

## **INFORMATION FOR FIRE SERVICES ON LPG / AUTOGAS VEHICLES**

### **What is LPG / autogas**

LPG or Liquefied Petroleum Gas, is either Propane or Butane. In the UK autogas is propane.

LPG is stored at 6.9 bar (100 psi) in which compressed state it becomes liquid.

In vapour form it has 250 times the volume of its liquid form and hence the popularity of storage under pressure.

LPG vapour is roughly twice as heavy as air, consequently the vapour may flow along the ground and sink to the lowest level.

LPG is colourless and odourless but a sulphur odorant is added to give it a distinctive "rotten cabbage" smell.

LPG is flammable when mixed with air in range between 2% and 10%, in this range the gas can be ignited in the same way as petrol vapour.

LPG stored under pressure cools to -15c. Contact with the skin of either liquid or vapour under pressure can lead to "cold" burns.

LPG can be found in vehicles which are either carrying cylinders or where the vehicle has had a conversion to its engine to run on autogas. Such conversions are either conversions from petrol to bi-fuel (where an additional fuel system and tank are fitted) so they can run on petrol or autogas via the flick of a switch or very occasionally monofuel which is autogas only where the petrol system and tank are replaced.

### **What is the autogas market in the UK?**

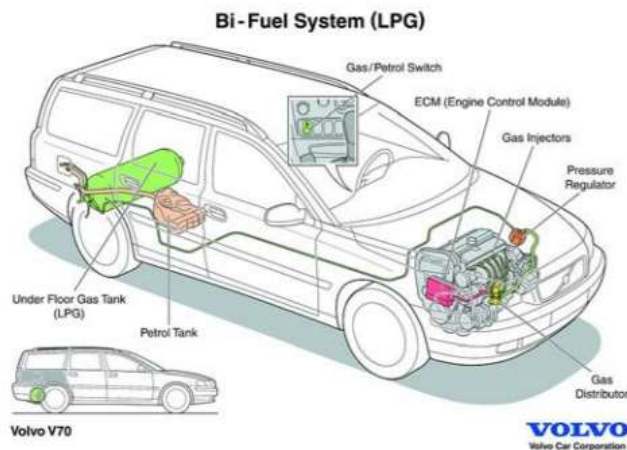
Autogas is an environmentally friendly fuel. Compared with petrol, running on LPG emits around 20% less CO<sub>2</sub> and similar or better than diesel. However, tests undertaken in 2003 proved that LPG vehicles on average emit less NO<sub>x</sub> than 20 diesels vehicles and fewer particulates than 120 diesel vehicles.

Worldwide there are over 13 million vehicles running on LPG and in the UK at the end of 2008 there were 150,000 running on LPG. In the UK this number is increasing by around 10% per year. These vehicles are primarily cars and January 2009 2 small vans up to Transit size. The majority of conversions are undertaken by UKLPG Approved Autogas Installers (see [www.drivelpg.co.uk](http://www.drivelpg.co.uk) ) but conversions can be undertaken by anyone.

The availability of autogas is also on the increase with over 1,400 autogas filling stations in the UK.

## LPG System Design

This shows a typical autogas system design and is composed of a complete additional fuel system.



The LPG tank is usually located in the rear of the vehicle. This can be in the boot, in the spare wheel well or on brackets underneath the vehicle. Tanks are either cylindrical (as shown above) or Toroidal (dough-nut shaped) to fit in the spare wheel well.

### Identification of an LPG vehicle

Autogas conversions do not need to display any identification by law in this country and is not recommended by the police as this may encourage vandalism, however they may be identified by:

- An autogas conversion will have an additional filler for the autogas intake as well as the original petrol intake, the autogas filler is usually found at the rear of the vehicle behind the petrol intake. But can also be found at different locations including on the tow bar or the bumper at the rear of the vehicle.
- A marketing sticker from the installer possibly on the windscreen, back windscreen or both.

However, it may not be able to identify these things during an operational incident.

### Safety Features on an LPG vehicle

Vehicles converted to autogas are in many ways safer than petrol vehicles as the tanks are far stronger and they have many incorporated safety devices.

- The fuel tank is made of steel and is substantially stronger than a petrol tank, this means that it can withstand higher impacts than normal petrol tanks.
- In the event of a fire which is heating the tank, the tank has a pressure relief valve which opens at 27 Bar venting excess gas and preventing a BLEVE.
- There is a non-return valve on the tank and the filler that stops the gas escaping from the filler intake.
- The tank also incorporates a stop fill valve with an 80% shut off. This allows room in the tank for the liquid autogas to expand.
- After 2001 all tanks must be fitted with an automatic shut off solenoid. This device shuts off the supply of fuel from the tank automatically when the vehicle is switched off, stalls, or is switched to petrol supply. Many conversions before this date also had

this safety feature and on conversions without the automatic solenoid a manual shut off valve may be found in its place.

- There is an excess flow valve fitted at the tank end, in the event of a fracture in the pipe line to the engine. This valve automatically closes down the supply to a minimum even if the engine is still running.
- The valves on the tank must be covered by an air tight box with an atmospheric vent to avoid autogas entering the car.

### **Hazards when there is a leak**

Autogas may be noticeable other than by smell. When autogas escapes the cooling effect on the surrounding area may show itself as frost at the point of escape and thus make it easier to detect. Because the refractive index of autogas differs from air, escaped vapour can sometimes be seen as shimmering.

Although it is not toxic at very high concentrations in air, autogas vapour is anaesthetic and can be an asphyxiant by diluting or decreasing the available oxygen especially if it is in an enclosed structure like a garage.

If there was an incident where crews are unsure of how to deal with or isolate the leak/incident they may wish to contact a specialist for advice – see [www.drivelpg.co.uk](http://www.drivelpg.co.uk) for the nearest approved installer.

If the leak cannot be shut off, then consideration must be given to the volume escaping and the direction it will flow – given wind direction and that it will flow to the lowest point – to determine perimeter and precautions for the area.

Use PPV to ventilate and help disperse vapour. Especially if there are drains or ditches where pockets of vapour may collect.

- Make sure the engine is switched off if not already done so and battery disconnected.
- If a substantial amount of gas has leaked with a risk of ignition, cordon off the area, ensure a perimeter with a radius of at least 150 metres.
- Make ready any equipment necessary e.g PPV
- Ensure no naked flames or smoking in the area, and make sure there are no sources of ignition. Beware, as with petrol vapour, even opening the vehicle door or boot can trigger a light switch which is a potential source of ignition.
- Consider the need for BA especially in enclosed areas.
- If it is in an enclosed space, if it is safe to do so push the vehicle into an open area.
- Ensure you are wearing the correct level of PPE whilst trying to establish if there is a leak and its location, this includes wearing gloves and making sure goggles and visor are both down to protect from cold burns.
- Determine when LPG is dispersed (note there will still be a residual smell even when hazardous levels of gas are not present) and the area can be reopened.

## **Hazards in an accident situation with a leak of autogas and no fire**

Apart from the safety features mentioned above the autogas tank is a lot less likely to fracture from impact or leak in comparison to a petrol tank.

- Using LUKAS:  
If persons are trapped in an autogas vehicle with a leak, crews would have to perform the rescue with the potential of igniting any leaking gas. Although the LUKAS cutting equipment is designed not create any sparks, metal on metal can.

Also the LUKAS powerpack is not intrinsically safe, and there for must be sited as far as possible from the incident with both hoses run out completely.

Use PPV whilst working on the vehicle to disperse vapours: Whilst using spreading and cutting gear and especially the hydraulic ram use extra precaution. Even if there is no leak and the tank is isolated there is still fuel in both the supply line to the engine and between the tank and the filler. Although they are in positions that would normally require cutting or spreading, sometimes the supply lines may run near the sill of the vehicle rather than underneath the vehicle. Thus when performing a dash board roll there is the chance of localised tearing and deforming of the sill. If the pipes are ruptured January 2009 5 there will be a leak and the subsequent dangers of ignition. So try to identify the pipes before cutting or spreading the area.

## **Hazards if a vehicle is on fire**

The main dangers involved with a vehicle of this type under fire stems from the tank itself. Like other cylinders these tanks are at risk from a BLEVE (boiling liquid expanding vapour explosion). The extreme heat of a fire can cause a weak spot in the cylinder which will crack, once it cracks the BLEVE will occur.

In the UK vehicle autogas tanks have to have a pressure relief valve fitted to help prevent an explosion. However, it can still cause a problem, this is because when the pressure relief valve operates it will expel a quantity of gas creating a jet of flame.

If the vehicle is on its roof the same behaviour is demonstrated however liquid instead of gas is expelled from the relief valve, when it reverts to a gas it expands 250 times creating a bigger jet of flame.

- Firstly, to try and identify if it has an autogas conversion and if so to approach with extreme caution.
- Firefighting to be conducted using the correct PPE (full fire kit and breathing apparatus).
- If autogas is identified a priority would be to cool the tank, to prevent it from fracturing, using a jet as it can give you a bigger throw than a hose reel. Consider the use of a ground monitor.
- If approaching the vehicle whilst still alight take extreme caution, remember that if the pressure relief valve actuates there may be a jet of flame.
- Set up a perimeter around the vehicle, Hereford & Worcester Fire Brigade suggest a radius of 150 meters. Ensure all members of the public are out of the exclusion zone and those living in houses in the area affected should stay indoors and be vigilant.

- Make sure that once the fire is totally out that the tank is cool apply water as necessary and check for any cracks or leaks, especially if there is a chance of reignition.

**NOTE**

The information contained above is taken from SIS procedures with input from both the fire service and UKLPG. They are prepared for information only to assist general knowledge of LPG vehicles and do not constitute a required guideline. Neither the fire service nor the UKLPG accept any liability for the information contained nor any way in which it may be used.

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