

Guidelines for Good Business Practices in the LPG Industry

GOOD
INDUSTRY
PRACTICES

The World LPG Association

The World LPG Association (WLPGA) was established in 1987 in Dublin, Ireland, under the initial name of The World LPG Forum.

The WLPGA unites the broad interests of the vast worldwide LPG industry in one organisation. It was granted Category II Consultative Status with the United Nations Economic and Social Council (ECOSOC) in 1989.

The WLPGA exists to provide representation of LPG use through leadership of the industry worldwide.

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This third revision of the *Guidelines for Good Business Practices in the LPG Industry* has been coordinated and drafted by Mr David Tyler of the World LPG Association (WLPGA) with the support from a task force including:

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**Guidelines for
Good Business Practices
in the LPG Industry**

Foreword

John Danilovich - ICC Secretary General¹

The International Chamber of Commerce (ICC) is the world business organisation which speaks with authority on behalf of its network of over six million companies in every part of the world, with a diversity of trades and sectors that gives it a unique role in today's economy.

From its very beginning in 1919, ICC has been a driver of global fair trade. ICC champions trade and investment, the market economy system, and global economic integration as a force for sustainable growth, job creation and prosperity.

The main activities of ICC include rule setting, dispute resolution and policy advocacy, thereby ensuring that the rising tide of trade and commerce reaches every shore without cumbersome processes. As its member companies and associations are themselves engaged in international operations, ICC has unrivalled authority in formulating rules, developing guidelines and establishing codes that govern the conduct of business across borders. Although these ICC practices are voluntary, they are observed in countless transactions every day and have become part of the fabric of international trade.

The role of business in an open market economy is to create wealth for shareholders, employees, customers and society at large. In order to fulfil this role, good business behaviour and practices are required for the best interests of all stakeholders.

In our globalised context and rising population, the management of energy regulatory, safety, health and environmental concerns are critical for the management of world energy. ICC recognises that companies all over the world need to integrate good business practices into their daily operations in this field. ICC is pleased to support the "Guidelines for Good Business Practices in the LPG Industry" addressing these topics: the guiding document serves as a unique foundation to accompany decision making for LPG companies and associations where there are sometimes weak regulations. This document also informs policy makers to assist them in creating a regulatory and policy framework structured in such a way as to minimise unsustainable practices from the LPG Industry and provide a competitive business climate.

The guidelines comply with the ICC long-standing culture of offering practical and educational reference tools for international businesses, thereby facilitating business and spreading good practices.

With this support, ICC acknowledges the effort made by the WLPGA to inform, educate and influence their stakeholders toward sustainable standards and corporate behaviour beyond their legal obligation, enabling the international LPG industry to improve the marketplace, and setting an example to other industries.

John Danilovich
Secretary General

¹ originally written in 2015

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Executive Summary

These **Guidelines for Good Business Practices in the LPG Industry** have been developed by the WLPGA for two specific purposes:

- To provide global LPG industry participants with a tool for ensuring the marketplace, and more importantly the customer, is not compromised by those in the industry who carry out 'bad practices', and
- To enlist the support of government in establishing and enforcing policies and regulations that creates a safe, equitable, and competitive environment for industry participants, and to ensure the benefits of LPG are not denied to those who rely on LPG for basic life needs.

These guidelines serve as a voluntary framework for LPG companies and associations where there are no, or weak, regulations. They will also provide an operating framework where laws and regulations do exist, but are weakly, arbitrarily, or inequitably enforced. For more detail on the safety implications of good practice it is recommended to read the **Guidelines for Good Safety Practice in the LPG Industry**, a publication of the United Nations Environment Programme and the WLPGA.

The LPG industry accepts its responsibilities for operating its business in conformity with applicable laws, regulations and standards. Yet, there are some issues over which only government has authority to enforce. Governmental authorities should view these guidelines as a 'checklist' to ensure these issues and recommendations are considered in their own regulations. Government should also support industry's efforts for self-regulation.

Senior officials and policy makers will find this **Executive Summary** helpful in understanding the product, the basic operations of the industry, the rationale for government involvement, and a brief description of some of the more common practices that demand enforcement. Officials charged with development and enforcement of policies and regulations will find a detailed discussion of the industry, its operations, and recommendations for proper practices throughout the document.

Since these Guidelines were last updated, the WLPGA have published several new documents which provide more detailed information in a number of areas of the business including LPG use in Commercial Kitchens, the use of LPG in Water Borne Vessels and LPG Cylinder Filling Plants. Where the reader has specific interest in these subjects it is strongly recommended these new publications are also studied alongside these Guidelines (www.wlpga.org/publications/).

Since the last update, there has also been some significant developments in the area of the 'Internet of Things' (IoT). The ability to communicate and store information and data with the 'Cloud' has created new opportunities for the LPG industry. For example, the ability to affordably monitor and track assets such as small LPG cylinders. This allows the owners of those assets to retain greater control of where they are, and how they are being used, which will significantly reduce the risks in the distribution channel. A new section has been added (3.7) to introduce this topic and how it can be applied to improve business practices in the distribution channel.

LPG - Its Uses and Benefits

LPG is a vital source of energy for hundreds of millions of people throughout the world. LPG consists mainly of Propane and Butane, which are gases at atmospheric temperature and pressure. When subjected to modest pressure or refrigeration, these gases liquefy making it possible to transport and store LPG as a liquid, yet be used as a gas.

This requires pressurised cylinders and containers (tanks), the care and handling of which is the subject of much of this document.

LPG is a clean and portable fuel. It provides heat and power in remote areas as well as in densely populated urban towns and cities. Because of its portability, it is not dependent on transmission lines or pipeline grids. The most popular application for LPG is for cooking, heating and water heating in the residential and commercial markets. The agriculture sector uses LPG for crop and animal production, grass cutting and weed control, and powering farm equipment such as irrigation pump engines. Industry relies on LPG for heating, drying, process heat and powering industrial trucks. In response to growing concerns of urban street air pollution and greenhouse gas formation, LPG use as an automotive fuel (Autogas) continues to grow rapidly, especially with the increasing health concerns from diesel emissions which are now confirmed to be a group one carcinogen to humans.

This multitude of uses means that many people are involved in the storage, handling and distribution of LPG. It also means there is the opportunity for unethical, unauthorised, or illegal practices to emerge putting innocent people, and reputable companies, at risk.

Industry Practices

In part, the motivation for this document is driven by the issue of 'metal management', a term describing the multi-functions of purchasing, supplying, maintaining and controlling cylinders - and other containers - used to store and transport LPG. LPG distribution, in particular the distribution of LPG by cylinders, is unique in the energy industry. LPG is one of the very few common consumer products sold in a metal or composite plastic container that is often costlier than the product it contains. In the distribution system many parties may physically handle the cylinder before it reaches the customer. Once the cylinder of LPG has been sold, the seller (who is frequently the cylinder owner) has no direct control over its subsequent use. This makes the importance of maintaining the cylinder or container integrity throughout the distribution chain an essential part of customer safety.

Some unscrupulous individuals elect to fill cylinders owned by others, steal others' cylinders and pay little or no attention to proper procedures for filling and handling LPG and maintaining the related equipment. Equally important, once the cylinder leaves the direct control of the owner, there is no guarantee as to when, or if, the cylinder will be returned. Yet, the owner is exposed to the risk that the misuse of their cylinder could result in injury to personnel, loss or damage to property, and loss of customer business. Accidents caused by circumstances, or people, beyond the control of the cylinder owner, can result in severe liability claims, damage to the reputation of the owner, damage to the company's brand, and general undermining of the overall reputation of the industry.

These aspects of the LPG industry make it of special importance that the market framework within which the LPG is sold and delivered ensures that cylinders and containers are properly maintained. Maintenance of the cylinder and container is the responsibility of the owner; proper and safe use is the responsibility of everyone in the distribution chain including the customer.

The Role of Government

Government plays a vital role for the LPG industry. Two essential areas of government involvement are the elimination of bad practices and bad operators, and providing a competitive business climate.

A. Elimination of Bad Practices

Within the market framework just mentioned there is a clear role for a partnership between industry and government. While industry works to provide a sustainable modern energy supply, government should be aware of, and work to rectify, some of the more egregious practices of unscrupulous operators including:

- Poorly designed and badly constructed LPG storage facilities.

This is one of the more capital-intensive investments in the LPG industry. Poorly designed plants and other facilities can result in unfair competition, as a result of lower capital outlay by unscrupulous operators, and greater safety risk to employees, customers and the general public.

- Inadequate training of staff

Inadequately trained staff leads to a high-risk environment, operational errors, and endangerment of customers and the general public.

- Allowing unauthorised premises/personnel to operate

LPG plants contain hazardous goods. It is essential they operate in accordance with approved procedures adapted and suited to their environment. Unauthorised operation can lead to inequitable competition, the encouragement of bad practices by others, sub-standard equipment in service, danger to the general public and governments being deprived of legitimate revenue.

- Use of unsafe LPG containers (cylinders and tanks)

LPG containers, when constructed to established standards and codes, are durable and have a long useful life. When they are no longer safely usable, they should be made unserviceable. The use of unsafe containers results in unfair competition, a serious risk to the general public, and possible litigation for reputable manufacturers.

- Illegal filling (decanting) of cylinders

One of the more destructive practices in the LPG industry is the illegal filling (pirate filling) of cylinders by someone other than the cylinder owner. This dangerous practice can result in:

- (i) no control over the condition of the cylinder
- (ii) no control over the quality or quantity of the product in the cylinder
- (iii) serious risk of damage or injury to those handling the cylinder, including the customer, and
- (iv) inequitable and often unsustainable competition

- Unauthorised acquisition, reworking, and repainting of cylinders

This practice involves one company stealing the cylinder of another company, repainting it with the brand of that other company, and then re-introducing it into the market. This can result in:

- (i) no control over the cylinder condition
- (ii) serious risk exposure to those handling the cylinder, including the customer
- (iii) inequitable competition, and
- (iv) loss of assets of the legitimate owner

- Under-filling of cylinders and containers

LPG is sold by weight in cylinders, and by weight or volumetric meter in larger containers. Under-filling can be a deliberate act or one of negligence. The customer is entitled to receive all the product purchased.

- Over-filling of cylinders and containers

The over-filling of cylinders and containers is unlikely to be done deliberately but poorly calibrated filling equipment might lead to this. Over filled cylinders and containers is a dangerous practice that increases the probability of an uncontrolled loss of product.

- Poor maintenance of trucks, plants and containers

Whether an operator chooses to have attractive equipment is a matter of choice. Maintenance of that equipment is not a matter of choice. Poorly maintained equipment can lead to leakage of product, unsafe cylinders, unsafe trucks on the road and hazardous plant conditions. All these conditions will result in risk to employees, personnel and the general public.

B. Provide Competitive Business Climate

LPG has a unique role for both developing and developed economies. It is often the first, and sometimes the only, modern form of energy available. In developing countries, the first use is frequently for cooking. Here, LPG displaces wood, coal, charcoal, kerosene, animal waste and other dirty traditional fuels. LPG is a clean burning and portable fuel, and, as such, it:

- Brings the benefit of modern energy to many, without the need for costly infrastructure in transmission lines or pipelines
- Saves precious trees and forests, frequently the only source of fuel for many
- Improves the air quality of homes to which women, children and the elderly are particularly exposed and sensitive

LPG is, however, used for more than just cooking. Over 1,500 uses have been identified in the residential, commercial, industrial, agricultural, chemical and automotive markets.

For the LPG industry to fulfill its role, it must operate within a framework of 'good business practices'. It also must rely on the establishment and enforcement of sound governmental practices that:

- (i) ensure common rules for all participants in the market equally applied and enforced
- (ii) clearly define the rights and responsibilities for all participants including the customer
- (iii) offer those with investments an opportunity for a fair and reasonable financial return on those investments
- (iv) provide an avenue of redress for those aggrieved by 'bad practices'

For private business to bring the benefit of LPG to those wanting or needing its products and services, there must be a 'level playing field' where the rules are the same for all players. Only then will businesses take the risk of investment, provide jobs, and contribute to the economic welfare of the communities in which they operate.

A business climate that favours some over others, either by lack of enforcement or inequitable enforcement of regulations, will ultimately prove a disincentive to the legitimate operators and encourage a reduction in industry standards and inevitably a reduction in industry competition.

The Role of Industry

It is not only government that has responsibilities. It is important to note that WLPGA views the bad practices discussed in this document as an industry issue, and is not relying on government to determine how the industry should operate. During over 100 years of existence, the LPG industry, in cooperation with government and international organisations (CEN/ISO), has consistently developed standards of practices that, in many countries, have been incorporated into government regulations. The LPG industry works continuously to evolve these standards in response to new technologies, new applications and other new challenges.

The LPG industry is also accountable, and accepts its responsibilities, for:

- Providing a safe, dependable energy to its customers

- Providing training for its staff
- Operating its plants, transportation and equipment in a safe manner
- Treating employees, contractors and customers fairly
- Operating its business ethically
- Cooperating with local and national officials

The purpose of this document is not to encourage a global uniform business structure. Rather, its purpose is to create a solid common base on which LPG businesses can be built and compete fairly. The important element of differentiation within the industry is encouraged as companies continue to strive towards best practice. Only then will customers receive and enjoy the many benefits provided by LPG.

Introduction and Purpose

Introduction

LPG is a convenient, portable, clean and highly efficient fuel and is used in many different applications in countries all over the world.

The global availability and popularity of LPG has driven widespread and increased application, resulting in it being used for the first time in many countries. Used not just by customers, but operators of LPG companies, distributors, retailers, contractors, government authorities and many other people with an involvement in the business. The versatility of the product enables it to be used in new applications in countries where it has already established itself as a popular energy source.

In all markets, wide varieties of practices are adopted in the marketing and distribution of the product and associated services. Some of these practices are not always in the best interests of the industry, the companies or the customer.

Some of these practices are illegal. Others may be legal but unethical, others legal but unsafe. Where these bad practices do exist, they are putting people at risk, jeopardising the reputation of the LPG industry and threatening the long-term prospects for the industry.

Purpose

This document is produced by the WLPGA to provide some guidelines for good business practices throughout the LPG industry for the benefit of all stakeholders in the industry, particularly LPG marketers/suppliers and regulatory authorities. This document will be helpful to LPG industry associations around the world to assist them in the promotion and application of good business practices in a fair and equitable manner for the benefit of all concerned, particularly the customer and the end user.

These Guidelines contain examples of good business practices that can be easily applied to any LPG business. It draws from the experience of people who have been involved with the product and industry for many years.

The first chapters provide some background to the LPG industry by briefly reviewing the stakeholders - and their roles - in the business, the product, and the distribution chain. For those already familiar with the LPG industry, you may decide to proceed straight to Chapter Four – Good Business Practices. This section of the document discusses good business practices from the main storage facility to the final customer by considering some of the major market segments - domestic and commercial cylinder (or packed), reticulated, domestic and industrial bulk, and automotive. Chapter Four also highlights some of the more prevalent bad practices that are in evidence across the business and discusses the impact they have on the overall industry.

One new section that has been included in this update is 3.7 which focuses on the Internet of Things (IoT). There have been many developments in this area since the last update and it is timely to include a brief explanation in this document about some of the new technology and innovations around IoT and how they can impact on the LPG business.

IoT presents some very interesting, and now affordable, offerings for the LPG industry that can contribute to improving the efficiency of the business, controlling the assets, and helping to eliminate bad practices. There are many examples in this document where bad business practices impact upon the safety and welfare of people. These will be discussed, but for more detail on the safety implications of good practices it is recommended to read the *Guidelines for Good Safety Practice in the LPG Industry*, a publication of the United Nations Environment Programme and the WLPGA.

Chapter One

Stakeholders in the LPG Business

1.1 Stakeholders and Good Business Practices

- 1.1.1 LPG businesses around the world operate with a variety of different practices. Most of these are good but some are illegal, unethical and/or unsafe. These bad business practices damage the brand and reputation of the industry, and of reputable companies, undermine business profitability and can put lives of innocent people at risk by compromising on safety.
- 1.1.2 To counter bad business practices, reputable players may have to invest more to ensure safety and protect their business interests, a cost which is either passed on to the customer or undermines the financial foundation of the business.
- 1.1.3 There are many different interested parties, or stakeholders, involved in successfully running a safe and profitable LPG business.
- 1.1.4 Everyone involved has a responsibility and should collaborate to ensure that well informed decisions are taken.
- 1.1.5 Good business practices that are well designed and properly implemented benefit everyone. They help achieve public interest goals, attract customers and minimise regulatory intervention. The diagram below shows some of the key stakeholders in the LPG business. They are examined in more detail in section 1.2 to 1.9.



- 1.1.6 Good business practices stimulate more efficient and cost-effective operations and minimise the impact of any negative social, safety, environmental or economic issues. Companies using good business practices attract better staff, making them more competitive.

- 1.1.7 The application of good business practices helps companies improve their public image and their credibility with government authorities, since good business practices complement existing regulations and legislation.
- 1.1.8 Good business practices should be generic and flexible enough to be workable and easily understood, but detailed enough to prevent confusion. They should be an achievable goal for all stakeholders.
- 1.1.9 In return for complying with these responsibilities, those with investment in the distribution chain are entitled to a return on that investment. To ensure this, and encourage responsible investment in the LPG Industry, the company has the right to stipulate, where applicable, how employees, affiliates, and customers use the company's equipment. This includes the equipment being used only for the sale of the company's own gas, thereby providing the company with an incentive to ensure that the equipment is maintained in a safe condition.
- 1.1.10 When others infringe the company's rights through theft or misuse of equipment, the company has a right to expect a regulatory framework that will protect its investment by allowing appropriate legal action and redress.

1.2 Producer/Supplier/Marketer

- 1.2.1 The LPG producer/supplier/marketer is the primary link in the distribution chain and has ultimate responsibility for serving the customer. This group also has responsibilities to their shareholders, their employees and society in general.
- 1.2.2 The LPG producer/supplier/marketer establishes the good business practices within the organisation that flow through the entire chain of distribution. Third parties that are contracted to the LPG producer/supplier/marketer will be influenced by their view of business practices exhibited by them.
- 1.2.3 It is vital that good business practices form an integral part of the organisations' culture. If not, bad practices will threaten not only the business but also the rest of the industry. Good business practice starts at the LPG production source through to the depot where storage, cylinder filling and bulk loading occur. It is here that an LPG producer/supplier/marketer begins to set the example. It continues throughout the distribution chain and culminates at the customers' installation.
- 1.2.4 In many cases, the producer/supplier/marketer is responsible for the construction, operation and maintenance of facilities, both at its own and at the customer premises. In such cases, this group has a responsibility for ensuring that these facilities are safe for use and fit for purpose, including training employees, customers and distributors, and developing contingency plans for emergency situations. However, the producer/supplier/marketer group are not responsible for the misuse of these facilities by the customer.
- 1.2.5 The producer/supplier/marketer is responsible for ensuring that the customer receives the quantity and quality of gas being paid for, with no under or over-filling. A well-planned supply of gas to the customer is also necessary. This will reduce the need for additional LPG storage at the customer premises and/or reduce the number of deliveries and service calls.

1.3 Equipment and Appliance Manufacturer / Supplier

- 1.3.1 The equipment and appliance manufacturer/supplier provides LPG equipment to store, handle, distribute and use of the product. This equipment includes storage tanks, cylinders, cylinder filling plants, vehicles, compressors, pipework, pressure regulators, gauges and controls as well as the appliances and equipment that uses LPG.
- 1.3.2 Both equipment and appliance manufacturers/suppliers must act in a responsible manner and provide instruction and training along with a range of goods that are fit for purpose and operate safely and reliably with LPG. They should recognise the essential role they have in promoting good business practices and work closely with LPG companies to ensure this happens. They should also ensure that future technical needs are met by working closely with other LPG stakeholders.

- 1.3.3 There is a wide range of LPG equipment and appliance design codes and standards that have already been developed. Some of these are listed in Appendix Three of the document *Guidelines for Good Safety Practice in the LPG Industry*.
- 1.3.4 The equipment used in an LPG business is likely in most cases to be owned by, and become part of, the asset base of the company. The way it performs will influence the success and reputation of the company as well as the level of customer satisfaction.
- 1.3.5 Customers are likely to own gas-consuming appliances such as stoves, cookers, burners, engines and in some cases the container, the gas pipelines and regulators. They expect to receive clear operating instructions and advice on how to use, and maintain, the equipment and appliances properly in a safe environment (e.g. properly located in a well-ventilated area) and how to act in case of an incident.

1.4 Contractor/Installer

- 1.4.1 Contractors and installers are employed to carry out tasks throughout the storage, handling and distribution chain. They can be employed within the primary storage depot or LPG cylinder-filling plants, assist in distributing the product, or be involved with the construction and maintenance of customer installations.
- 1.4.2 Both contractors and installers should employ people who have achieved the required level of skill and competency. Often this is set down in law or described in codes of practice such as those listed in the document [*Guidelines for Good Safety Practice in the LPG Industry*](#).
- 1.4.3 Contractors/installers may carry out work for more than one company; therefore, they are in a unique position to compare different work practices. They have a responsibility to undertake tasks according to their agreed contract conditions, but they are also able to promote good business practices within the industry.

1.5 Distributor/Agent/Dealer/Retailer

- 1.5.1 The distributor/agent/dealer/retailer is the next link in the distribution chain that supplies the customer with product and services.
- 1.5.2 The distribution chain may likely involve several different third-party businesses that moves the product from the LPG storage depot, cylinder filling plant or bulk loading facility to the customer. For many, the distribution of LPG is their main activity. For others, it is only part of their business.
- 1.5.3 The distributor/agent/retailer/dealer all have a common aim - to move the product in a safe and efficient manner to the end user, and assist in meeting both the needs of the marketer/supplier and the customer.
- 1.5.4 The distribution chain is where many bad practices occur and continue unnoticed. As the product moves further down the distribution chain from the depot to the customer, the control over business practices by the marketer/supplier becomes weaker. This is the point in the distribution chain where the customer interface occurs. It is critical that good business practices are in evidence here.

1.6 Customer

- 1.6.1 The customer is the final link in the distribution chain through the purchase and use of the product.
- 1.6.2 The range of different applications for the product means that LPG customers can be representatives of a whole range of different applications including large industrial consumers and individual householders.

- 1.6.3 Customers clearly have a right to expect that they will be delivered the correct quantity and quality of LPG being ordered, and paid for. Customers have a right to expect that any equipment or storage container (including cylinders) on their premises be kept in a safe condition by the equipment owners. Customers also have a right to be informed of how to use LPG in a safe manner, and how to respond to an LPG emergency.
- 1.6.4 To ensure that these rights are respected, customers also have responsibilities. These include applying a duty of care to the equipment of the owner, complying with operating and safety instructions, ensuring that only LPG supplied by the equipment owner is used in their equipment, and maintaining a safe environment (e.g. ensuring there is adequate ventilation for the equipment, and the pressure vessels are secured and protected from damage).
- 1.6.5 For a large industrial application this responsibility may also include emergency response actions and obligations to carry out any simulated firefighting and emergency response training. Customers also have a duty to keep their supplier informed, particularly if it relates to the performance of the product. Customers are one of the most important stakeholders in the LPG business and can strongly influence the way the business is run.

1.7 LPG Associations

- 1.7.1 LPG industry associations are a common feature of LPG businesses worldwide. Their structures and roles may differ, but they all have as one of their objectives the creation of an environment for developing the LPG business in their country, or region, in a safe, consistent and efficient manner. An industry association provides an opportunity for all the major stakeholders to discuss issues relating to safe standards of operation, good business practices and to act as the common voice of the industry. Industry associations liaise with the national and local regulatory authorities. They may also produce standards and codes of practice in a self-regulating environment.
- 1.7.2 The WLPGA strongly supports the presence of an LPG association in any country where an LPG business exists. In support of that the WLPGA has produced a Guide to Good Industry Practices for LPG Associations (<https://www.wlpga.org/wp-content/uploads/2015/09/good-business-practices-for-lp-gas-associations.pdf>).

1.8 National and Local Authorities

- 1.8.1 National and local authorities are the governmental bodies that pass laws and adopt and enforce codes of practice and standards of operation. They represent the public who has entrusted them to produce a sensible, workable framework, with the expectation of industry compliance.
- 1.8.2 Their role is primarily to protect the interests of both customers and industry. This protection is typically carried out by ensuring that a good legislative and regulatory framework is in place and suitably enforced. Such a framework includes appropriate regulations and proper enforcement. These should be supported by codes of practice and technical and safety standards for all parts of the business, from supplier to appliance manufacturer to user. These codes and standards may frequently be adopted from other recognised international codes and standards rather than be initiated.
- 1.8.3 In the absence of adequate regulations, or proper enforcement, a self-regulating LPG industry can work very well with the commitment and cooperation of all stakeholders. Regulatory authorities need to support self-regulation efforts if there are inadequate official standards and regulations.
- 1.8.4 Unrealistic high standards attract unnecessary costs that ultimately must be passed onto the customer. They can also encourage unethical and unsafe practices because they provide an incentive for cheating and non-compliance.
- 1.8.5 It is important for authorities to involve all stakeholders in the development of LPG standards. A sense of ownership of standards will encourage their application and compliance. There is also an important obligation of governments to inspect and audit operations, provide advice on any non-compliance and to identify and close

those illegal activities that jeopardise legitimate businesses and the safety of the general public. The application of severe penalties for non-compliance is an important measure to ensure bad practices are eliminated.

- 1.8.6 Governments should also be encouraged to follow developments in the LPG industry. Countries that have successfully introduced LPG should be used as models for other countries. LPG industry stakeholders can facilitate dialogue among various countries' legislative and regulatory authorities. Inconsistent regulations or wayward interpretation of standards and codes by different parts of the same government/authority, can prove difficult to unravel and align, and can be avoided by early and consistent engagement by the industry.
- 1.8.7 National and local authorities often have the power to issue licenses and sanction approval for new or existing LPG storage, handling and distribution infrastructure. In order to ensure safe practices are maintained, it is important that authorities enforce regulations equitably and allow marketers/suppliers to seek redress against theft or misuse of their equipment.
- 1.8.8 As detailed later in this document, allowing marketers/suppliers to control equipment, cylinders and other LPG storage facilities in which they have invested, allows them to generate a return from their investment and gives an incentive for LPG marketers/suppliers to ensure these are properly maintained and safe for use.

1.9 Retailer Service Station

- 1.9.1 LPG – known as Autogas when used in on-road engine applications – has very good engine fuel properties and is the world's number one alternative transport fuel to gasoline and diesel.
- 1.9.2 Autogas may or may not have separate vehicle re-fuelling arrangements and these may be under the control of the marketer, or in some cases, the customer. The customer may for example be the operator of a taxi fleet.
- 1.9.3 The procedures for storage, handling and re-fuelling Autogas at these locations need to be clear and well communicated in the same way that they are for gasoline and diesel. Their role is similar to that set out in 1.5 above.

Chapter Two

LPG - The Product

2.1 LPG - A Global Fuel

- 2.1.1 Worldwide LPG demand has grown by around 5% a year during the last decade. It is produced from the refining process of crude oil as a by-product, and from natural gas production. Currently (2017), global demand of LPG is around 300 million metric tonnes/year with a forecast of continued growth for the foreseeable future.
- 2.1.2 LPG is a global fuel. Although the majority of production is in North America and the Middle East, it is used in most countries of the world. Demand has been growing strongly in Central America, the Middle East and Asia although some African countries have also experienced particularly high growth rates. It is estimated that half the global LPG demand will arise in developing countries within 30 years.
- 2.1.3 Nearly 50% of the world's LPG demand is in the domestic (residential) and commercial markets where it is used for primarily cooking, space heating and water heating. It has excellent engine fuel properties and is becoming increasingly popular as an automotive fuel and for power generation.
- 2.1.4 The impact of this growth on society and the environment is significant as LPG is displacing solid fuels such as wood, coal, charcoal, kerosene and animal waste. These traditional fuels produce particulate matter (PM) which can cause severe health problems through respiratory illness. As a result, LPG is making a significant contribution in improving air quality levels in the home, in commercial kitchens and in restaurants.
- 2.1.5 There are other social issues associated with changing domestic fuel use. No longer does the household have to deal with the messy collection and storage of solid fuel, and prepare and clean appliances. LPG further eliminates the risk of burns from lingering fires.
- 2.1.6 The use of LPG as Autogas has led to significant improvements in urban street level air quality by displacing traditional automotive fuels such as diesel and gasoline. Autogas offers considerable strategic and environmental benefits in the supply and economics of automotive fuels. This is especially important following the World Health Organisation's (WHO) announcement in 2012 that diesel emissions are a confirmed Group One Carcinogen to humans, encouraging the total or partial displacement of diesel by LPG as a transport fuel option in several countries.

2.2 Properties of LPG

- 2.2.1 LPG, is the term widely used to describe a family of light hydrocarbons. The two most prominent members of this family are Propane (C_3H_8) and Butane (C_4H_{10}). LPG can also describe mixtures of the two. LPG is derived from natural gas processing and crude oil refining and is a by-product.

Typical Properties of LPG			
Property	Propane	Iso-Butane	n-Butane
Chemical Formula	C ₃ H ₈		C ₄ H ₁₀
Boiling point at 101.3 kPa (°C)	-42.1	-11.8	-0.5
Liquid density at 15 °C (kg/m ³)	506.0	561.5	583.0
Absolute vapour pressure at 40 °C (kPa)	1510	530	375
Flash Point (°C)	-104	-83	-60
Upper flammable limit (% vol. in air)	9.5	8.5	8.5
Lower flammable limit (% vol. in air)	2.3	1.9	1.9
Vol. vapour per vol. liquid	269	221	235
Relative vapour density (air = 1)	1.55	2.07	2.07
Coefficient of expansion (liquid) per 1°C	0.0032		0.0023
Minimum air for combustion (m ³ /m ³)	24		30
Kinematic Viscosity (centistokes) @ 20°C	0.20	0.29	0.30
Latent Heat of Vapourisation (kJ/kg) @ 20°C	352		368
Specific Heat (kJ/kg/°C) @ 20°C – liquid	2.554		2.361
Specific Heat (kJ/kg/°C) @ 20°C – vapour	1.047		1.495
Minimum ignition temperature (°C) in oxygen	470 - 575		380 – 550
Maximum Flame temperature (°C)	1980		1990
Octane number	>100		92
Specific Energy (gross) MJ/kg	49.83		49.40

2.2.2 Natural Gas (NG) may contain up to 10% Propane and Butane, which has to be extracted out before it can be transported. LPG represents about 3% – 10% of typical crude oil refinery production. The refinery is designed to mainly produce other fuels such as gasoline, heating oil, (aviation) kerosene, and diesel.

2.2.3 LPG is lighter than water as a liquid but heavier than air as a gas. In their liquid state Propane and Butane have the appearance of water but only about half the density of water.

2.2.4 Propane and Butane boil at different temperatures - Propane at around minus 42°C, Butane at around 0°C. The gas produced when Propane and Butane boil (vaporise) is invisible and has no natural odour (although a disagreeable and unpleasant odourant is added to aid the detection of a leak). A liquid leak will give the appearance of a white cloud. This white cloud is formed by condensing and freezing the water vapour in the atmosphere.



A controlled leak of liquid LPG

2.2.5 In liquid form the volume of LPG changes significantly in response to changes in temperature. As a result, LPG storage containers are never filled to capacity. This allows expansion to take place inside the container without causing damage to the container, and ultimately an uncontrolled release of gas. Typical fill levels for LPG storage containers are around 80% of the container's volume.

2.2.6 LPG is easily stored as a liquid under moderate pressure. One unit of liquid expands to about 270 units of vapour (for example, one litre of liquid Propane will expand to about 270 litres of Propane vapour).

2.2.7 The flammable range of LPG is a mixture of between 2% and 10 % LPG in air. This mixture needs around 24 times (for Propane) and 30 times (for Butane) the same volume of air for complete combustion which means LPG needs adequate ventilation for burning. The energy content is very high, and it produces a very hot flame. For more details on the properties of LPG refer to the document [Guidelines for Good Safety Practice in the LPG Industry](#).

2.3 Product Benefits

- 2.3.1 The physical properties of LPG enable significant amounts of energy to be transported easily as a liquid under moderate pressure, yet when used it has all the attributes of a gaseous fuel. Because LPG consists of mixtures of Propane and Butane, specifications have been established for many different applications. For more information on this important subject see *Guidelines for Good Safety Practice in the LPG Industry*.
- 2.3.2 LPG is a clean burning fuel. This allows the flame to be in direct contact with food (e.g. ovens), and articles such as fine pottery, without fear of contamination.
- 2.3.3 LPG has environmental and health benefits. It is non-toxic and will not contaminate aquifers or soil. If spilt, LPG will evaporate and disperse into the atmosphere. Unlike methane (Natural Gas or NG) the constituents of LPG (Propane and Butane) do not contribute to the atmospheric greenhouse gas loading.
- 2.3.4 LPG mixed with air produces a very hot flame when ignited and has good temperature control. The high flame temperature allows it to be used in the metal cutting industry and any application requiring precise temperatures.
- 2.3.5 LPG is portable. It does not rely on a distribution network of pipelines or transmission lines. Its portability allows it to be used in some of the world's most remote areas or in downtown urban areas.
- 2.3.6 LPG has an infinite life span (shelf life). Unlike some other liquid petroleum fuels, LPG will not oxidise and deteriorate over time in storage.

2.4 Main Applications

- 2.4.1 LPG can provide power to the smallest domestic appliance or the largest industrial application. In addition to its many applications as a fuel, LPG is also an important feedstock for the chemical and plastics industry.
- 2.4.2 Clean burning LPG is ideally suited for domestic and commercial cooking, space heating and water heating, and power generation, particularly in remote locations.
- 2.4.3 LPG assists farmers to increase their output, and improve the quality, of crop production through weed flaming, crop harvesting, and crop drying. LPG is also used to heat breeding houses for pigs and poultry, and powers farm equipment such as tractors and irrigation pump engines.
- 2.4.4 There are almost no limitations for LPG use in the industrial sector. Some common applications include heat treatment furnaces, direct firing of ceramic kilns, glass making/working, textile and paper processing, paint drying and cotton singeing, process heat (oil and steam) and as an excellent clean-burning fuel for forklift -trucks.
- 2.4.5 The purity of LPG also enables it to be used as an aerosol propellant in its unodourised form.
- 2.4.6 The clean burning nature and portability of LPG has led it to become one of the fastest growing transport fuels. Although it has been used for years as a low emission alternative to gasoline and diesel forklift trucks, more recently LPG is being used for on-road applications in vehicles such as taxis, private cars and buses. The photo opposite is an example of a dedicated LPG passenger vehicle.
- 2.4.7 Finally, the versatility of LPG allows users to rationalise on one form of energy eliminating the need for storing and handling several different types of fuel.

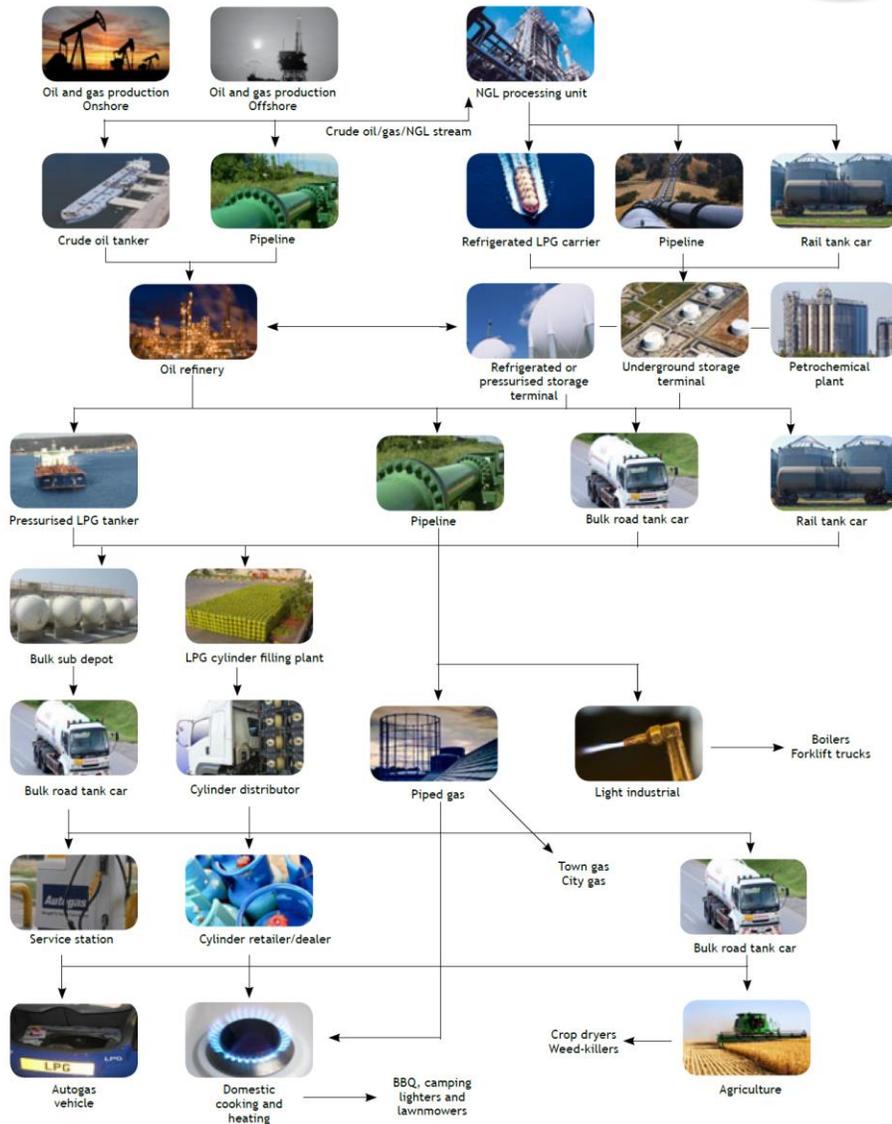


Chapter Three

LPG Distribution Chain



LPG DISTRIBUTION CHAIN



3.1 Primary Storage

3.1.1 Following production, the first stage in the local distribution chain of LPG is primary storage where product is received from the producer. Examples of primary storage are underground caverns, refrigerated tanks, and steel cylindrical shaped or spherical shaped tanks. The tanks may be underground, mounded (partly underground or partly above ground but covered) or totally aboveground. All tanks are either pressurised or refrigerated. Refrigerated storage enables the product to be kept as a liquid under minimal pressure.

3.1.2 Caverns can only be constructed where the ground and rock strata configuration allow. Being underground they are less obtrusive to the landscape.

3.1.3 Mounded storage facilities (illustrated here) are employed where it is difficult to achieve the degree of safety required in densely population areas. They also have the advantage of being less obtrusive and inherently better protected against fire.



3.1.4 Above ground cylindrical tanks and spheres are the most common symbols of LPG primary storage. Being aboveground they must be protected against fire and impact.

3.1.5 LPG can be distributed to and from primary storage facilities by various means. These include ship, barge, pipeline, rail tanker, road tanker, tank-container, and cylinders.

3.2 Cylinder-Filling Plants

3.2.1 From primary storage the product moves either to a bulk loading facility or to an LPG cylinder filling plant. Cylinder-filling plants can be fully automatic, employing few people, or manually operated and heavily dependent on operators.



Automatic cylinder filling carousel

3.2.2 Empty cylinders enter the filling plant where they are visually checked for wear and damage – and if necessary repaired and cleaned, or condemned and discarded (all metals are recyclable). Further inspection determines whether the cylinder is due for re-qualification. After filling, and checking for over or under filling, cylinders are then carefully checked for leaks before being sealed, applicable warning labels and protective coverings affixed and loaded onto distributor trucks or put into store.

3.3 Bulk Loading

3.3.1 Some applications for LPG consume large quantities of product making the use of cylinders inefficient and impractical. In such cases local bulk storage facilities are installed at customer premises or intermediate depots to receive product in bulk, normally by road tanker.

3.3.2 Road tankers vary in size from around 1 metric tonne (1MT) capacity to over 20 metric tonnes (20MT). Road tankers are filled in the LPG depot and deliver product in bulk to one or more customer facilities. Drivers are responsible for ensuring the vehicle is properly loaded and the correct amount of product safely delivered to the correct locations. They must be suitability licenced, fully trained and certified.

3.3.3 An LPG road tanker is a road-going pressurised vessel that must comply with rigorous specified standards of design, construction, operation and maintenance. In addition, there are other aspects of the design and



LPG road tankers by storage tanks

operation that need to be considered because the vehicle is being driven on the roads, often through populated areas and busy traffic.

- 3.3.4 The actual bulk loading operation involves strict procedures to control the hazard of transferring several tonnes of product from primary storage to a vehicle. Similar procedures apply to the unloading of product at the customers' premises or intermediate terminals.
- 3.3.5 LPG can be sold to the customer by weight or by volume, but in the automotive sector it is always sold to the final customer (motorist) by volume to reflect the traditional marketing of gasoline and diesel fuel.
- 3.3.6 The supplier of gas may own the storage and distribution facilities at customer sites through a loan or lease arrangement, or the customer may decide to purchase his own equipment. Whatever the arrangement, storage must be properly sited, designed, constructed and maintained through regular inspection by trained personnel.

3.4 Distribution

- 3.4.1 A distributor or dealer network commonly handles the link between the LPG storage depot and the retailer. However, marketers/suppliers may deliver directly to the customer. Distributors may be subsidiaries of the marketer/supplier, or third-party companies contracted by LPG marketers/suppliers. Distributors act on behalf of the marketer/supplier and in accordance with their instructions. Distributors will often interface with the customer.
- 3.4.2 Product title, or ownership, transfers from the LPG marketer/supplier to the customer through the distribution chain. Distributors may own vehicles to deliver and transfer product or rent them from transporters. These vehicles must comply with strict safety requirements because they enter the LPG depot of the marketer/supplier.
- 3.4.3 Good business practices are very important in the distribution chain, but like the imposition of good safety practices, they are often less easy to control as the product travels further from the LPG depot.

3.5 Retailing

- 3.5.1 The retailer is the point in the distribution chain where the customer is presented with the consumer proposition. A retailer has an essential role in ensuring the customer is informed about any safety instructions, is satisfied and continues to purchase, and is well informed on safety instructions.
- 3.5.2 Customer Service Centres are a vital part of a retailing organisation that can support these aims.
- 3.5.3 The retail bulk delivery transaction may be performed by the marketer/supplier, or by the distributor directly from the storage depot to the customer location. Cylinder deliveries are usually made by the market/supplier subsidiary or by a contracted distributor.
- 3.5.4 Bad practices at retailer level are likely to be witnessed by the customer; therefore, it is especially important to promote good business practices at this level. Also, significant consumer protection regulation in many parts of the world provides heavy penalties for identified illegal practices.

3.6 Customer Interface

- 3.6.1 The final link in the distribution chain is the customer. There will be occasions when the customer deliberately or unknowingly introduces some examples of bad business practices.
- 3.6.2 The customer is likely to be less familiar with the product, and the product benefits, than others in the distribution chain. Customers will rely heavily for advice from the supplier. It is extremely important that the customer receives this advice in a timely, clear and accurate way.
- 3.6.3 The customer needs to understand that unethical or illegal practices, such as misapplication or using illegally filled cylinders, can jeopardise personal, business or public safety, and jeopardise any relationship with the customer.
- 3.6.4 Good business practices dictate that proper records be maintained of all educational and warning materials that are given to customers.

3.7 Internet of Things

- 3.7.1 The LPG industry is asset intensive and tracking those assets, and measuring their effectiveness in operation, is an important part of what is often called 'metal management'.
- 3.7.2 Tracking and measuring assets in the LPG business has its challenges but to do so effectively is an important task when striving towards good business practices.
- 3.7.3 There has been some major developments in digital technology, and the use of the internet, since this document was first published. The subject now demands some attention to ensure that the role of the Internet of Things (IoT) is understood, and its role in achieving good business practices is recognised.
- 3.7.4 As an example, although telemetry was being used to monitor storage tank contents twenty years ago the technology depended on a safe and reliable telephone land line for it to function effectively.
- 3.7.5 Cellular telephones were an improvement on land lines and the cost of installing and maintaining these systems began to fall. This made the technology more affordable and justifiable, particularly where small storage facilities were being used.
- 3.7.6 The cost of transponders, which had to store all the information on the asset, remained relatively high, effectively restricting their use to larger and more expensive assets.
- 3.7.7 The internet has enabled this information to be now stored in the 'cloud' with small passive transponders needing just the minimum storage requirement to communicate.
- 3.7.8 These transponders allow individual cylinders to be detected and tracked at all points in the supply chain.
- 3.7.9 This tracking information provides LPG companies with unprecedented supply chain transparency and process control, allowing companies to combat LPG pilferage, diversion and theft of cylinders and build their brand by building targeted customer loyalty programs based on actual consumer consumption and purchasing behavior.
- 3.7.10 The IoT is not just restricted to cylinders. The ability to apply IoT throughout the whole value chain, from production well head through the entire distribution chain to the consumer, brings potential benefits right across the whole LPG business.



Transponders have become small and affordable

Chapter Four

Good Business Practices

4.1 The Market and Good Business Practices

Several LPG marketing segments - domestic and commercial packed (cylinders), reticulated (piped LPG), domestic and industrial bulk, and automotive - are examined below for common examples of bad practices at each stage of the distribution chain.

In examining the business in this way, some key issues are highlighted. The driving force behind this discussion is first and foremost the safety of the customer and the general public. The impact of bad practices adds unnecessary inconvenience and costs to a business that the customer ultimately must bear.

Proper attention to good business practices is essential for maintaining:

- The customer proposition - including the quality of cylinders, tanks and the product itself
- Business assets - including personnel and all hardware
- The reputation and brand of the company
- The financial responsibility of the company
- Competition in the marketplace
- Other stakeholder interests

Primary storage, LPG cylinder-filling plants and bulk loading facilities are examined. The business practices discussed in these areas relate mainly to terminal and depot operations. However, their impact goes well beyond the depot and carries on throughout the entire distribution chain.

Business practices in the distribution chain and the customer interface are then examined. It is in the distribution chain that many of the endemic bad practices can occur, and can go unnoticed initially.

Some of the more important practices are discussed, including 'metal management' - the term that defines the integrated functions of owning, handling, and maintaining the cylinders (both steel and composite) and containers in which the LPG is stored.

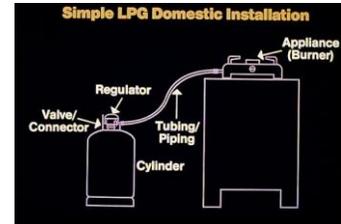
The issue of good business practices for cylinders is so important that a separate review of the risks and remedies has been included in Appendix One.

First, a brief description of the marketing segments:

4.1.1 Domestic Packed

4.1.1.1 The most popular marketing segment found across the global LPG industry is the supply of small portable domestic cylinders to households through a distributor and retail network.

4.1.1.2 The domestic LPG market typifies the business for many people. The domestic customer is usually serviced with an LPG cylinder, that can be as small as 1kg up to 45kg, that supplies gas, via a pressure regulator, through a hose connection to a domestic appliance.



4.1.1.3 In some countries the cylinder/valve package is purchased outright by the customer, in others it is loaned on deposit, leased or rented. Occasionally, it is provided free of charge as part of the customer proposition. The issue of cylinder ownership is critical to the success of a domestic LPG business, for both supplier and customer, and is covered in more detail later in this chapter.

4.1.1.4 Because of its durable construction, a cylinder may be refilled hundreds of times during its useful life, but only if properly maintained and refurbished when required.

4.1.1.5 A retailer or distributor in the neighbourhood generally services the customers. This arrangement may include a home delivery service, or the customer may take the cylinder to be filled or exchanged at a local outlet.

4.1.2 Commercial Packed

4.1.2.1 Small commercial applications - such as hotels and restaurants - can be serviced from a single large cylinder or several cylinders connected with a manifold. These cylinders usually range from 12kg to 50kg capacity. Typically, the manifold is designed to have half the number of cylinders supplying the application, and the other half on standby waiting to replace empty cylinders. Automatic changeover valves ensure an uninterrupted supply of gas.

4.1.2.2 The demand for LPG needs careful monitoring to ensure the application is properly serviced. With several cylinders in operation at the same time, the demand can normally be met through natural vapourisation. This is where the liquid vapourises inside the cylinder under ambient conditions. When the ambient temperature is too low, or the demand is too high, a small vapouriser can be fitted to artificially produce the vapour from the liquid to meet demand.

4.1.2.3 The customer is supplied with cylinders from the filling plant usually via a distributor. The cylinders are normally owned by the LPG Company and provided as part of the commercial proposition. As with domestic cylinders, maintenance is carried out at the filling plant when the cylinders are returned for refilling.

4.1.3 Reticulated

4.1.3.1 Reticulated – or piped – LPG and SNG (Synthetic Natural Gas – or LPG/Air) have been successfully introduced in many countries and is becoming increasingly popular. Customers are provided with an individual metered supply of LPG through a piped network. This type of service eliminates the need for individual cylinders or tanks.

4.1.3.2 In a reticulated system LPG is stored at a central storage compound and supplied through a series of distribution pipelines to each household. The supply pressure at the central supply is reduced in stages as the LPG moves closer to the customer. The eventual gas pressure at the appliance is like that from a regular cylinder supply making it possible to use the same gas appliances.

4.1.3.3 A significant financial investment is necessary to establish the storage facility and infrastructure of pipework to service each household with LPG. The company supplying the gas operates like a standard gas utility company.

4.1.4 Domestic Bulk

4.1.4.1 Individual domestic supplies can be serviced from either a facility like the commercial packed arrangement or from a small bulk tank adjacent to the point of use. The latter design is like a small industrial bulk facility where the domestic customer will receive and pay for the product in bulk after delivery.

4.1.4.2 These tanks are generally less than 2MT in capacity, and will be located on the property. Apart from providing a safe location, safe access must also be provided for the delivery vehicle and driver/operator.

4.1.4.3 The customer is responsible for the general housekeeping of the storage facility, but maintenance will normally be the responsibility of the supplier. Demand will not be as high as with industrial customers but there will be periods of the day when demand peaks. These will coincide with the periods of high demand for cooking and heating.



*Typical small bulk
LPG tank*

4.1.4.4 This type of service is also typical for the agricultural market where LPG assists farmers in increasing output, and improves the quality of crop production through weed flaming, crop harvesting and crop drying. LPG is also used to heat breeding houses for pigs and poultry, and power farm equipment such as tractors and irrigation pump engines.

4.1.5 Industrial Bulk

4.1.5.1 A small bulk storage facility is installed when the demand from the industrial or commercial application is too high to service with large cylinders.

4.1.5.2 This facility may be like the one supplying a domestic bulk installation, typically consisting of a small storage tank of several tonnes capacity, a vapouriser, pressure regulators and a piped network to the application. An area for a bulk vehicle to park during the unloading procedure is required, as well as safe access to the unloading point by the driver/operator.

4.1.5.3 Industrial bulk facilities may also be installed to supply LPG in liquid form. One example is to provide liquid LPG to re-fill cylinders on site for fork lift trucks. In this case the customer must be properly trained to manage the re-filling operation safely, including the inspection and correct filling of cylinders. It is important in this event to closely monitor cylinder condition and adopt a procedure to periodically check and retest the fork lift truck cylinders. Training, maintenance and monitoring remain the responsibility of the LPG supplier.

4.1.5.4 These facilities will be normally designed, installed, maintained and operated by the LPG marketer/supplier. Demand may be several tonnes of LPG a day. Stocks need careful monitoring to ensure a continuous supply of LPG.

4.1.5.5 The customer will often leave the delivery scheduling to the LPG marketer/supplier but the actual delivery is sometimes contracted to a distributor.

4.1.6 Automotive

4.1.6.1 Autogas has become one of the fastest growing applications for the product and many countries are undertaking trials and developing new business opportunities. The environmental benefits of LPG mean that exhaust, or tailpipe, emissions will be significantly improved where the product has replaced diesel and gasoline as an automotive fuel. The WHO announcement in 2012 confirming diesel emissions are a Group One Carcinogen to humans will likely accelerate demand for Autogas further into this sector, especially after the subsequent controversy over measuring actual 'real world' diesel emissions.



*A large dedicated Autogas service station in
Hong Kong*

- 4.1.6.2 The Autogas market requires a network of refueling sites consisting of bulk storage facilities, pumps and dispensers, like the traditional gasoline and diesel fuel network.
- 4.1.6.3 Owners of fleet vehicles may arrange these facilities at their own premises, or for the Autogas market to reach a wider customer base the refueling outlets must be located with immediate access to high traffic areas. LPG vehicles using these outlets may be either converted from gasoline, or be purpose built, factory fitted, units.
- 4.1.6.4 These refueling outlets are similar in design to a bulk industrial facility except the product is metered to the customer in liquid form through a dispenser.

4.2 Primary Storage

- 4.2.1 Section 3.1 describes Primary Storage as the first step in the LPG distribution chain, the types of storage commonly used, and the various means of transportation used in receiving and distributing product at the primary storage facility. This Section deals with some typical examples of practices to be followed within the primary storage area. However, there is an equally important aspect of primary storage relating to good practices required of transporters in delivering the product to and from the primary storage facility, or when delivering directly to the customer.
- 4.2.2 Much of the discussion in section 4.4, Bulk Loading, also applies to transporters. Good practices require that transporters use well designed vehicles, have staff who are properly trained in handling the product, follow safe driving practices on the road as well as within the primary storage areas, maintain the transport vehicle in a good operating and safe condition at all times, follow correct loading and unloading procedures, protect the product from contamination, adhere to assigned schedules, and deliver the correct quantity of product required.
- 4.2.3 The remainder of this section deals with practices relating to the primary storage area since it is here where large quantities of LPG are stored. Bad practices can lead to serious, often fatal incidents that can have a major disruptive effect on the business and the general public.

(a) Properly designed and constructed facilities

The storage facility is one of the most capital-intensive investments in an LPG depot. There are many well-established international standards and codes of practice that provide guidance for the design and construction of these facilities.

Badly designed and constructed facilities results in:

- *Greater operational risks*
- *Unfair competition as a result of lower capital outlay*
- *Higher maintenance and upgrading costs*
- *Construction delays and marketing plans not being met*
- *Reduced asset life*
- *Increased risk of downtime and delays in delivering the customer proposition*
- *Increased risk to the customer and the general public*
- *Increased liability exposure and increased monitoring by relevant authorities*

It can be prevented by:

- *Promoting proper industry standards*
- *Adoption of adequate industry design standards and codes of practice*
- *Use of proper materials and good project management techniques*
- *Use of qualified contractors throughout the design, installation and commission stages*
- *Designing for Propane rated vessels*

- 4.2.4 Regulatory Authorities need to ensure that sound consistent standards are rigorously applied across the LPG industry. All similar storage facilities must meet the same proper risk assessment criteria in order that marketers/suppliers compete in a safe and equitable manner, so customers are not compromised.
- 4.2.5 The project specifications should be clear and include sufficient detail of materials and processes to ensure complete compliance.
- 4.2.6 In particular, the design of pressure containers should include at least one type of over-fill protection, such as fixed ullage gauges or automated level controls. A remote operated valve system for control of product flow as well as a fail-safe alarm system that isolates containers and pipework is also good practice. Pipework containing liquid should also be protected from overpressure by fitting hydrostatic relief valves.
- 4.2.7 The threat of overfilling brings with it the danger of product spillage and damage to the vessel or pipework. Product spillage in a depot, or at a customer location, is a very dangerous event. Spillage coupled with any ignition source can lead to fire and an explosion. This is not only hazardous to operators on site, such an event also puts the assets at risk and the operation of the company is jeopardised. It also threatens the continuing supply of product to customers.
- 4.2.8 Having adequate firewater available is critical but, so too is having the ability to activate the fire-fighting facilities in the event of an incident occurring. Locate emergency buttons in accessible areas away from potential fire zones.
- 4.2.9 The use of salt water for fire protection should be avoided to prevent the risk of corrosion. Salt water dramatically shortens the effective life of the asset and threatens the integrity of the vessel. If salt water is used at any time, the system and vessels should be thoroughly flushed with fresh water after use.
- 4.2.10 Good primary storage design should include corrosion and impact protection of vessels and pipework. Without this the life of the asset is shortened and the increases the risk of product leakage through material failure.
- 4.2.11 The application of proper design standards for major LPG installations across the industry is an important issue that should be promoted and enforced by local and national authorities together with industry members and the LPG associations. For more detail refer to the document [*Guidelines for Good Safety Practice in the LPG Industry*](#).
- 4.2.12 It is good practice to design storage vessels for Propane, since Propane's vapour pressure is higher than that of Butane. This provides flexibility and reduces the risk of an error when receiving different mixtures of Propane and Butane.
- 4.2.13 Employing qualified contractors, using proper design standards and applying good project management will help ensure the customer is not burdened with unnecessary costs and delays.

(b) Properly sized storage capacity

The amount of storage capacity required is an important issue that needs careful consideration. Too much, or too little capacity, can have an adverse effect on the business and the way the customer is serviced.

Incorrectly sized storage capacity results in:

- *Under utilised assets and higher unit maintenance costs*
- *Over utilised assets and stock out*
- *Congestion at the jetty and loading bays (insufficient storage)*
- *Inadequate time for maintenance (insufficient storage) and...*
- *Unsafe facilities*

It can be prevented by:

- *Good understanding of current and future demand patterns*
- *Proper planning and stock control*
- *Sharing of facilities*

- 4.2.14 For sea-fed depots, insufficient storage may lead to congestion at the jetty as the arriving vessel is delayed waiting for sufficient ullage in the receiving storage. Demurrage costs will result. Matching storage capacity with vessel size to optimise parcel size and reduce unit freight costs may be justified.
- 4.2.15 Insufficient storage capacity leads to an excessively busy facility and inadequate time for proper maintenance. Poorly maintained facilities are not only a danger to operators, but their useful life is shortened.
- 4.2.16 Inadequate storage also affects the cylinder-filling plant and the bulk-loading gantry where vehicles must queue for product. This leads to traffic congestion within the plant and increases the risk of accidents.
- 4.2.17 Unplanned stock outs, resulting from excess demand due to unseasonable weather conditions or unforeseen customer demand, can be rectified through 'borrow and loan' agreements with other LPG companies. These practices are sensible arrangements and benefit the whole community providing they do not compromise any business principles.

(c) Proper training of staff

Training of staff throughout the entire distribution chain is an essential good business practice. However, primary storage contains large amounts of LPG and the consequences of operator error can be more serious than in some other links of the chain.

Inadequate training of staff results in:

- *A high-risk environment*
- *Operational errors*
- *Risk to assets*
- *Lowly motivated staff*
- *Higher staff turnover*
- *Possible litigation*

It can be prevented by:

- *A thorough understanding of staff skills and job requirements*
- *Regular on-going training programmes including on the job training and assessment and re-assessment of the competence of critical staff*

- 4.2.18 Reference checking, discussions with previous employers, and reviewing previous driving records, along with results from drug and alcohol testing, will assist in identifying undesirable, high risk, candidates for employment and reduce future liability exposure.
- 4.2.19 Well-structured and current on-going training will encourage an active and knowledgeable workforce that will enhance workplace standards. Training must include product knowledge, product safety and emergency response procedures.
- 4.2.20 Training reduces errors and creates an environment for improvement with the opportunity for feedback. Training of emergency response teams also reduces the risk of minor incidents turning into major incidents.
- 4.2.21 Training and competence assessment are essential for those staff performing critical activities or working in critical areas.
- 4.2.22 On the job training can expose bad work practices and lead to tighter procedures. With input from individual's own experiences, these procedures are more likely to be followed. Independent assessment of all learned skills is essential at two levels – confirmation that the new trainee has acquired sufficient skills, and, confirmation that the experienced operator has retained sufficient and accurate skills long after the initial training is completed.
- 4.2.23 The application of relevant and developed procedures and well-trained staff also reduces the risk of an incident and will mitigate litigation that may arise from a workplace injury. But most importantly, well-trained staff protect the customer and the general public from incidents and accidents.

(d) Proper product specification and quality control

Product specifications need to be sufficiently tight, and checked for compliance, to ensure the product can be stored, handled, distributed and used safely in the application for which it is intended.

Poor product quality control results in:

- *Off-specification or unusable stock*
- *The customer proposition not being met*
- *Customer complaints and possible litigation*
- *Clean up costs*
- *Risk of stock out*
- *Risk to assets*

It can be prevented by:

- *Adopting fit-for-purpose product specifications*
- *Regular checking of product specification*
- *Proper and clear procedures*
- *Regular housekeeping*

- 4.2.24 The customer proposition depends on the product meeting the desired specification and performing as promised. LPG generally consists of Propane and Butane mixtures. Each product has a distinct vapour pressure. Cylinders and tanks constructed to specific design criteria for one product may not be suitable for the other. It is not only good business practice but also an essential practice that cylinders and tanks are used only in the type of service for which they are constructed.
- 4.2.25 Applying unnecessary additional controls in the specification adds costs and limits availability, both of which are undesirable for the customer.
- 4.2.26 LPG may contain unwanted components from processing, often called 'heavy ends'. These need monitoring to avoid problems with equipment in the distribution chain as well as problems with customer owned equipment powered by LPG, especially automotive engines.
- 4.2.27 The distribution chain may also introduce undesirable forms of contamination such as rust and scale. Rust originates from pipework and storage vessels, and scale may form in pipework. If allowed to accumulate, rust can block filters, interfere with pressure control systems in the distribution chain and chemically change or reduce the odorant used to assist in leak detection. Water may also sometimes enter the storage vessels.
- 4.2.28 Adopting good product quality control checks helps avoid the need for the cleaning of distribution systems, prevents customer complaints and reduces the risk of product recall from the market.

(e) Good housekeeping and maintenance

Poor housekeeping and maintenance reveals a neglectful attitude but is not difficult or expensive to remedy. Generally, ownership motivates proper maintenance.

Inadequate housekeeping and maintenance results in:

- *Untidy facilities*
- *Increased risk of fire, accident, incident or obstruction*
- *Damage to the company image and brand*

It can be prevented by:

- *Programmed maintenance*
- *Regular tank draining*
- *Clearly stated procedures*
- *Regular audits and inspections*
- *Incentives*
- *Assessment of critical assets*

- 4.2.29 Keeping the LPG facilities clean and tidy will encourage a tidier work ethic and help eliminate unwanted items that could fuel a fire, create an obstruction, or cause personal injury. Clean and tidy facilities will also improve the efficiency of operations.
- 4.2.30 Regular audits and inspections by personnel from other job functions create opportunities for a better understanding of all other processes involved. New observers often identify items or issues overlooked by those personnel who operate continuously in the one environment.
- 4.2.31 Programmed maintenance helps to avoid an unplanned shutdown of plant as well as extending the life of the assets.

4.2.32 Maintenance should be carried out regularly and records kept ensuring there is a full understanding of operating costs. Accurate measurement of the effect and impact of maintenance will also assist in predicting component failure.

4.2.33 Regular draining of bulk storage tanks will remove any unwanted water and other contamination. Draining of bulk tanks must be done in a controlled manner.

4.3 Cylinder Filling Plants

4.3.1 Business practices in LPG cylinder-filling plants affect the efficiency of the principal activities of receiving, checking and filling cylinders. They also impact on the safety of the plant, the condition of cylinders in the market, the operation of the distribution chain and, ultimately, the safety of the customer and general public.

4.3.2 The recommended practices described, relate both to new and existing plants. These practices have a major influence on the way cylinders are distributed through the chain to the customer where some of the more invasive practices can occur.

(a) Good plant design and layout

The investment in an LPG cylinder filling plant, and the way it operates, ultimately reflects in what the customer pays. The customer is best served with a well-designed and constructed plant that operates efficiently and safely.

Bad plant design and layout results in:

- *Operational problems and reduced safety levels*
- *Increased operating expenses that are ultimately passed on to customers*
- *Dissatisfied customers and employees*

It can be prevented by:

- *Planning for the future, training of personnel*
- *Using temporary facilities initially or...*
- *Contracting out cylinder-filling process*
- *Rationalising the cylinder portfolio - but not at the expense of the customer proposition*
- *An integrated approach to design*
- *Liaising with local authorities*

4.3.3 Having adequate parking space, and good traffic flow for vehicles moving through the plant, reduces the risk of a collision. Clear directional signs and driver training also helps in minimising the risk of a traffic accident inside the facility and on the roads outside the depot. Crash protection devices should protect any piping or storage tanks that are exposed to vehicular traffic. Avoid the need to reverse vehicles inside the plant when planning the layout.

4.3.4 Matching vehicle design with loading and unloading platforms improves the overall efficiency of the plant and reduces the risk of damage to cylinders. Ensuring the filling plant platform is the same height as the vehicle loading platform will make the unloading and loading of cylinders easier and reduce work place injuries.

4.3.5 Some automated plants with high throughput levels utilise pallets and forklift trucks to load and unload cylinders. These practices reduce cylinder damage, eliminate the physical effort of handling cylinders, and reduce risk of personal injury where the use of pallets and forklifts has been investigated fully and follows a well-

planned site plan/process. Where pallets are used, the distribution channel must also have the capability to accommodate them.

- 4.3.6 In automated cylinder-filling plants padding the conveyors will reduce damage to the paintwork of cylinders. Damage to cylinders creates a risk of leakage, affects the appearance and shortens the asset life.
- 4.3.7 Cylinder-filling plants can be noisy facilities. It is important to protect the workforce from high noise levels, and to liaise with the local authorities during the planning stage to ensure there are no complaints about the future operation.
- 4.3.8 There is inevitably some product loss within the filling plant. It is essential to design well-ventilated plants and locate them in well-ventilated areas. This creates a more agreeable work environment for operators and reduces fatigue. It also reduces the risk of creating flammable mixtures within the work area. It is important to eliminate any sources of ignition. When building new plants be aware of prevailing winds and site them away from adjacent ignition sources.
- 4.3.9 Many bad practices can be minimised by having an effective licensing procedure in place that is properly enforced.

(b) Adopting good operational processes

The procedures in a cylinder filling plant must ensure the cylinder leaves the plant in good condition and is correctly filled - two of the most important features of the cylinder proposition. Some of these processes are carried out manually and sometimes automatically

Adopting poor processes results in:

- *Bad examples being observed by employees and distributors*
- *Damage to cylinders*
- *Poor metal management*
- *Plant congestion*
- *Operational errors and reduced levels of safety for employees and the general public*

It can be prevented by:

- *Understanding the functions*
- *Good scheduling*
- *The use of conveyors and pallets (if justified)*
- *Job rotation*
- *Training of all operational staff*

- 4.3.10 Good cylinder filling plant practices include checking vehicles carefully upon entry to ensure compliance with depot regulations. Removing cigarette lighters permanently from the dashboard of vehicles sends a clear message to drivers that smoking is strictly prohibited when handling LPG, and being near LPG cylinders. Many sites impose a policy of instant dismissal of any employee found with any source of ignition (lighters and matches).
- 4.3.11 Strictly controlling the inventory of cylinders entering and leaving the plant ensures that unfit-for-service cylinders will not leave the plant. Cylinders should be closely inspected upon entering the plant for condition and conformance and then maintained in good serviceable condition. Cylinders should be carefully handled. Poor cylinder handling causes unnecessary damage to the assets that can result in cylinder leakage, a shorter life and poor safety.

- 4.3.12 Set good examples for distributors observing operating practices within the plant. Distributors are more likely to emulate the same practices observed in the plant when they carry out their own distributor functions. Proper scheduling of distributors arriving at the depot will avoid congestion at the entrance and create a more orderly sequence of activity. This results in the market being better served, reducing frustration and the potential for vehicle accidents, and minimising risk to personnel.
- 4.3.13 Segregating cylinders as they arrive at the depot according to the degree of work required will ensure a consistent cylinder finish to reinforce the brand image. This might involve washing, cosmetic painting or a complete refurbishment.
- 4.3.14 If warning labels are used on cylinders they need to be legible to provide clear advice to customers to avoid misuse, risk of injury and possible litigation.
- 4.3.15 Using conveyors that have been designed for cylinders will minimise damage as cylinders travel through the filling plant. Conveyors also reduce the need for handling by personnel. This reduces the risk of hand, foot and back injuries.
- 4.3.16 Cylinders must be accurately filled. Overfilled cylinders that leave the plant can be a threat to the cylinder construction and put the customer and the general public at risk. Under-filled cylinders leaving the plant exposes the company to claims of cheating and litigation from weights and measures authorities, generates customer complaints and damages the reputation of the company.
- 4.3.17 Fitting cylinder-filling plants with post-filling control checks to ensure the contents meet the required fill tolerances is essential. Inaccurate filling causes delays to the production schedule as rejected cylinders are removed and corrected.
- 4.3.18 Tare weights should be accurately and clearly marked on the cylinder, weigh scales regularly checked and calibrated, and operators fully trained in the correct procedures as to the correct procedures. Rotating jobs within the filling plant reduces boredom and fatigue and lessens the risk of operator error.
- 4.3.19 There are various ways of determining whether the cylinder/valve package is gas tight. Some involve the use of equipment others involve the use of soapy water and a visual check.
- 4.3.20 If the process of checking the integrity of the cylinder/valve component is overlooked, the whole business is threatened. Leak detection is often combined with the application of a security seal or shrink-wrapping around the valve. This good practice is a visual signal to the customer of the integrity of the company. The security seal is also a deterrent for those seeking to interfere with the product in the distribution chain. For POL valves it is good practice to apply a gas tight plug to prevent leaks from the valve being accidentally opened when not connected to an appliance.

(c) Allowing only authorised premises to operate

LPG filling plants contain dangerous goods and need to operate with approved procedures. One way of ensuring proper procedures is a licensing procedure that authorises the operation.

Allowing unauthorised facilities to operate results in:

- *Inequitable competition*
- *The encouragement of other bad practices*
- *Sub-standard cylinders in circulation and...*
- *An increased risk of product leakage and reduced safety of employees and the general public*
- *Governments being deprived of legitimate taxes*

It can be prevented by:

- *An industry approach to sound metal management policies*
- *An integrated effort by the LPG industry and government*
- *Penalties for operating unauthorised operators*

- 4.3.21 If Regulatory Authorities do not apply strict controls, then unauthorised filling plants will proliferate with a potential consequence of putting the customer and general public at risk.
- 4.3.22 Some operators of unauthorised facilities may be heavily involved in other illegal activities such as decanting (the act of transferring product from one cylinder to another), illegal filling, and the stealing and repainting of competitor's cylinders.
- 4.3.23 Unauthorised filling plants will fail to maintain cylinders. They tend to survive by cheating on the legitimate marketers through illegal acquisition of cylinders, retailers and customers. They are also likely to deliberately cheat customers by under-filling.
- 4.3.24 It requires a consolidated effort by all concerned, for the welfare of customers and the industry, to support the regulatory authorities in eliminating illegal and invasive practices. They jeopardise the reputation of the industry and deprive governments of legitimate taxes.

(d) Prevent re-issuing of scrap cylinders

When cylinders are eventually scrapped they should be disposed of in such a manner as to prevent them being re-issued into the market. If this is not done, they present a serious threat. Piercing the cylinder wall is a widely accepted practice to stop re-use of condemned cylinders

Re-issuing of scrap cylinders results in:

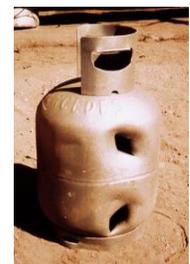
- *Unfair competition*
- *A serious risk of product leakage and injury*
- *Reputable manufacturers facing litigation*

it can be prevented by:

- *An industry approach to permanent disposal and metal recycling practices*
- *Regular monitoring of the distribution chain*
- *An integrated effort by the LPG industry and government*

- 4.3.25 A common bad practice by some illegal operators is the cutting and re-fabrication of scrap cylinders. When cylinders are eventually scrapped because they can no longer be used in the market it is good practice to destroy all components of the construction.

- 4.3.26 Two and three-piece cylinders are effectively taken out of the market by pressing a large hole across the welds. If this is not done, it is possible for illegal operators to rescue parts of the scrapped cylinder and re-issue it into the market with false markings in a cut down form. This type of cylinder is extremely dangerous because it will have had no heat treatment process to relieve stresses from the welding operation making it particularly vulnerable to failure.



Cylinders must be completely destroyed

- 4.3.27 Customers acquiring these illicit cut-down cylinders are likely to have them illegally refilled. These cut-down cylinders, and others that have exceeded their re-certification date, are able to circulate freely in the market with no proper check on condition.
- 4.3.28 A sound metal management policy that is adopted by the whole industry will make it difficult for this type of activity to flourish.
- 4.3.29 Any participation in a scheme that supports the purchase or use of cylinders acquired illegally, or supports the practice of under-filling is bad practice and should be avoided.

4.4 Bulk Loading

4.4.1 The bulk loading of product at a depot involves the transfer of LPG into a vehicle that is destined for interim or customer storage. In many cases this transfer takes place near the general public. In the majority of cases this transfer is into a road vehicle, but railcars are also used to transport large quantities over long distances.



LPG loading bay

4.4.2 The bulk-loading gantry is where product is transferred in bulk from primary and intermediate storage facilities to a road vehicle, rail tanker or barge. Pumping rates are normally quite high. An incident during the transfer of product could result in a large and rapid release of liquid LPG and create a serious danger to the operators and the general public.

4.4.3 Here are some brief examples of recommended practices found in the bulk loading of LPG followed by some recommended ways to carry out this important task.

(a) Unobstructed vehicle access

Poor access at the bulk-loading gantry not only causes problems during the loading operation; it also hinders access to emergency vehicles and the escape of bulk vehicles in an emergency

Poor vehicle access results in:

- *Increased risk of vehicle collision*
- *Congestion at the loading bay*
- *Delays to deliveries*
- *Increased driver hours and tiredness*

It can be prevented by:

- *Segregating traffic movements*
- *The use of clear directional signs within the plant*
- *Good planning and driver training and instruction*

4.4.4 The bulk loading of road vehicles requires a well-planned layout allowing clear and unhindered access to, and exit from, the loading gantry.

4.4.5 It is good practice to segregate the movement of bulk vehicles away from the often-busier LPG cylinder filling plant. Clear painted directional signs set out in a one-way system, eliminating the act of reversing the vehicle, will minimise the risk of vehicle accidents inside the plant.

- 4.4.6 There should be clear instructional signs at the loading gantry where there may be one or more vehicles either waiting to load or parked up.
- 4.4.7 The loading gantries should be planned to match demand. Failure to do this may result in congested loading bays, the risk of shortages and customer complaints.

(b) Correct loading and accurate metering

The accurate and correct loading of product requires well-designed equipment, clear operating procedures and well-trained staff.

Incorrect loading and inaccurate metering results in:

- *Overloading and damage to plant and vehicle*
- *Dissatisfied customers*
- *Possible regulatory violations*
- *Unscheduled product releases and reduced safety to the operator*

It can be prevented by:

- *Clear operating procedures*
- *Well trained staff*
- *Regular audits and monitoring*
- *Accurate scheduling*

- 4.4.8 Good business practice is essential when loading bulk LPG. Barges, road tankers and rail cars must be secure and unable to move until the loading operation has been completed.
- 4.4.9 The vehicle should be loaded to no more than its rated capacity. Loading through a pre-set control system can prevent overloading. Overloading can cause structural damage to the tank and introduces a real risk of product spillage through the pressure relief valves. Any unplanned release of LPG, especially in liquid form, is a serious event and one that must be avoided. Operational staff is put at risk and the threat of fire seriously jeopardises the entire business.
- 4.4.10 Personnel must be trained in proper loading procedures. Overloading is a clear illustration of procedural lapses or system failure and can lead to prosecution.
- 4.4.11 Accurate scheduling, and understanding customer demand profiles, reduces distribution costs by proper load planning. If this is not done, there may be temptation for occasional deliberate overloading in order to meet demand.
- 4.4.12 Thoroughly check and routinely calibrate meters and weighbridges. Scrutinise procedures to ensure that overloading never occurs.
- 4.4.13 Accurate meters ensure correct deliveries are made and the customer receives the correct quantity of product.

(c) Good safe condition of bulk vehicle, rail car or barge

The condition of any equipment in an LPG business is essential. However, vehicles, rail cars and barges are involved in transferring large quantities of product at high discharge rates, thus any incident can be particularly serious.

Poor condition of bulk vehicle, rail car or barge results in...

- *Increased risk of product leakage*
- *Reduced safety to employees and the general public*
- *Risk of injury and litigation*
- *Damage to the company image and brand*

and can be prevented by...

- *Sensible investment*
- *Good planned maintenance programmes*
- *Sound procedures such as thorough pre-and post-trip inspections*
- *Accurate meters and weighbridges*

- 4.4.14 Rail cars and barges should be checked for condition and compliance, and secured before loading.
- 4.4.15 On entry to the plant bulk vehicles should be carefully checked and weighed to ensure compliance with depot regulations. It is good practice to load only empty vehicles. Any residue in a returning vehicle should be drained. Vehicles should comply with proper design standards and be roadworthy.
- 4.4.16 Vehicles travel on highways and share roads with the general public. The condition of the vehicle and the way it is driven will be a statement to the public, customers and society. Therefore, implementation of good business practice within this activity is important to uphold the reputation of the LPG industry.

(d) Thorough focus on operator skills and training

Drivers should be properly trained, competent and fully understand the procedures involved for loading and unloading product and on road driving skills under the local traffic regulations

Insufficient focus on operator skills and training results in:

- *Increased risk of major product leakage*
- *Risk of injury and litigation*
- *Damage to the company assets and image*

It can be prevented by:

- *Careful recruitment policies and regular training*
- *Simulated emergency exercises with de-briefing sessions*
- *Clear and easily understood instructions*
- *Regular audits*
- *Safety incentive programmes*
- *Involvement in journey management*
- *Maximum working and driving hours*

- 4.4.17 The best preventative measure to ensure good business practices is the careful recruitment of properly qualified employees. In addition to effective interviewing techniques during the application stage of employment, companies should review the applicant's driving record, and conduct pre-employment testing and screening for use of illegal substances.
- 4.4.18 It is good practice to remind drivers of their obligations by conducting regular audits during operations at the loading bay. Drivers should be aware of what to do in an emergency, both within the depot, on the road and at the customers' facilities.
- 4.4.19 Drivers should be encouraged to extend their normal driving activities to include journey management, especially the reporting of road and traffic conditions, and the reporting of unsafe customer storage facilities.
- 4.4.20 Involving drivers in any emergency response exercises is good practice. It is also good practice to also involve them in any de-briefing sessions held with firefighting personnel.
- 4.4.21 Recognising drivers with good safety records demonstrates senior management commitment to safety and the adherence to company procedures.
- 4.4.22 Application of the IoT to measure and monitor tankers and drivers' performance can provide valuable information.

4.5 Distributors/Dealers

- 4.5.1 The distribution chain is where some of the worst cases of bad practice are found; many have a major influence on the business and society.
- 4.5.2 Following are examples of practices to be avoided in the Distributor/Dealer link of the distribution chain. The impact of each is discussed and some recommendations of good practice are offered.

(a) Illegal filling (decanting) of cylinders

One of the more destructive practices in the LPG business is the illegal filling - or pirate filling - of cylinders in the distribution chain. Cylinders belonging to one company are used without permission by another company and refilled.

Illegal filling results in:

- *No control over cylinder condition*
- *No control over the quality or quantity of product*
- *Serious risk of damage and injury from leaking cylinders*
- *Injury and damage compensation claims difficult to process*
- *Inequitable and illegal competition*
- *Industry reputation being threatened*
- *Assets being degraded*

It can be prevented by:

- *Designs that make it difficult to illegal fill (e.g. self-sealing valves/security seals)*
- *Alerting authorities and taking action to eliminate practice*
- *Customer awareness programmes - highlighting risks & consequences*
- *Keeping a close control of the distribution chain; monitoring and auditing*

4.5.3 Illegally filled cylinders are a major threat to a company. Branded cylinders are issued into the market with no control over the cylinder condition, the quality of LPG or the quantity of product in the cylinder. In the event of an incident, the blame will unfairly come back to the original owner of the cylinder because the illegal filler will be difficult to trace (see also Appendix One [b]).



Poorly maintained cylinder with badly corroded base

4.5.4 The practice creates a serious risk to the general public, creates inequitable and illegal competition, and damages the reputation of the industry.

4.5.5 In some countries the practice of swapping different brands of cylinder is condoned. Exchange centres are established where cylinders are returned to their original owners. Alternatively, swap arrangements are made to periodically exchange and reconcile stocks.

4.5.6 This is dangerous practice because it tempts pirate filling, especially when a company's cylinder stocks are low. It also means that at any one time there are competitor's cylinders at the depot over which there is little control of condition.

4.5.7 The price differential between small and large cylinders can create an incentive to illegally decant. Customers are often cheated with illegally filled cylinders because the opportunity to under-fill creates a further incentive for the activity. The application of subsidies can create this situation.

4.5.8 Fitting of valves to cylinders that inhibit the filling process, coupled with the use of security seals, can make the illegal filling process more difficult.

4.5.9 It is important that authorities are fully aware of the consequences of this behaviour and every effort is made to eliminate it. However, the individuals that carry out these activities are often determined enough to overcome such obstacles. There has to be a concerted approach by all concerned to be successful in wiping out this invasive practice.

4.5.10 The exception to this practice is where both companies support legitimate cross filling and the practice is closely monitored and controlled. There may be good reasons to have an exchange filling arrangement in a country where there are large distances between filling plants. A contracted agreement to fill each other's cylinders could make logistical sense to minimise distribution costs.

4.5.11 Aside from the commercial disadvantages of illegal overfilling, it remains a potential risk. Overfilled cylinders left out in the sun or subjected to excessive heat puts severe stress on the vessel causing the relief valve to discharge and ultimately distort the cylinder under hydraulic pressure. These cylinders are then rendered useless and have to be scrapped when they do eventually return to the filling plant. In extreme cases they could fail, resulting in a serious safety incident.

4.5.12 Some customers may be unaware of the fact they are buying illegally filled cylinders. Others may see it as an opportunity for sourcing cheap product. Active customer awareness, and education programmes that point out the risks and damage that illegal filling does to the business, can be an effective deterrent.

4.5.13 Frequent audits and monitoring programmes in areas where the activity is known to be prevalent is also a useful practice.

4.5.14 The use of single brand dealers that only represent one company may help stamp out the practice through the application of greater control and commitment.

4.5.15 Generating a concerted approach with the whole industry through the local LPG Association can be a powerful weapon against illegal filling. Ultimately the power of the law can be the biggest deterrent but often this only happens after a major incident. Strong enforcement measures with stiff penalties will help.

(b) Unauthorised acquisition, reworking and repainting of cylinders

This is where one company illegally acquires cylinders from another company and repaints and re-brands them in their own colours before re-issuing them into the market.

Unauthorised acquisition, reworking and repainting of cylinders results in:

- *No control over cylinder condition*
- *No control over the quality or quantity of product*
- *Serious risk of damage and injury from leaking cylinders*
- *Injury and damage compensation claims difficult to process*
- *Unfair and illegal competition*
- *Industry reputation being threatened*
- *Assets being degraded*

It can be prevented by:

- *Training personnel to recognise cylinder ownership*
- *Permanently identifying ownership on the cylinder*
- *Using only authorised facilities for reworking cylinders*
- *Destroying beyond repair when scrapping cylinders*
- *Tight controls at country borders*
- *Regular monitoring and inspection throughout distribution chain*
- *Cooperating with regulatory authorities*

- 4.5.16 The effect of illegal filling is more permanent than simply the loss of a sale of LPG. Assets are lost to the company that originally owned the cylinders.
- 4.5.17 Having clear, permanent markings on the cylinder is a useful deterrent to this practice. This can be done when the cylinders are manufactured. Markings should be difficult to remove, are not concealed by painting or galvanising, and do not affect the cylinder specification.
- 4.5.18 Another example that falls within the scope of this practice of illegal cylinder acquisition is the smuggling of cylinders from neighbouring countries. Cylinders from other countries may have been manufactured to different standards and specifications, and likely have no permanent markings. They may have already been scrapped and are being illegally disposed of in a new market.
- 4.5.19 The markings on a cylinder must describe its history. It is in effect its 'birth certificate'. Cylinders from cross border countries will not have markings of the new country and can be easily identified. If these cylinders are circulating illegally they will never return to a legitimate filling plant to be checked for compliance. It is important, therefore, that checks on cylinders are carried out in the distribution chain, including customers' premises. It is even possible for this type of cylinder to be used in vehicles for the illegal conversion to LPG.
- 4.5.20 Apart from the vigorous checking of cylinders in the distribution chain, cross border controls need to be imposed to stop this activity at source. Government authorities from both countries can assist with this.
- 4.5.21 Illegally smuggled cylinders can impose a serious risk to a legitimate LPG business, to the industry, and most importantly, to the customer.

(c) Under filling of cylinders

LPG is sold by weight. Customers expect to buy a full cylinder of gas. Under filling can be either a deliberate act or caused through negligence.

Under filling of cylinders results in:

- *Dissatisfied customers*
- *Possible claims and litigation*

It can be prevented by:

- *Monitoring and auditing of the distribution chain*
- *Regular calibration of weighing equipment*
- *Regular drainage of storage tanks to avoid a build up of 'heavy ends'*
- *Regular training on proper filling procedures*

- 4.5.22 Customers pay for and expect a properly filled cylinder. Cylinders that are illegally filled are often under-filled. They can also be tampered with and contents removed to cheat customers. When the contents of an LPG cylinder have been totally used the vessel should be empty. All the liquid LPG should have evaporated, leaving behind an empty cylinder containing no more liquid. If the cylinder contains any product that cannot readily evaporate it will remain there after all the gas has been used.
- 4.5.23 If a domestic cylinder has been deliberately contaminated with, for example, water or diesel fuel, then customers are paying for a useless product. Because the cylinder is opaque and can weigh several kilograms, it is possible the customer is unaware of the state of the contents. This type of contamination of cylinders is well known in some unethical distribution chains and filling plants. The practice is serious and cheats customers and may reduce customer safety. Authorities can assist by prosecuting those responsible.
- 4.5.24 Another more common issue relating to this practice is the steady accumulation of 'heavy ends' in cylinders. 'Heavy ends' is material heavier than Butane that will not readily boil off under ambient conditions. In this case the addition of contaminated product is more through negligence than a deliberate act and correction may be needed frequently.
- 4.5.25 It is good practice to randomly sample empty cylinders for contaminants throughout the distribution chain, including the cylinder filling plants. If a significant amount of contamination is evident, then product quality control procedures need to be tightened. This can often be achieved by regular tank draining.

(d) Poor 'metal management'

Metal management is the term used to describe the management of the cylinders and storage tanks in the business. They represent a significant investment, and if badly managed can have a serious impact on the efficiency of the business and the customer proposition.

Poor metal management results in:

- *Under-utilised assets*
- *An inefficient operation*
- *Lower standards of operation and badly maintained assets*
- *Damage to the customer proposition*
- *The encouragement of bad practices*

It can be prevented by:

- *Fully understanding and controlling the cost of the metal in the business*
- *Clearly identifying ownership*

- *The introduction of a cylinder or tank deposit scheme*
- *Controlling some of the bad practices outlined above*
- *Controlling the maintenance of cylinders and tanks*
- *Assisting householders with refundable deposits*

4.5.26 Apart from the financial cost of employing under-utilised assets, poor metal management will lead to an inefficient operation, lower standards of operation and further bad practices. These all eventually have a detrimental impact on the business and the customer.

4.5.27 There are two principal methods of cylinder and container ownership: LPG company owned, and customer owned.

4.5.28 When the company owns the container, the company either loans or leases it to the customer. The customer exchanges an empty cylinder for a full one paying only for the gas. The company is responsible for filling and supplying safely maintained cylinders. Frequently, the owner's investment is secured through a refundable deposit system.

The Refundable Deposit System

When the cylinder is owned by the LPG company, the investment, replacement and working stock costs of cylinders are borne by the LPG company. In order to ensure that these costs are recovered, the LPG company will often charge a refundable deposit to the customer, the amount of which will be adequate to finance the initial investment, and the subsequent maintenance activities for the remainder of the cylinder's life.

Without being an absolute rule, this is typically around 130% of the replacement cost of the cylinder. If the deposit is too low, a market for second-hand cylinders can emerge, possibly resulting in pirate filling. Also, inactive cylinders can accumulate since there is little incentive to return the cylinder.

The liability, should defective cylinders enter the market place, is often with the LPG company whose responsibility it is to maintain them. It is unlikely that LPG companies will invest in the maintenance of competitors' cylinders for which they are not liable.

Therefore, it is essential that cylinders are only returned to filling plants operated by the cylinder owner, or plants with which the owner has a separate 'hospitality' agreement to fill and maintain others' cylinders. In order to ensure that this system functions correctly, it is vital that all cylinders clearly identify the company that owns them.

Should the customer wish to change gas suppliers, the deposit is usually refunded in return for the empty cylinder, although often the voucher given as a receipt for the original deposit is required. Voucher systems prevent cylinder thefts since the cylinder is worthless to a thief without the appropriate paperwork. Usually a condition of the refund is a return of a cylinder of only the same brand originally supplied.

The purpose of the deposit is to encourage the customer not to lose the cylinder, to recover the cost of continuing cylinder investment and to recover the cost of inactive cylinders. The refundable deposit provides the LPG company a level of assurance that it will not incur a large loss nor make a significant profit from the maintenance and replacement of the metal.

- 4.5.29 In some countries, deposits are not common practice, even where it is the LPG company that owns the cylinder, especially in developing countries. This is because the initial outlay by the customer for the deposit is too costly, thus discouraging development of an LPG market. In these countries, bad practices such as cylinder thefts have the negative effect of reducing the incentive that companies have to implement maintenance procedures. In such cases an effective enforcement of cylinder controls is even more important to ensure safety. An alternative is for authorities, or local communities, to assist households in the financing of the deposit.
- 4.5.30 It is also common for unscrupulous marketers to 'kidnap' competitor's cylinders in order to prevent a competitor from operating in a particular area. This reduces competition and imposes costs on reputable marketers that ultimately must be passed on to the customer.
- 4.5.31 In the case of customer owned cylinders, two common practices occur. In the first, the customer has a *personally identified cylinder* where the customer brings the cylinder to the plant or to a retailer to be filled, then taken away. The customer is responsible for any maintenance cost or replacement if the cylinder has reached the end of its useful life. Since maintenance is the responsibility of the customer, the filling plant operator or retailer's diligence in ensuring the cylinder is acceptable for refilling is particularly important.
- 4.5.32 In the second, the customer has 'virtual ownership' where a *legally owned cylinder* is exchanged for one of like kind. Since the customer does not have physical possession of the same cylinder brought to the exchange transaction, the customer is not responsible for its replacement at the end of the cylinder's useful life. In this instance the LPG supplier has the responsibility of maintenance and replacement since the initial cylinder is somewhere in the inventory 'float'.
- 4.5.33 Regardless of ownership, there is a constant need for diligence at the filling plant, distributors and retail network to make sure that only properly maintained and qualified cylinders are filled.
- 4.5.34 Labels can be removed, so there should be some form of permanent marking such as embossing on the cylinder to identify ownership. This is preferably done on the cylinder body as the shroud can be illegally replaced, especially if it is bolted on.
- 4.5.35 Recently the use of bar codes and transponders on cylinders has been introduced in some markets to assist in the monitoring of cylinder assets. These are good examples of techniques that can be used to know how many cylinders there are in the business and where they are. Transponders that utilise the internet cloud to store data has enabled the cost of these to be brought to a level where even small cylinders can be economically monitored.
- 4.5.36 Metal management is equally important in the bulk segments. Tanks and equipment provided by LPG marketers/suppliers to customers on free loan, or through some form of financial arrangement, should only be used for product supplied by the owner. Discrete filling connections and restricted access to the bulk compound are some other methods to prevent the illegal filling of bulk tanks by other suppliers. Telemetry is also helpful here.

(e) Poor cylinder handling

Although cylinders are constructed to withstand a certain amount of misuse their appearance and function can be badly affected by poor handling. Severe improper handling will result in damage to the cylinder.

Poor cylinder handling results in:

- *Damage to the appearance and customer proposition*
- *Increasing risk of product leakage*
- *Potential hazardous condition*

It can be prevented by:

- *Correct cylinder design*
- *Distributor training and monitoring*
- *Good vehicle, equipment and facility design*
- *Remuneration programmes linked to cylinder condition*

- 4.5.37 The use of correct cylinder handling equipment assists the efficient operation of the business and also minimises the risk of injury to staff.
- 4.5.38 Distributors handling cylinders should design their premises in a manner that makes it easy to load and unload the vehicles without damage to the cylinder or injury to the operator. Cylinders should also be stored in areas that offer protection from weather and damage.
- 4.5.39 It is good practice to link distributor remuneration to cylinder condition through inspection of cylinders on entry to the filling plant and through a regular monitoring programme.

(f) Over storage of cylinders

The storage of cylinders in the distribution chain is carried out in much smaller premises than filling plants and the restrictions are tighter. There may be local requirements outlining the maximum amount of product to be stored and these should not be exceeded.

Over storage of cylinders results in:

- *A danger to people and facilities*
- *The threat of litigation*
- *Under-utilised assets*

It can be prevented by:

- *Well-designed storage areas*
- *Distributor awareness and training programmes*
- *Regular on-site monitoring*

- 4.5.40 The manner in which cylinders are stored should allow easy access to any single cylinder in the event of a leak. It is good practice to have a clear walkway between each pair of rows.
- 4.5.41 Premises should be well ventilated, well lighted and have clear access for emergency vehicles. Exit points should be clearly marked and not require personnel to pass large concentrations of stored product in order to exit the premises. It is also good practice to link distributor remuneration to working stock levels.



(g) Inefficient planning and scheduling

The distribution chain can seriously affect the consistency of offering to the customer through inefficient planning and scheduling.

Inefficient planning and scheduling results in:

- *Increased operating costs*
- *Longer delivery times*
- *Higher levels of working stock*
- *Dissatisfied customers*

It can be prevented by:

- *Monitoring of demand patterns*
- *Planned maintenance programmes*
- *Coordinated planning with the distributor network*

4.5.42 The initial business plan can rapidly become redundant in a growing business. As the business develops there is a need to carefully monitor and adjust the business plan and the network.

4.5.43 Depots and stores can be in the wrong location, leading to excessive transport costs, longer delivery times and increased inventory. Delivery trucks can be wrongly sized for the load and demand profile of the market.

4.5.44 Careful planning of distributor delivery schedules can reduce operating costs, shorten delivery times and limit the amount of working stock. This is a particularly important issue because if the distribution chain is working efficiently it has a beneficial effect across the whole business.

(h) Lack of understanding of the role of the distributor and the customer proposition

The consistency of customer service can be seriously affected by a lack of understanding as to what is required at the distributor level. A distributor network may consist of many different companies carrying out similar tasks. Inconsistencies in the quality of customer service can lead to customer dissatisfaction.

Lack of understanding of the role of the distributor and the customer proposition results in:

- *Disagreements*
- *Inconsistent brand images*
- *Dissatisfied customers*
- *Damaged reputations*
- *Risk of litigation*

It can be prevented by:

- *A dedicated distributor network*
- *Clear and simple distributor agreements*
- *Good communication throughout the chain*
- *Regular training of all distribution and service personnel*

- 4.5.45 In some countries distributors and dealers are contracted by LPG companies to carry out certain services through the distribution chain. They are often small family businesses sometimes with a long history of association with the industry. On occasion, they may carry out tasks on behalf of more than one company.
- 4.5.46 One of the most important business practices in the distribution chain is to have clear, simple agreements describing the services to be carried out, the remuneration for those services and the level of performance expected. The agreement should promote good practice, prohibit cylinder swapping of different brands and require adequate stocks. It should describe the extent of their activities, either geographic or sometimes by type of market serviced, in order to avoid confusion leading to customer dissatisfaction.
- 4.5.47 For industrial/commercial distributors these activities might include the responsibility for maintaining customer storage installations, in which case there needs to be clear written procedures outlining what is to be done and when it is to be done. This activity requires different skills and training.
- 4.5.48 The agreement should describe the level of competency required for staff. This is particularly important for drivers who have a significant role in carrying out many of the tasks. There should be recognition in the agreement of the need for training and the obligation of the LPG company to provide this. Elimination of bad practices in the distribution chain is a key training issue.
- 4.5.49 The information outlined in the [Guidelines for Good Safety Practice in the LPG Industry](#) provides a good basis for distributor, dealer and retailer training.
- 4.5.50 One of the roles of distributors and dealers is to educate retailers and customers about the safe storage, handling and use of the product. In addition, by providing distributors and dealers with proper education and on-going training, the LPG industry will minimise the risk of litigation and unnecessary oversight by local authorities.
- 4.5.51 The customer proposition needs to be fully understood by all those involved in marketing the product. If the distribution chain is unaware of what has been promised, there may be dissatisfied customers. Reputations are then damaged, and disagreements arise.

(i) Fraudulent acts

Fraud is criminal deception and the consequences are very serious. There are some activities in the LPG business where fraud can occur if not checked.

Fraudulent acts result in:

- *Loss of product and revenue*
- *Damaged reputations*
- *Expensive investigations and litigation*

It can be prevented by:

- *Sound business processes*
- *Procedures that make fraud difficult*
- *Involvement of the customer during product transfer*
- *Regular calibration of meters*
- *Strong penalties*

- 4.5.52 One example of fraud in the distribution chain involves the deliberate inaccurate metering of product.
- 4.5.53 Bulk deliveries of LPG to industrial and domestic customers, or reticulated domestic installations, should always involve the customer witnessing and agreeing to the amount of product transferred. This reduces the possibility of disputes.
- 4.5.54 Fraud can also take place in bulk domestic installations where product is individually metered to customer households. Either the distributor or customer can be cheated if meters are tampered with.
- 4.5.55 Another area where fraud can also take place is inside the cylinder filling plant during the loading of packed trucks with full cylinders. Trucks might be loaded with a higher number of cylinders than the correct number that is supposed to be loaded.
- 4.5.56 Regular checks and calibration are required on all metering equipment right through the distribution chain. This close monitoring signals to all concerned that there are procedures in place to prevent fraud occurring.
- 4.5.57 Systematic checks of the quantities of cylinders on the packed trucks at the gate and inside the cylinder filling plant before loading and after loading are recommended.

4.6 Retailers

- 4.6.1 Retailers are generally used only to service the domestic packed LPG business. However, this represents one of the largest of the LPG market segments.
- 4.6.2 Occasionally distributors and dealers will integrate their business and become retailers. Some typical examples of good practices to be followed the retail chain are as follows:

(a) Thorough knowledge of the customer proposition

At the retail interface it is important to adopt good business practices and know all details relating to the customer proposition.

Inadequate knowledge of the customer proposition results in:

- *Customer expectations not being met*
- *Disagreements and complaints*
- *Lost confidence*

It can be prevented by:

- *Careful explanation of what is required*
- *Training*
- *Clear service agreements*
- *Performance measures and follow up*
- *Incentives*

- 4.6.3 It is vital that the customer proposition is clearly understood by the retailer. If this does not happen then customer expectations will not be met, and complaints will arise. There will be disagreements with retailers and confidence will be lost.

- 4.6.4 The retailer needs to have a clear understanding as to what is being presented and what is expected of the retailer and the expectations of the customer. If requested by the customer, the retailer should provide delivery of the cylinder and connection to the appliance. This may require training and some form of service agreement setting out clearly what is required.

(b) Safe and legal storage, handling and distribution of the product

The retailer has an obligation to store, handle and distribute product in a correct and legal manner. Working stocks will be smaller than those at distributor premises.

Poor storage, handling and distribution of the product results in:

- *Risk of product leakage*
- *Damage to assets*
- *Damage to the customer proposition*
- *Safety risk to the community*
- *Damage to the company image*
- *Risk of litigation*

It can be prevented by:

- *A detailed analysis of what is required*
- *Training of retailers and providing of literature*
- *Clearly defined service agreements*

- 4.6.5 There must be a clear understanding of what is required legally. The same good practices that were mentioned in the distributor/dealer network apply here. Cylinders should be stored in well-ventilated and secure areas that have good access for emergency removal in the event of an incident. Any damage to cylinders at retail premises may result in product leakage and pose a danger to the public. Retail premises should be equipped with at least the minimum fire-fighting equipment required by legislation or regulation.
- 4.6.6 Unlike distributors and dealers, retail premises are often in crowded and heavily populated areas. It is important that strict controls are imposed on the storage of working stock.
- 4.6.7 It is good practice to regularly train and monitor the activities of retail outlets to ensure there is no activity that would threaten the image of the company or public safety.
- 4.6.8 The retailer has an opportunity to illegally decant product in the same way as a distributor. The presence of weigh scales in retail premises should be treated as suspicious. They might be used for illegal decanting.

4.7 Service Stations

- 4.7.1 The application of good business practices at the service station is particularly important. With the growth in the Autogas market sector, the LPG service station population is increasing quickly.
- 4.7.2 The success of an automotive LPG (Autogas) business depends largely on the strength of the network. Planning and operation of a network can have lasting impact on the effectiveness of the business. Some typical examples of good practices include:

(a) Good network planning

One of the key success factors of a retail fuel business is having a good network plan. The introduction of LPG for automotive use (Autogas) necessitates integrated planning.

Poor network planning results in:

- *Poorly located and difficult to access service stations*
- *Inadequate facilities for the customer*
- *Higher unit costs*
- *Difficult to access dispensers on forecourt*

It can be prevented by:

- *Good market research and regular tracking studies*
- *Creating awareness*
- *Proper forward planning*
- *Liaising with local authorities*

- 4.7.3 Service stations need to be highly visible, easy to access and easy to exit for approaching traffic. Difficult access results in traffic congestion and possible queues onto the main roads.
- 4.7.4 Refueling delays create a bad image and lead to customer dissatisfaction. This can be avoided with the installation of efficient dispensers with fast pumps. Customers new to automotive LPG may need assistance with refueling. The use of forecourt personnel, even for self-serve stations, is good practice. If forecourt personnel are used, they must be properly trained.
- 4.7.5 Busy automotive LPG sites have large throughputs and frequently have daily bulk deliveries. It is good practice to ensure the bulk vehicles are allowed easy access to the site and can park unhindered during discharge and away from the forecourt traffic.
- 4.7.6 LPG Associations can play a key role in effectively promoting infrastructure development by advertising, and by working with local authorities in developing regulations that provide safe, easily accessible customer-friendly facilities.

(b) Safe and reliable equipment

The use of good quality and reliable dispensing equipment, which is regularly checked and calibrated, will ensure trouble free operation at the point of sale.

Inadequate and unsafe equipment results in:

- *Risk of product leakage on forecourt*
- *Difficulty of making re-fuelling connection to vehicle*
- *Queues on forecourt*
- *Risk of customer complaints and litigation*
- *Dissatisfied customers*
- *Damage to brand and industry reputation*

It can be prevented by:

- *Installing approved dispensing equipment*
- *Regular checks, and maintenance of dispensing equipment*
- *Regular calibration programmes*
- *Use of approved contractors*

- 4.7.7 LPG storage tanks on retail service stations are often positioned underground to accommodate the required safety distances and improve overall site appearance.
- 4.7.8 In view of the number of vehicle movements on site, it is good practice to erect sturdy barriers to eliminate the risk to pipework and other equipment from potential impact damage.
- 4.7.9 Good housekeeping and maintenance of the storage, handling and distribution facilities will not only protect the assets, it will also project an image of care and responsibility.

(c) Good control of forecourt activities

It is important that the activities on the forecourt are properly managed to ensure an efficient operation and eliminate some of the bad practices that can infiltrate the business.

Poor control of forecourt activities results in:

- *Risk of product leak*
- *Congestion on site*
- *Conflict on site*

It can be prevented by:

- *Strict rules with station operator banning illegal practices*
- *Customer awareness and education programmes*
- *Frequent audits and monitoring*
- *Specific Autogas LPG dispenser nozzles*

- 4.7.10 The pricing structure for LPG in some markets creates an incentive for using Autogas for domestic and commercial purposes. There are also situations where the pricing structure encourages the misuse of domestic or commercial LPG in automotive vehicles. In either instance this is not only bad practice, but also a dangerous practice and the public must be informed of those dangers.
- 4.7.11 These activities may result in Propane, with a higher vapour pressure than Butane, being dispensed into Butane vessels. This can lead to overstressing and ultimately failure of the vessel risking injury to personnel and property.
- 4.7.12 Automotive dispensing equipment is not designed for filling domestic cylinders and should not be used in this manner. The connection between dispenser and vessel will not be secure resulting in product leakage in a public area.
- 4.7.13 The illicit refueling of domestic cylinders on service stations creates a safety risk and prevents the proper maintenance of cylinders. Clear service agreements outlining what is expected of the operator are essential for any control.

- 4.7.14 Regular checks and audits will help create a disciplined environment, but the need for proper training of service station staff is a vital additional element in the quest to promote good business practice on the forecourt.
- 4.7.15 Creating customer awareness of the risks involved in illegal forecourt filling is essential in stopping the practice.
- 4.7.16 Effective closed-circuit television (CCTV) site monitoring will act as a strong deterrent. These systems can now include alarms sent to mobile phones.

4.8 Customers

- 4.8.1 Customers rely heavily for good advice and information about LPG and its applications. They expect to receive the product in a timely fashion, in good order and expect that it will perform as promised.
- 4.8.2 In return, the supplier will expect to be paid for the product in accordance with the terms and conditions agreed. Some typical examples of good practice necessary at the customer interface are:

(a) Good product knowledge

Customers have rights and obligations that are often described as a 'duty of care' or 'duty to inform'. In order for them to carry this out they must be well informed.

Inadequate product knowledge results in:

- *Customers unable to handle emergencies*
- *Poor response to maintenance of storage facility*
- *Under-utilised benefits of LPG*
- *Risk of accident, incident and litigation*
- *Dissatisfaction with using LPG*

It can be prevented by:

- *Customer awareness and education programmes*
- *Simulated emergency training at customer's premises with distributor and retailer*

- 4.8.3 Customers need to have simple and clear instructions about the storage, handling and use of LPG in order to exercise their obligations.
- 4.8.4 For domestic customers, it is good practice to make these instructions available with the cylinder. Sometimes this is done with a sticker or label, or it might be made available through leaflets. It is also wise to support this material with some form of customer support centre where anybody can access information about the product.
- 4.8.5 For larger customers, the erection of signs at storage installations and conducting training programmes can assist in transferring this information.
- 4.8.6 Illegal activities at consumer level are easier to prevent if the consequences are fully understood.

(b) Safe and legal installations

Some customers may be tempted to install appliances and equipment themselves. This may not only be dangerous; it can also be illegal.

Illegal installations result in:

- *Risk of incident and danger to other users*
- *Loss of asset to other markets (e.g. domestic cylinder used in auto application)*
- *Inefficient application or loss of production*
- *Insurance and litigation implications*
- *Possible public relations impact*

It can be prevented by:

- *Cost effective customer propositions*
- *Tamperproof devices*
- *Available resources to provide proper installations*
- *Proper supervision of installations*
- *Customer education and training*
- *Regular monitoring and inspection*
- *Support from regulatory authorities*

4.8.7 In the event of an incident involving illegally installed appliances or equipment, the company supplying the product will likely deny any responsibility. Insurance is also likely to be voided leaving customers and the LPG supplier vulnerable.

4.8.8 Poorly installed appliances may also result in inefficient operation causing damage to the process, loss of production and increased energy costs.

4.8.9 Providing an easy and cost-effective alternative for customers that discourages 'do-it-yourself' activities is good practice. This can be achieved by instructing retailers and dealers to provide appliances and equipment in a total package that includes installation, but at an attractive cost.

4.8.10 Engine conversions should be carried out by professionally trained personnel and in workshops properly equipped for the task, using components and systems which are approved for automotive applications

4.8.11 The cost of a proper engine conversion to LPG involves the purchase of tank, pipework, vapourisers and control equipment. Cheaper, illegal and unsafe conversions are sometimes done that involve the illicit use of small domestic or industrial cylinders modified to fit the boot (trunk) of a vehicle (see photo opposite). This is a very dangerous practice.



4.8.12 A private car running on LPG may consume more product in a day than a domestic household does in a month. This high level of consumption attracts illegal decanters that are prepared to service illicit vehicle conversions. The whole practice leads to a very unsafe industry and one where cylinders are again being misused and not maintained.

4.8.13 It is important to establish a comprehensive network of well-designed and conveniently located refueling outlets together with a chain of authorised and registered conversion workshops. This can only be done with the close cooperation of authorities and government regulators to stamp out anything that compromises this objective.

(c) Customer friendly equipment

LPG equipment can sometimes be very difficult for the customer to use. Designs need to ensure ease of use by customers of all ages and abilities.

Difficult to use and unfriendly equipment results in:

- *Dissatisfied customers*
- *Risk of incidents*
- *Damage to the LPG brand*
- *Loss of customer business*

It can be prevented by:

- *Well-designed equipment and appliances*
- *Customer service support*
- *Clear operating instructions to customer*

4.8.14 One of the most common areas of difficulty for domestic and commercial customers is making the connection safely and securely between cylinder valve and regulator, especially in barbeques and other outdoor appliances.

4.8.15 The distribution chain can provide an important customer service when the product is being delivered. There is an excellent opportunity at the point of delivery for developing customer relationships and strengthening the proposition through demonstrations and giving advice to the customer.

(d) Well maintained facilities

The maintenance responsibility rests with the owner of the installation unless this has been transferred by contract to another party.

Difficult to use and unfriendly equipment results in:

- *Dissatisfied customers*
- *Risk of incident*
- *Loss of customer business*

It can be prevented by:

- *Guidelines on housekeeping to customer*
- *Clear description of roles and responsibilities for customer and distributor*
- *Distributor responsibilities linked to remuneration*
- *Frequent auditing and monitoring programmes at customer installations*

4.8.16 For small installations the customer may own the facilities. The larger ones are more likely to be owned by the LPG supplier.

4.8.17 It is important that the facilities are kept properly maintained to ensure the product remains safe and secure. Good maintenance also protects the assets of the customer or supplier and the overall business.

4.8.18 This includes the cylinder in the case of a domestic customer. If the customer owns the cylinder, ongoing maintenance may be neglected. Maintenance is always best undertaken at the cylinder filling plant where facilities and procedures exist. With the company owning the cylinder, there is a vested interest in protecting that asset by making sure it receives proper and regular inspection and maintenance every time it comes back to the plant to be re-filled.

Chapter Five

LPG Safety

LPG by nature is a hazardous product until it has been safely used, and the products of combustion disposed of properly.

This document has focused on the business implications of good practice in LPG but that should not be at the expense of safety. Reference has already been made to the *Guidelines for Good Safety Practice in the LPG Industry*. It is recommended these documents be read together.

Safety should be at the top of any agenda when discussing LPG. An unsafe LPG business is a bad LPG business.

Almost all examples of good business practice in the LPG industry can have some linkage back to safe practice and the promotion of safe practice cannot be over emphasised.

Appendix One

Good Cylinder Practices Review

Issue/Bad Practice	Risks	Remedy
<p>(a) Illegal acquisition and re-branding of cylinders A variant of (b) where cylinders are repainted with the identification mark/brand of another company, and subsequently marketed under this brand. This often occurs across international borders, or by transporting cylinders to a region in which the original owner does not operate.</p>	<ul style="list-style-type: none"> ▪ Legitimate operators lose effective control over the condition of their cylinders. Pirate fillers have no incentive to adequately maintain stolen cylinders bearing the identification mark of the cylinder owner. Product Quality or quantity difficult to identify. ▪ Serious damage and injury from badly maintained cylinders. ▪ Injury and damage compensation claims difficult to process since it will be impossible to identify the original filler with certainty. ▪ Industry reputation threatened, customer less willing to use gas. 	<ul style="list-style-type: none"> ▪ Permanently identifying ownership on the cylinder. ▪ Tighter controls at country borders. ▪ Regular monitoring and inspection throughout distribution chain. ▪ Cooperating and assisting regulatory authorities in enforcing regulations and identifying non-compliance.
<p>(b) Illegal filling (decanting) of cylinders One of the more destructive practices in the LPG business is the illegal filling (or pirate filling) of cylinders in the distribution chain. Cylinders belonging to one company are used without permission by another company and refilled. This practice sometimes involves cylinders that have been scrapped as no longer safe for use and is therefore particularly dangerous.</p>	<ul style="list-style-type: none"> ▪ Legitimate operators lose effective control over the condition of their cylinders. Pirate fillers have no incentive to adequately maintain stolen cylinders bearing the identification mark of the cylinder owner. This also applies to product quality or quantity since customers will find it difficult to identify who the filler actually was. ▪ Serious damage and injury from badly maintained cylinders ▪ Injury and damage compensation claims difficult to process since it will be impossible to identify the original filler with certainty ▪ Industry reputation threatened, customers less willing to use gas. 	<ul style="list-style-type: none"> ▪ Industry and government to clearly identify cylinder ownership, be vigilant against cylinder thefts, support legal action in case of malpractice. ▪ Enforce industry/state regulations relating to maintenance of cylinders and tanks, identify noncompliance operators, and establish mechanism for enforcement. ▪ Governments/local communities assist householders with refundable deposits ▪ Licensing of new LPG operators, regular inspection of facilities ▪ Designs making it difficult to illegally fill (e.g. self-sealing valves/security seals) ▪ Customer awareness programmes of risks and consequences of pirate filling ▪ Destroying beyond repair when scrapping cylinders
<p>(c) Re-use of scrapped cylinders Using cylinders that have been</p>	<ul style="list-style-type: none"> ▪ Cylinders that are known to be unsafe enter the market 	<ul style="list-style-type: none"> ▪ Destroying beyond repair when scrapping cylinders

<p>scrapped (usually due to their no longer being safe for use)</p>	<ul style="list-style-type: none"> ▪ Accidents occur but it is difficult to determine liability 	
<p>(d) Under filling of cylinders Customers expect a full cylinder of LPG. Under filling or filling when impurities are in the cylinder</p>	<ul style="list-style-type: none"> ▪ Customers are cheated ▪ If due to poor operation/management at the filling plant, overfilling may be likely with potentially disastrous consequences in the event of vessel rupture 	<ul style="list-style-type: none"> ▪ Monitoring, calibration of equipment and audit of the distribution chain ▪ Regular drainage of storage tanks to avoid a build up of 'heavy ends' ▪ Regular training on proper filling procedures in filling plants
<p>(e) Filling of cylinders at Autogas service stations Depending on relative pricing in the market, there may be an incentive for customers to purchase LPG at an Autogas service station rather than from an authorised LPG dealer, e.g. by filling an empty cylinder. Relative pricing in some markets may encourage the reverse, e.g. the use of domestic LPG cylinders in vehicles. This practice can also be hazardous but is not discussed in detail here.</p>	<ul style="list-style-type: none"> ▪ The filling connection will not necessarily be suitable for LPG cylinders and there is a risk of leakage ▪ Cylinders will have bypassed the normal inspection, repair, requalification procedures at the filling plant. As they degrade with normal use the probability of accidents due to faulty cylinders will increase ▪ The cylinders will not necessarily be suitable for Autogas use, largely Propane, whereas the cylinder maybe rated for Butane 	<ul style="list-style-type: none"> ▪ Licensing regime for Autogas sites to include safe equipment checks and rules ensuring only suitable Autogas tanks are filled. ▪ Industry/authority cooperation in ensuring rules are followed and enforced ▪ Strict rules with station operator banning illegal practices ▪ Customer awareness and education programmes ▪ Frequent audits and monitoring ▪ Specific Autogas LPG dispenser nozzles

About the International Chamber of Commerce (ICC)

ICC – the International Chamber of Commerce – is the world business organisation. With member companies in more than 140 countries, it is a veritable “United Nations” of the business world.

As a globalised, more integrated world takes shape, companies large and small increasingly look to ICC to represent their interests at the highest levels of inter-governmental decision-making. Whether at the World Trade Organisation (WTO), the G8 or the United Nations, ICC ensures that the voice of business is heard.

ICC is the world’s leading advocate of the benefits of globalisation - convinced that international trade and investment and the market economy system are powerful forces for peace and prosperity. It is an official business interlocutor to the United Nations, has a close working relationship with the WTO and meets regularly with government leaders and heads of state around the world.

Global influence is further exerted through a network of national committees. These national organisations, representing business in all the major trading nations and most developing countries and transition economies, have direct access to key players in their national governments. National committees keep the ICC International Secretariat in Paris in close touch with national and regional business priorities and concerns. More than 2,000 experts drawn from ICC’s thousands of member companies feed their knowledge and experience into the crafting of the ICC stance on specific business issues.

Recognising the importance to business of spreading the benefits of economic growth, ICC works extensively with developing countries, helping them create vibrant economies and attract foreign investment. In addition to this vital work, ICC formulates voluntary rules by which business is conducted every day. From the small start-up in Toronto to the software company in Bombay, business everywhere benefits from ICC’s rules and mechanisms for the conduct of trade. Foremost among the essential services that ICC provides is the ICC International Court of Arbitration, the world’s leading arbitral institution.

Be it ICC online applications for doing business on the Internet, rules governing cross-border trade or standards for marketing and advertising – ICC is part of the fabric of world business.

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