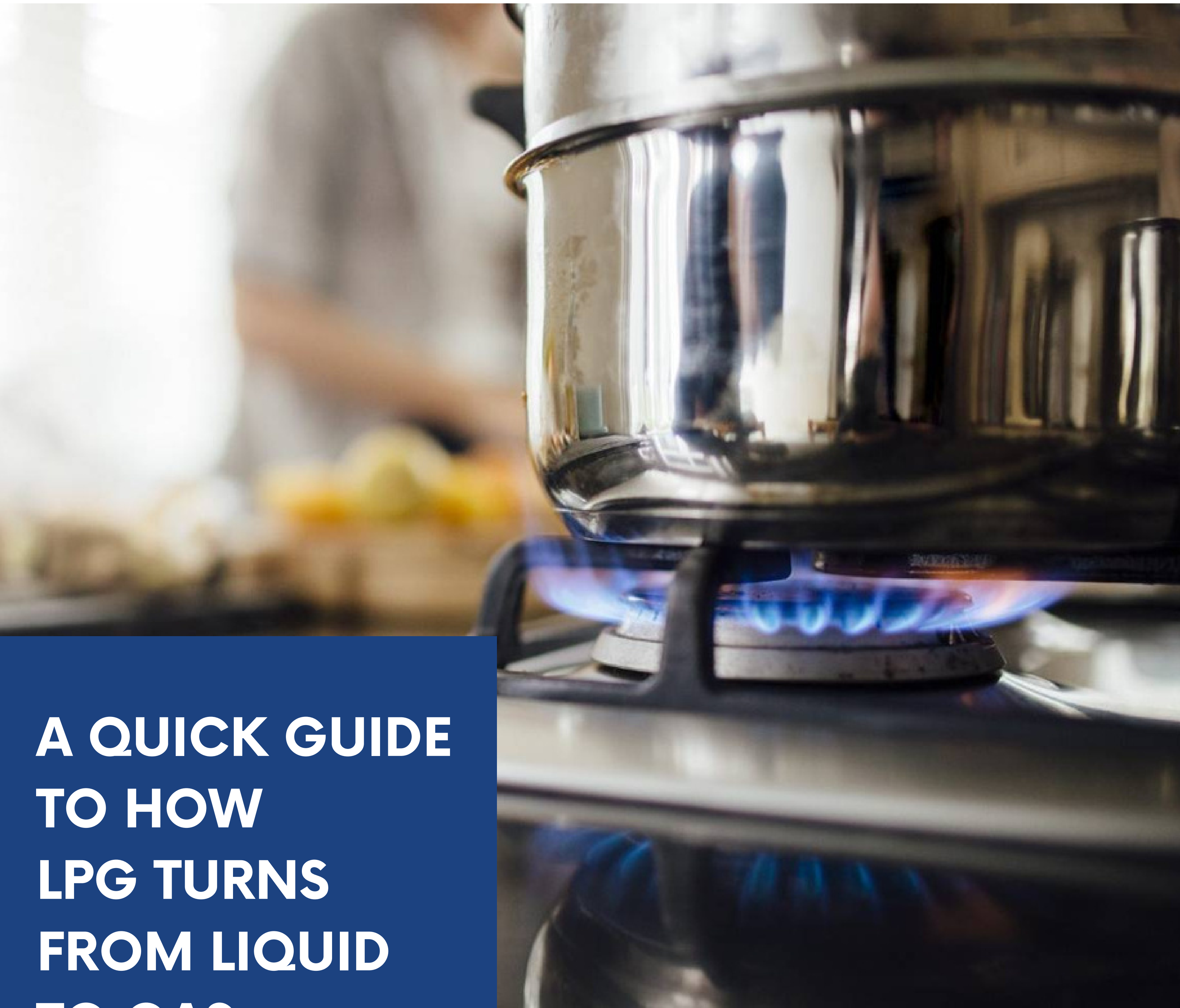
GALPRO STYLEX

LPG VAPORISATION EXPLAINED



A QUICK GUIDE TO HOW LPG TURNS FROM LIQUID TO GAS

LIQUID OR GAS?

WHAT IS LPG?

LPG (Liquid Petroleum Gases) is a mixture of natural hydrocarbon gases. In most of the world LPG is mainly made of Propane, whereas in NZ LPG is a blended mix of Propane and Butane.

LPG is an excellent fuel and incredibly flammable, which makes it a reliable energy source and potentially dangerous. For this reason a strong "stenching agent" is added to the blend so that even a small leak can be smelt and detected early.

Even though LPG is most commonly used as a fuel in Gas form (as a vapour), it is actually stored in cylinders and containers as a liquid. If you could see through a cylinder, LPG would look much like water, being a clear liquid.

LPG BOILING POINT

For LPG to turn from a liquid to a vapour it must reach its boiling point. Propane and Butane have different boiling points which means they will begin to vaporise at different temperatures.

As Propane boils at a lower temperature than Butane it is more suitable for applications in colder climates. If an outdoor Butane cylinder is being used in a cold environment, it may not reach its boiling point which would leave the user with no useable gas. Hence the Propane and Butane is mixed.

LPG (1 ATM)	Liquid	Vapour (Gas)
Propane	< -42°C / < -43.6°F	≥ -42°C / ≥ -43.6°F
Butane	< -0.4°C / < 31.28°F	≥ -0.4°C / ≥ -31.28°F

LPG STORAGE

STORAGE

As you can see in the previous table, LPG is stored in cylinders/containers at an ambient temperature well above its boiling point without turning to vapour. This is because LPG can be kept in a liquid state if it is stored under enough pressure. The process of converting LPG gas into liquid is called liquefaction.

For LPG gas to be liquified at 20°C:
Propane must be pressurised to 836 kPa
Butane must be pressurised to 115 kPa

For LPG gas to be liquified at 50°C:
Propane must be pressurised to 1713 kPa
Butane must be pressurised to 510 kPa

LPG cylinders are under constant pressure to enable the storage of LPG, this refers to the force which the gas is exerting on the inside of the cylinder walls. This pressure can vary depending on the environmental temperature and the rate of vaporisation.

Temperature		Vapor Pressure	
°C	°F	kPa	PSIG
54	130	1794	257
43	110	1358	197
38	100	1186	172
32	90	1027	149
27	80	883	128
16	60	637	92
-1	30	356	51
-18	0	152	24
-29	-20	74	11
-43	-45	0	0

Source: Elgas Ltd

VAPORISATION

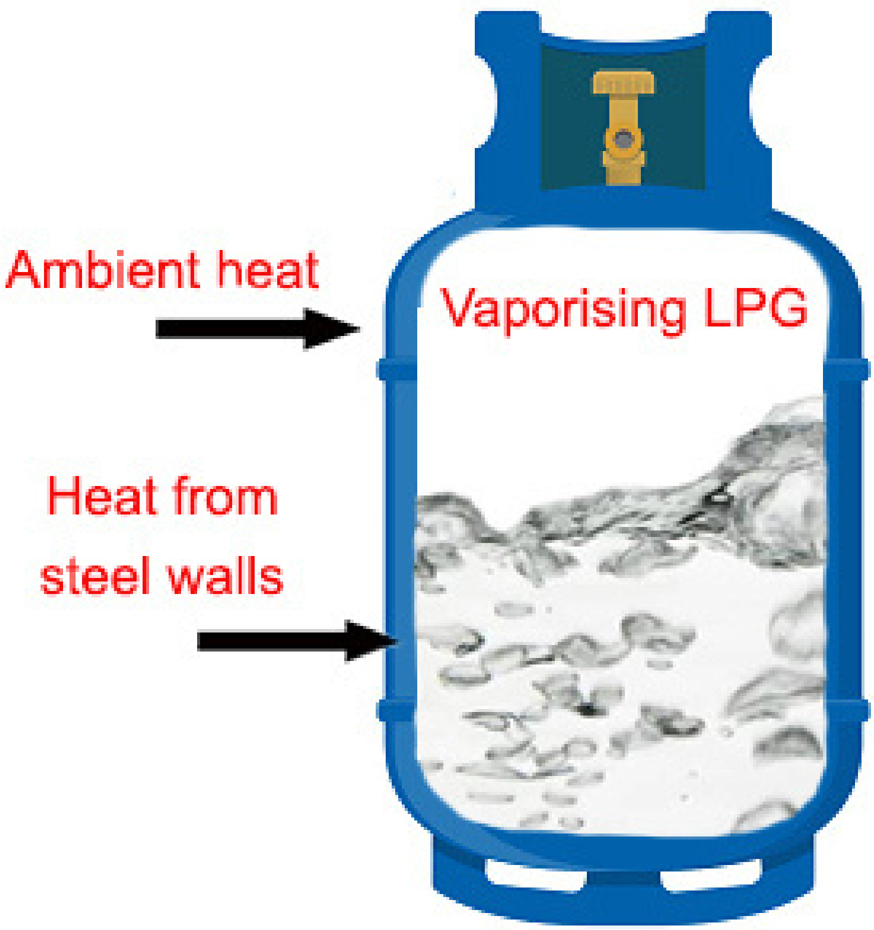
HOW DOES VAPORISATION WORK?

Everytime a gas appliance is turned on, liquid LPG boils within the cylinder/container to convert to vapour. This is because some pressure within the cylinder is relieved as the appliance is turned on, allowing for vaporisation.

In order for the LPG to boil and convert to vapor, it draws heat from the surrounding environment, in this case the steel cylinder.

The cylinder is heated by the ambient air surrounding it, which the LPG then draws from the cylinder steel to aid with vaporisation.

If the surrounding environment is cold, this will slow down the rate of vaporisation, especially dependent on the Propane and Butane ratio.



LPG CONSUMPTION

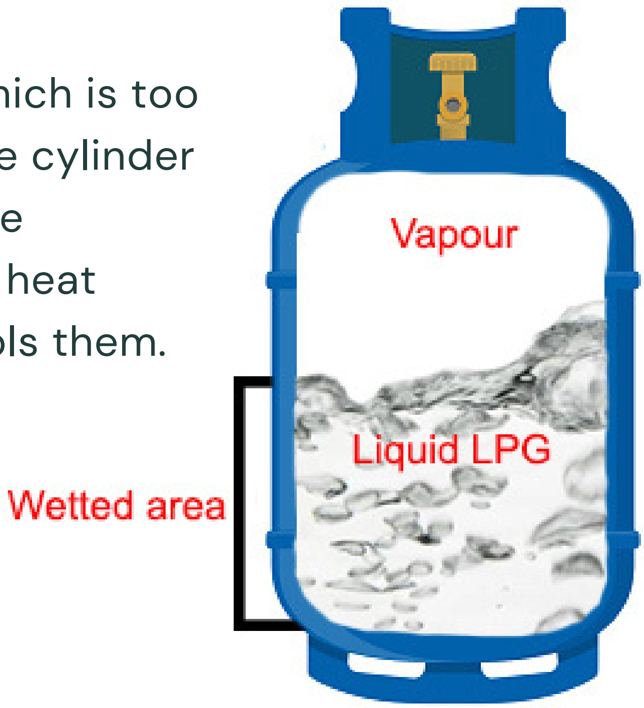
CONSUMPTION

Each household will have varying consumption of LPG dependent on the appliances they are running and the size of the household. Therefore the vessel (cylinder/container) size and installation must be suitable for the amount of LPG being drawn from the cylinders and their capable vaporisation rate.

A larger vessel provides a greater vaporisation rate.

The liquid LPG draws heat from the vessel walls, this area is called the "wetted area". Based on this concept, the larger the "wetted area" the higher the vaporisation rate, this rate will drop as the level of LPG within the vessel drops. The less contact between the vessel and the liquid LPG "wetted area", the less heat can be drawn from the steel to aid in vaporisation.

With a high LPG consumption of a vessel which is too small, it is common to see the outside of the cylinder "ice up" as gas is being drawn faster than the vaporisation rate, which in turn draws more heat from the surrounding cylinder walls and cools them.



This can then cause damage to the appliance in use, or cause it to temporarily stop functioning properly due to the starvation of LPG.

"The vaporisation capacity of any LP Gas container is dependent on the amount of heat that can be transferred from the external environment through the storage vessel wall into the liquid, this heat can be supplied from either artificial or natural sources.

The surface area of a vessel which is bathed with liquid is called the "wetted surface". The greater the wetted surface, the greater the vaporisation capacity of any storage vessel." - AS/NZS 5601.1:2013 (J8)

VAPORISATION CAPACITY

CYLINDER VAPORISATION CAPACITY

To calculate the vaproisation capacity of an LPG vessel a few assumptions have to be made, which makes the table below, a guideline and not completely accurate. These assumptions are:

- That the LPG is Propane (not a Propance and Butane mix)
- The cylinder/container is 30% full
- Relative humidity is 70%
- The vessel is under continuous load

Vaporisation capacity of gas cylinder					
Vaporisation capacity, MJ/h					
Vessel size kg	-1°C	4°C	10°C	16°C	22°C
45	118	141	164	188	211
90	155	185	216	246	277
190	265	318	372	424	477

Source: AS 5601.1:2013 (J2)