

Product description

1. This appendix draws upon the World LP Gas Association website, the LPGA's Codes of Practice, suppliers' literature and documentation from the British Standards Institute.

What is LPG

2. LPG is the abbreviation used to describe liquefied petroleum gas, a group of hydrocarbon gases typically containing three or four carbon atoms per molecule and often referred to as C3 or C4.
3. The normal constituents of LPG are: propane (chemical formula C₃H₈), propylene (C₃H₆), Butane (C₄H₁₀) and butylenes (C₄H₈). Commercial-quality products marketed as butane and propane in the UK are not pure chemical hydrocarbons and contain trace quantities of other similar gases.
4. In the UK, quality specifications for LPGs are defined by *BS 4250 Specifications for Commercial Propane and Commercial Butane*, the typical properties of which are given in Table 1.

TABLE 1 Limiting requirements for properties of commercial butane and propane

<i>Property</i>	<i>Commercial butane</i>	<i>Commercial propane</i>
Gauge vapour pressure, at 40°C (measured or calculated) (kPa), max	505	1,550
Total sulphur content (mg/kg), max	200	200
Mercaptan sulphur content (mg/kg), max	50	50
Hydrogen sulphide content (mg/m ³), max	0.75	0.75
Ammonia content (mg/m ³ in the vapour phase), max	2.3	2.3
Copper corrosion, 1h at 40°C	Class 1	Class 1
Tendency to freeze in valves	-	Pass
Dienes content, mole percent max	0.5	0.5
Ethylene content, mole percent, max	-	1.0
Alkynes content, mole percent, max	0.5	0.5
C ₄ and higher hydrocarbons content, mole per cent, max	-	10.0
C ₅ and higher hydrocarbons content, mole per cent, max	2.0	2.0
R number	10 max.	10 max.
O number	33 max	33 max

Source: BS 4250:1997.

Key characteristics

5. LPG exists in gaseous form under normal atmospheric pressure and temperature. Unlike natural gas (methane—CH₄), which can only be liquefied by refrigeration, LPG is easily liquefied by moderate compression at ambient temperature. The decrease in volume resulting from liquefaction enables its easy transport in liquid form in pressurized containers and systems.

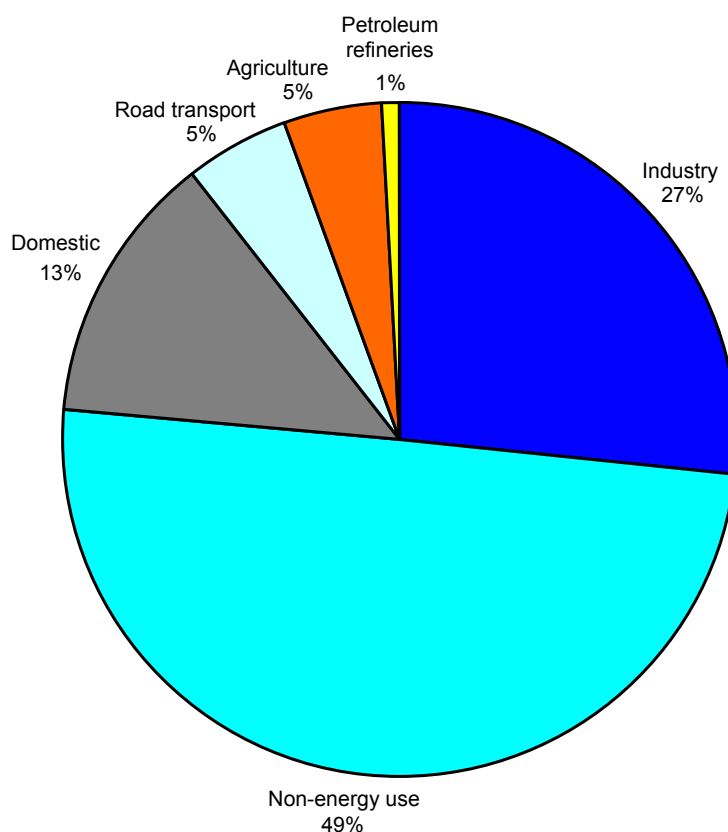
6. The boiling point at atmospheric pressure is -2°C for butane and -42°C for propane. This is the reason why, unlike butane, propane can be stored in liquid form outside in the UK during the winter months and is the only LPG used in domestic bulk tanks.
7. LPG as a liquid is colourless, and as a vapour, cannot be seen. Pure LPG has no distinctive smell, but for safety reasons a stenching agent is added prior to distribution to aid detection by the human nose at very low levels.
8. The calorific value (ie the amount of heat released when the fuel is burnt) of LPG is significantly higher than that of natural gas: it is $38\text{MJ}/\text{m}^3$ for natural gas; $95\text{MJ}/\text{m}^3$ for propane and $121\text{MJ}/\text{m}^3$ for butane. For this reason, natural gas appliances and LPG appliances are not interchangeable.

LPG uses

9. LPG has four main uses: as an alternative transportation fuel for fork lift trucks (but also for general automotive applications); as a source of heat for space and process heating; as a propellant for aerosols; and as a feedstock for the petrochemical industry.
10. They are four key markets for LPG as a source of heat:
 - (a) the domestic market, where it is used for cooking, central heating, space heating, hot water, air conditioning and outdoor activities;
 - (b) the commercial market, which has similar applications to the domestic market, but on a wider scale;
 - (c) the agricultural market, which includes: greenhouse heating, flame weeding, crop drying, waste incineration, distillation and powering equipment; and
 - (d) the industrial market, where LPG is used to power industrial ovens, kilns, furnaces and machinery, in food production for shrink wrapping, and other applications requiring process heating.
11. The domestic market represents only 13 per cent of the overall UK demand for LPG, as shown by Figure 1. By contrast, demand for LPG by industrial customers and for non-energy use (applications include: vehicle painting, surface treatment and the processing of industrial waste) represents 76 per cent of consumption.

FIGURE 1

2004 consumption of propane by end-use



Source: DTI, *Digest of United Kingdom Energy Statistics 2005*.

Packaging

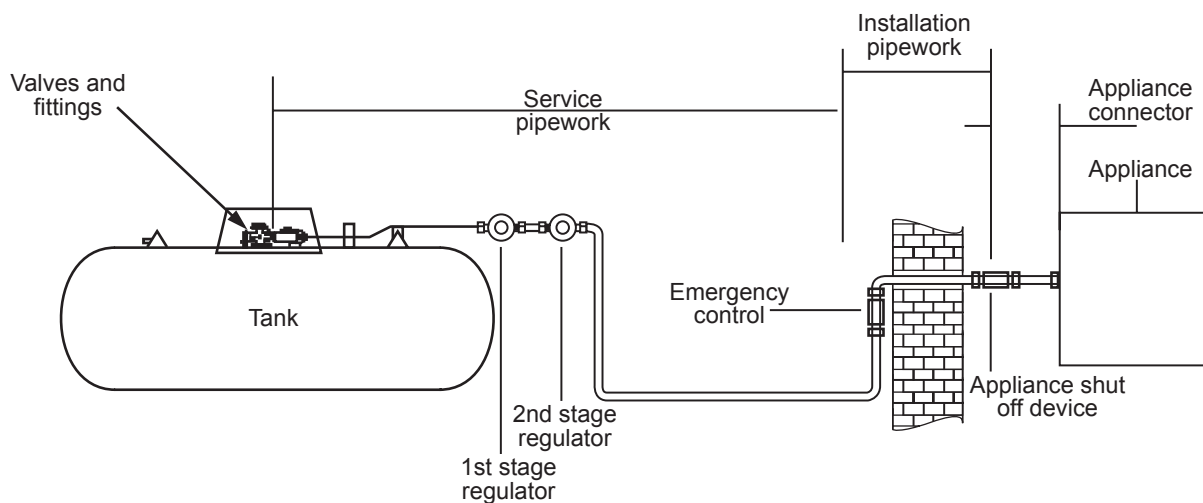
12. In domestic applications, Commercial butane is predominantly stored in blue cylinders up to 15 kg and generally used for leisure applications and mobile heaters. Commercial propane is predominantly stored in red cylinders, or bulk storage vessels when the quantities required are too large for supply in cylinders, and is used for heating and cooking.

Domestic bulk installations

13. Domestic bulk LPG tanks vary in size from 200 kg to 2,000 kg. They are installed outdoors on customers' premises and LPG is delivered to them from a road tanker. The amount of gas delivered is recorded via an onboard meter and then charged to the customer.
14. Storage tanks are normally installed above ground, as described in Figure 2. Tanks can also be buried or semi-buried (mounded) below ground, although this approach is less widespread and more recent.

FIGURE 2

Typical domestic installation

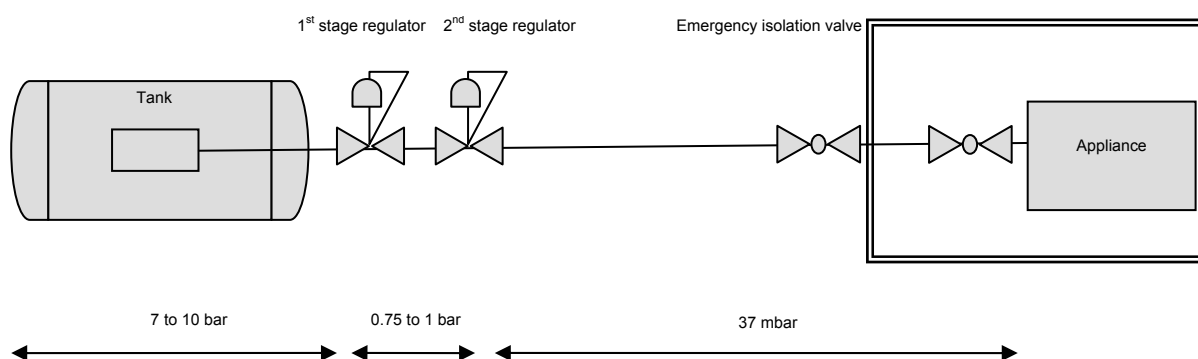


Source: Based on LPGA chart.

15. Propane is stored on the premises in liquid form under a pressure of 7 to 10 bars within the bulk tank. The pressure applied to the gas is reduced in two stages to bring it to a safe working pressure of 37mbar which the gas appliances are designed to operate on, as shown in Figure 3. On typical domestic installations, both regulators are mounted on the tank and gas pressure in the service pipework is at 37mbar. On some small commercial and some domestic installations, the second regulator is placed after the emergency control and gas is supplied at 0.75 to 1 bar through polyethylene (PE) service pipework between the two regulators. Under normal UK conditions, propane is in gaseous form after the first regulator.

FIGURE 3

Domestic LPG system with second stage regulator mounted at the tank



Source: Calor.

Note: The system would be protected by over-pressure and under-pressure shut-off devices which have been omitted from the diagram for the sake of simplicity.