Technical Publication

Liquefied Petroleum Gases (L.P.G) Characteristics & Fire Control.

Liquefied Petroleum Gas (LPG)

LIQUEFIED PETROLEUM GASES (also referred to as L.P.G. or L.P. Gas) in the form of Calor Commercial Butane and Calor Commercial Propane, is used throughout the country for many applications including cooking and heating. Not only are they used in residential homes but also in caravans, boats, and mobile kitchens, as well as in industry where they have many applications.

Technical Data

Calor Butane and Calor Propane have the following properties:-

1. They are vapors at atmospheric temperature and pressure but are normally stored in steel containers of various shapes and sizes in the liquid state. All L.P.G storage containers, whether static or mobile are typically 87% liquid filled, the remaining 13% of their gross capacity being taken up with vapor space to allow for expansion.
2. L.P.G whether in liquid or vapour state, contains no toxic components and is therefore non-poisonous. The vapour is, however, slightly anaesthetic when high concentrations are inhaled over a considerable length of time.
3. L.P.G. has a high calorific value (Propane 95 MJ/m^3 Butane 121 MJ/m^3) compared with natural gas.
4. The products of combustion are similar to those from natural gas, i.e. carbon dioxide, nitrogen and water vapour.
5. Liquid is half the weight of water, volume for volume, and will, therefore, lie on top of water like oil and petrol.
6. Butane vapour is twice the weight of air and Propane one and a half times, volumes for volume, and will, therefore, sink to the lowest point and, unless efforts are made to disperse it, the accumulation may remain for a long time.
7. The limits of inflammability are 1.9% to 8.5% for butane and 2% to 10.3% for propane in air.
8. One kilogram of butane at 15 ^{o}C and 1013.25 mbars (dry) produces 0.14 m^3 of gas. One kilogram of propane at 15 ^{o}C and 1013.25 mbars (dry) produces 0.54 m^3 of gas. It is thus possible to store, in liquid form, in a relatively small container, a potentially large volume of vapour.
9. L.P.G. acts as a refrigerant and contains an odorant. Therefore leaks may be detected, in addition to other evidence, by cooling at the leak area and by the smell of the odorant.

Basic Information

L.P.G. Vapour.

L.P.G. vapour escaping from a container to the atmosphere, unless burning, is not readily visible but under certain conditions can be detected:-

(a) in much the same way as heat waves can be seen rising from a hot object
or
(b) by the sound of the escaping gas if the leak is large enough.

Small leaks may be found by applying soapy water. N.B. never look for a leak with a naked flame.

L.P.G. vapour spreads out as an invisible gas, and as it is heavier than air, sinks to the ground. The distance which the gas will spread depends on prevailing conditions, such as the quantity of gas escaping, the topography of the areas and the weather conditions.

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A volume of escaping gas will:-
(a) Persist longer in a hollow or low spot than on a hill or open area.
(b) Thin out more rapidly if the air is in motion.
(c) Thin out less rapidly on a foggy day than it will on a bright sunny day.
(d) Linger longer in high grass or vegitation than open ground.
Various combinations of weather and topography will have a bearing on the distance the vapour will travel and the time required reducing the vapour to a non-inflammable mixture.

L.P.G. Liquid.
A liquid leak is readily visible. Small liquid leaks will develop ice at the point of escape. Large leaks such as from a hole or broken fitting will issue as a white cloud. This white cloud is caused by the liquid vaporizing and expanding so rapidly that it freezes the moisture in the air. The cloud is a rich and highly flammable mixture, especially at the outer edges and will flash if brought into contact with a source of ignition.
Flammable gas mixtures will also be found beyond the outer fringe of the vapour cloud, because, as the cloud warms up the gas becomes invisible and therefore more dangerous. The use of combustible gas indicators is the only way to determine at what point the gas has thinned out sufficiently to become non-inflammable.
A Liquid L.P.G. fire is more difficult to control than a vapour fire due to the fact that one litre of liquid produces between 233 and 274 litres of gas at 15 ^{0}C.

Recommended procedure in event of fire involving or seriously exposing L.P.G. equipment, or serious leakage of L.P.G. without fire

It is almost impossible to lay down a definite procedure to follow where containers, bulk tanks, bulk road tankers and container carrying vehicles are involved in an accident or fire. However, there are a few general procedures which may be of help in deciding a plan of action.

BASIC PRECAUTIONS
1. In any emergency situation it is of paramount importance to avoid endangering human life.
2. Always approach a fire or leak from upwind.
3. Keep all persons, except those necessary to deal with the emergency, at least 60 metres away from the danger are. If necessary, evacuate any area which is in the path of the gas cloud, eliminating all sources of ignition at the same time.

Leaking of L.P.G. without fire.
1. If escaping gas is not on fire, close any valve which will stop or reduce the flow of gas. Small lines such as copper tubing may be flattened to stop the flow. If a bulk storage tank or a road vehicle is involved in an accident consult the plant operator or driver (as the case may be) regarding the possibilities of shutting off the supply or leakage.
2. Where L.P.G. vapour or liquid is escaping and has not been ignited, it is not, except under certain conditions, a good policy to ignite it. There is no way of telling how far, or exactly where, the gas vapour has travelled.
3. It is vitally important that all sources of ignition are eliminated as soon as possible to prevent ignition of the gas vapour.
4. Where an accumulation of gas vapour is suspected, dispersal of the gas may be achieved in a confined space such as a building, by ventilation at ground level or by purging with an inert gas or water spray. Where large concentrations of gas vapour have accumulated in the open air as from bulk tanks, bulk road tankers or containers carrying vehicles, the gas vapour may

be broken up and dispersed by the use of water fog. This should be used as quickly as possible, directing the water fog across the normal gas vapour path and dispersing it into a safe location. Persons handling the hose should keep low behind the fog so that they may be protected to some degree from radiant heat should the gas become unexpectedly ignited.

5. It may be desirable to remove a container or tank to some isolated site so that it may leak safely without fear of ignition. Do this carefully and with the vessel in the upright position – never drag it in a manner likely to damage the valve or piping.

Leakage of L.P.G. which is on fire.

If a leakage of L.P.G. is on fire the action will depend on the circumstances but the first consideration must be to stopping the leakage or the shutting off of the gas supply.

1. Extinguishing an L.P.G. fire without the means of stopping the leakage or shutting off the gas supply may lead to a more dangerous situation.
2. A small fire from a container may be smothered by a wet cloth or dry powder extinguisher and then it may be possible to stop the leak and remove the cylinder to a safe location.
3. If the gas is escaping in large quantities and has been ignited, immediately apply large quantities of water to all surfaces in the form of a jet, spray or fog. Static bulk tanks and bulk road tankers should be approached from the sides of the vessels, not from the ends. Concentrate on piping and surfaces of containers or tanks exposed to radiant or direct heat.
4. If the only valve which can be used to stop the flow of gas is involved in the fire, consider the possibility of effecting the shut-off by approaching the valve behind a water spray. This approach should be made at right angles to the flame and the spray is used to reduce the intensity of the flame but not to extinguish it.
5. Controlled burning of escaping L.P.G. (which cannot be shut-off by closing a valve) together with the application of sufficient water to keep the vessel and pipework cool will allow the fire to consume the contents of the container or tank, without danger of causing failure.
6. In the absence of sufficient water to keep that part of the metal surface of the vessel adjacent to the vapour space cool, extreme radiant heat or direct flame impingement will cause the vessel to rupture and create what is commonly called an explosion.

Serious exposure of L.P.G equipment to fire.

1. Any fire must be controlled and in event of L.P.G. equipment being seriously exposed to heat it is of vital importance to keep the container or tank cool with water to avoid unnecessary release of gas.
2. Should a static bulk tank or bulk road tanker, fitted with a pressure relief valve, be exposed to heat to the point of the relief valve functioning, the discharge should, except under certain conditions, be allowed to burn if it becomes ignited and at the same time the vessel should be kept cool with large quantities of water.
3. Portable L.P.G. cylinders should be removed to a safe location.

TYPES OF FIRE EXTINGUISHERS.

Carbon Dioxide: Hand units are suitable for small fires only, mobile units suitable for larger fires.

Dry Compound: Extremely useful on L.P.G. liquid and vapour fires. The 2 Kg or 9Kg Dry Compound Extinguisher is specially recommended for smaller fires, and the mobile units for larger fires. NOTE – with dry powder it is essential to have complete coverage of the fire to prevent flash back.

Soda Acid: Will intensify a liquid or vapour fire. Use limited to cooling down of small cylinders.

Water Fog: An adequate supply for the dispersal of vapours.

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Water Spray: For cooling tanks and control of unignited gas vapour. Should not be used on liquid fires.

Water Jet: Must not be used on liquid fires as the vaporizing rate is increased tremendously when a water jet is applied to a liquid fire. Suitable for cooling cylinders and tanks.