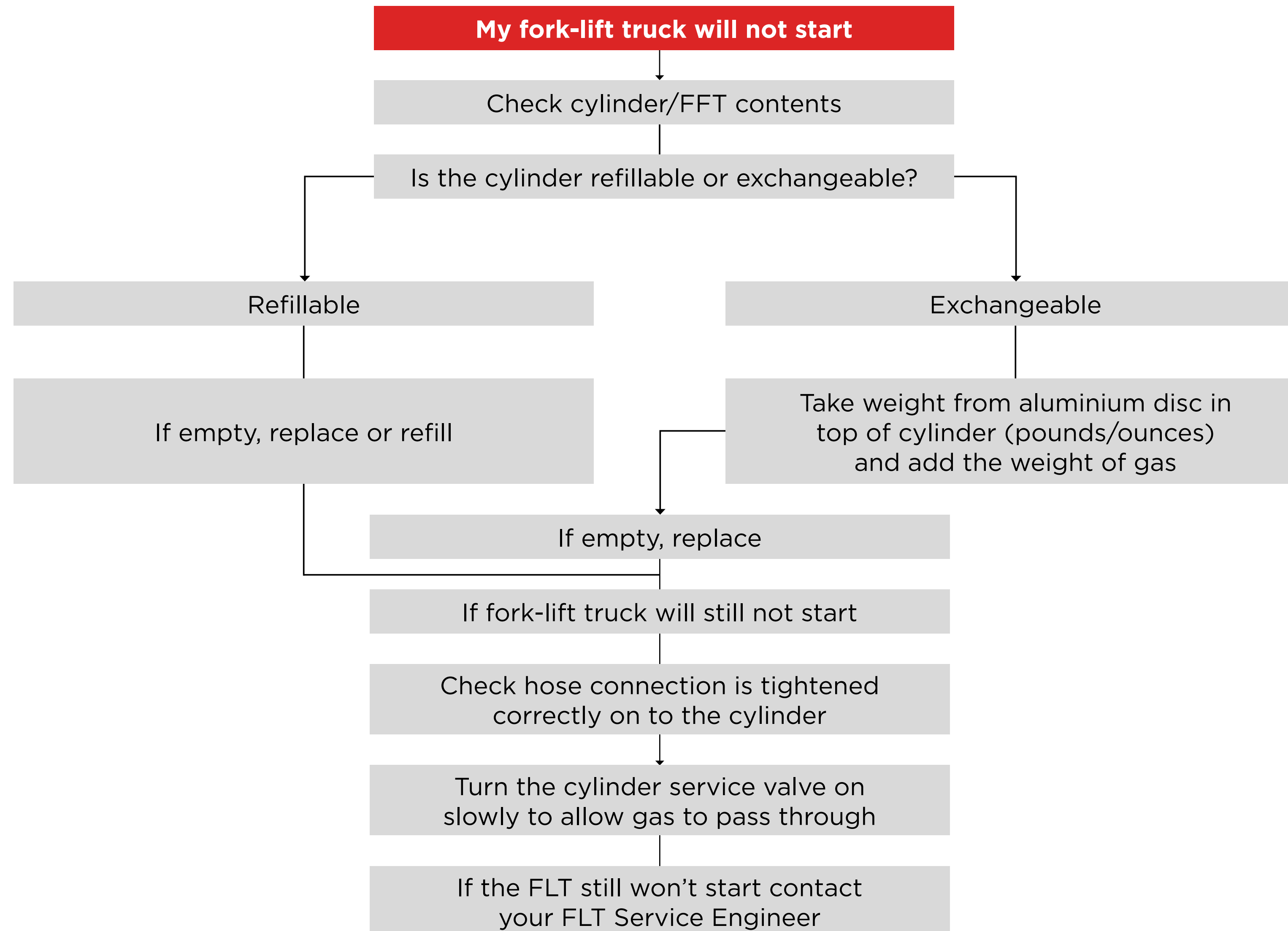
In case of cold burns immediately place affected area in tepid to cool water. If this is not possible cover the affected parts with light, dampened or wet woollen material. Encourage the casualty to exercise any fingers, toes or legs that are affected to increase circulation.

Inhalation

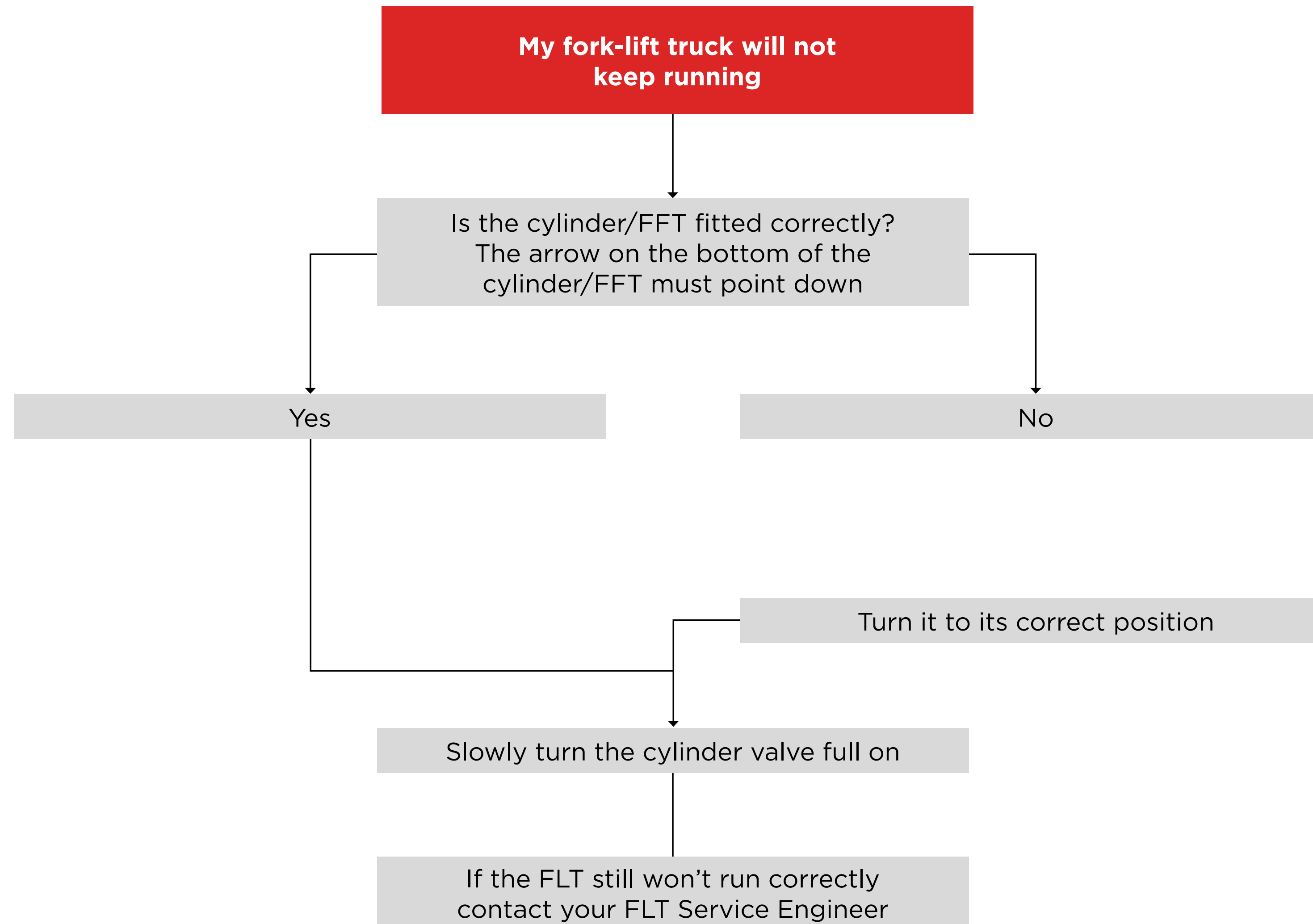
LPG vapour is mildly narcotic, which means that inhalation of high concentrations will produce anaesthesia. Prolonged inhalation of high concentrations will cause asphyxiation. The emergency treatment for inhalation is to move the casualty to fresh air, keeping them warm and at rest. In chronic cases, where there is a loss of consciousness give oxygen, or if breathing ceases give artificial respiration.

In all but the minor cases, professional medical treatment should be sought immediately.

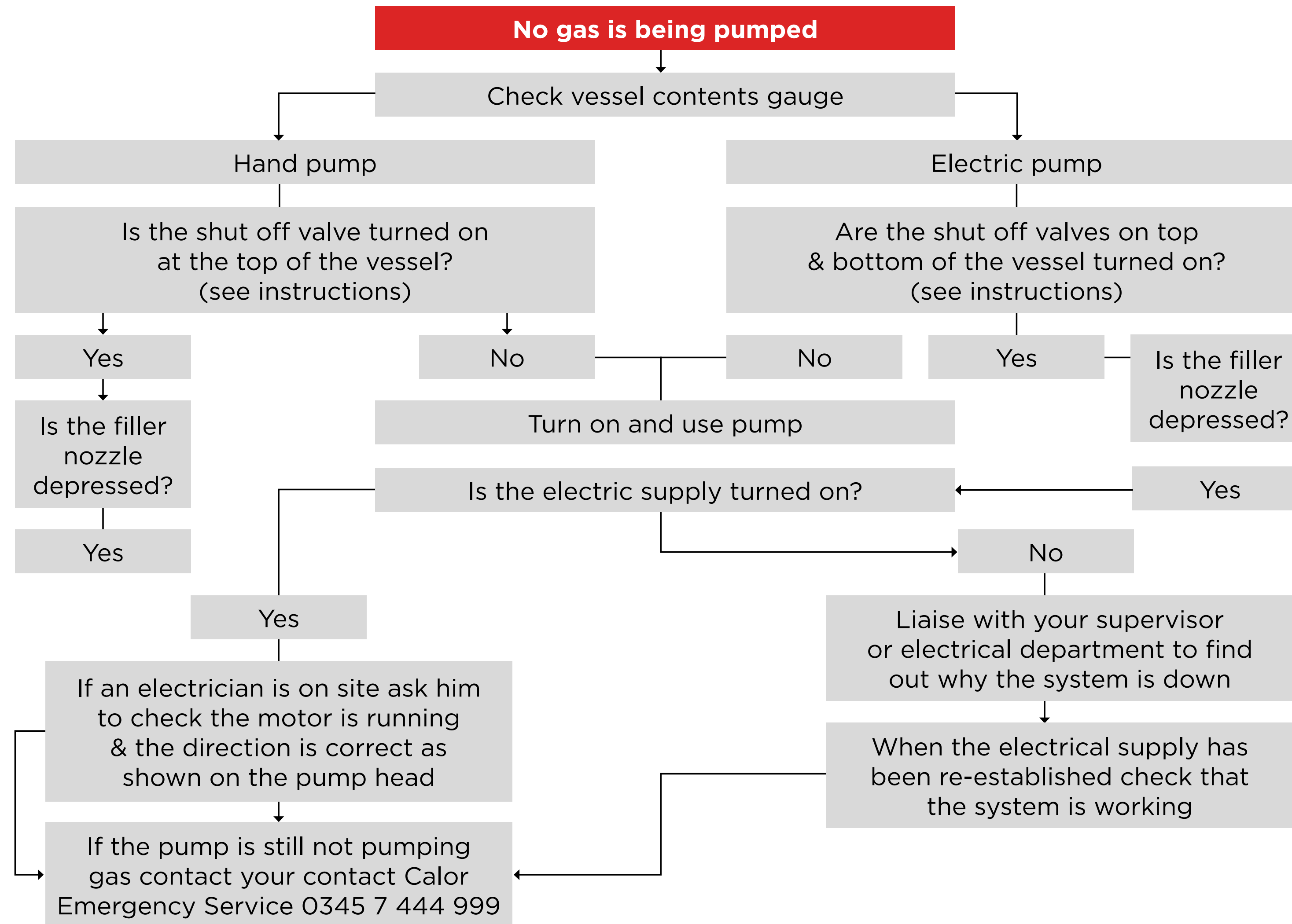
Troubleshooting



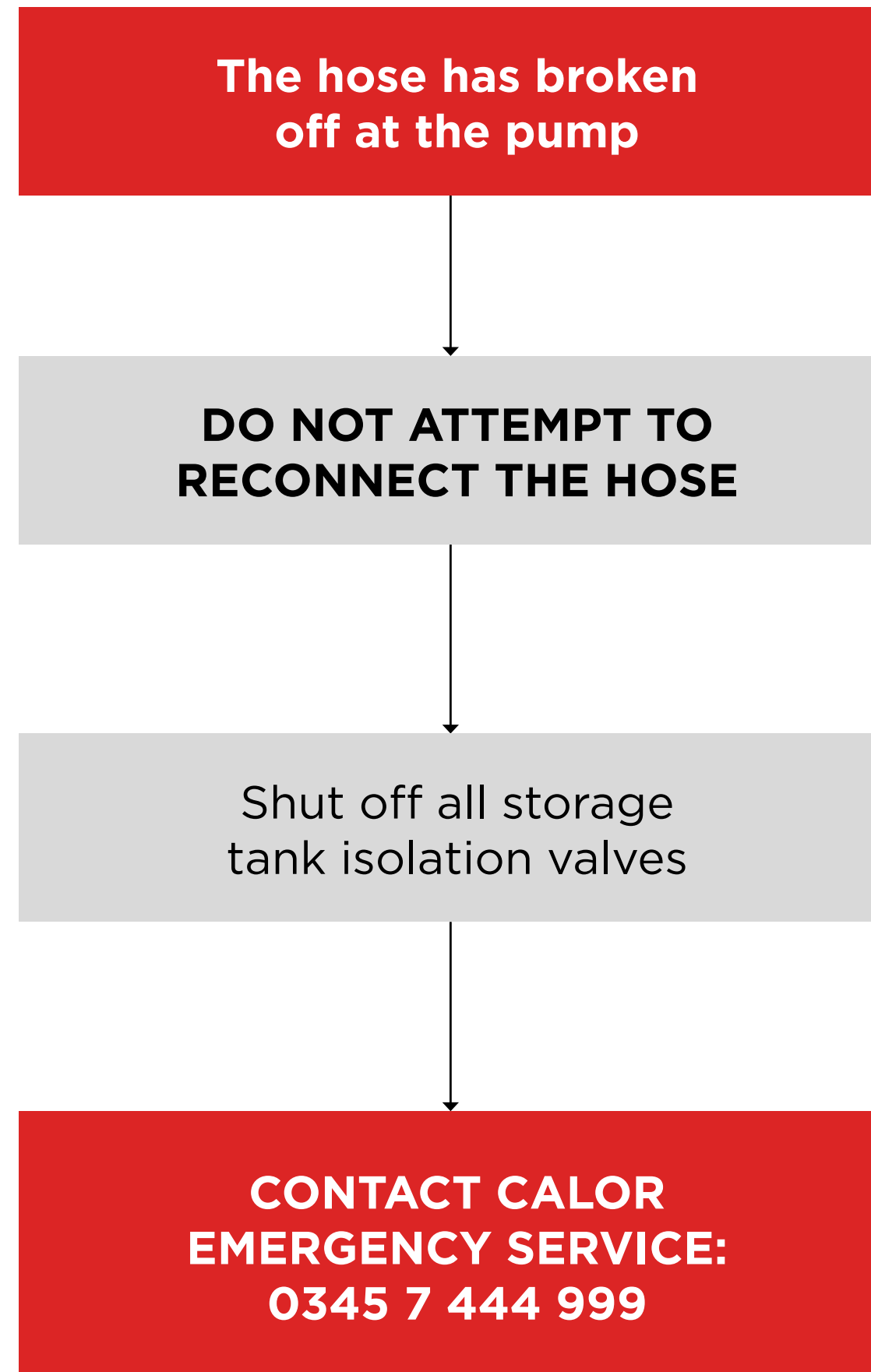
Troubleshooting



Troubleshooting



Troubleshooting



To find out what we could do for
your business, call 0800 121 4580
or visit calor.co.uk

