Guide to

Good Industry Practices for LPG Cylinders in the Distribution Channel

WLPGA

LPG
EXCEPTIONAL
ENERGY

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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Guide to

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Contents

Executive Summary

The global LPG business is dependent largely on cylinders. It is estimated that there are over 2 billion of them in circulation around the world.

LPG companies will often contract out the delivery of these cylinders - though a chain of distributors, dealers, agents and retailers - to their customers.

Control over the cylinder, after it leaves the filling plant, is a challenge for LPG companies, and this control diminishes as it moves through the distribution chain.

There should be clear simple contractual obligations with the distribution channel that are easily understood.

RE-FILLING LPG CYLINDERS

'…LPG cylinders must never be re-filled unless they have been thoroughly inspected by qualified personnel at a licenced facility. This is best done at an LPG filling plant….'

The information contained in this *Guide to Good Industry Practices for LPG Cylinders in the Distribution Channel* will not only help protect the cylinder, in its journey through the distribution channel to the end user, they will also help protect everyone who encounters the cylinder during that journey.

The Guide will be useful for not only LPG companies but also all the stakeholders in the distribution network.

It is in everyone's interest to ensure the LPG cylinder reaches the end user in the same condition that it was in when it left the cylinder filling plant.

Protecting the cylinder asset, maintaining the company brand, ensuring the customer proposition is delivered safely, are all important issues for everyone involved in the LPG business, not least the customer.

This will also encourage investment in the business to ensure its continued growth.

Some of the key messages in this Guide are summarised below:

STORAGE, HANDLING AND DISTRIBUTION OF LPG CYLINDERS - SUMMARY

- Cylinders must be thoroughly checked by qualified personnel before re-filling
- Only licenced filling facilities must be used to re-fill cylinders
- Cylinders must always be kept securely upright in well ventilated areas
- Only use fit for purpose vehicles – keep cylinders secure and don't overload
- Conduct daily safety checks on vehicles
- Handle cylinders safely, with care and respect
- Single branded networks is recommended – Avoid multi-branded distribution channels
- Protect cylinders from ignition sources, artificial heat and impact damage
- Make available and understand Material Safety Data Sheet (MSDS) for LPG
- Understand the basic LPG properties – LPG vapour is heavier than air
- Beware of nearby cellars, drains, gullies and rivers where vapour leaks will travel to
- Do not open disconnected cylinder valves
- Limit storage capacity - only store what is required
- Take note of cylinder requalification period
- Check for possible leaks (used with soapy water)
- Never use a match or flame to check for leaks, keep area well ventilated

Chapter One

Background

The WLPGA is committed to providing independent advice to LPG stakeholders to ensure safety in the operation of LPG equipment. The two WLPGA publications – *Guidelines for Good Business Practices* and *Guidelines for Good Safety Practices* - have been used extensively during the last two decades, all over the world, to provide guidance across key areas of the LPG industry.

These two Guidelines have been designed to provide general advice to all stakeholders on good industry practices throughout the supply and distribution chain.

Following the success of these Guidelines it was decided to develop and publish more detailed advice in certain areas of the LPG business that are considered more critical and where more prescriptive advice would be helpful.

The first of these areas was the *Guide to Good Industry Practices for LPG Cylinder Management,* which addressed the life cycle of an LPG cylinder from acquisition through to disposal. Others Guides that followed included various topics including *Guide to Good Industry Practices for LPG Cylinder Filling.*

This *Guide to Good Industry Practices for LPG Cylinders in the Distribution Channel* examines the important journey of an LPG cylinder from the filling plant through to the customer - the last yards. This journey is commonly handled by third parties; wholesalers, dealers, distributors, agents and retailers.

LPG companies, and third parties representing them in the distribution channel, are the key target audiences for this Guide.

The Guide discusses how LPG cylinders travel through distribution channels and why good control is needed for the consumer to receive and use the product in a safe and sustainable way. To illustrate this the Guide uses some photos to show examples of good practices.

The Guide explains the importance of asset ownership and the responsibilities that are associated with that, especially the issue of cylinder ownership, maintenance and re-qualification. It discusses how the internet of things (IoT) has enabled that to be achieved more efficiently and cost effectively.

LPG cylinders come in various shapes and sizes and this has an impact on how they are transported. The Guide looks at some of the variations and examines some of the latest techniques to ensure how the storage and handling of cylinders is done to minimise damage and prolong this important asset in the LPG business.

Finally, there are some important subjects included in the Appendix. These include the characteristics of LPG and how they impact on the safe storage, handling and distribution of the product, a typical checklist for an LPG vehicle, some procedures on what to do in an emergency, some safety guidelines from a major international LPG filling plant manufacturer, some advice from a major international LPG distributor on managing cylinders (metal management) and finally Appendix Six illustrates with some photos some of the more prevalent bad practices that exist in the distribution channel that must be eradicated.

Chapter Two

Objectives of the Guide

The LPG cylinder is an important asset of the business that not only needs to be protected for commercial reasons it is also required to withstand all the challenges of the distribution chain in order to keep the contents secure and safe.

Typical sizes of steel LPG cylinders used in the residential, commercial and industrial sectors

The majority of LPG consumed around the world is delivered to the consumer in steel cylinders of various sizes and types. The basic shape and design have not changed much since LPG was introduced over 100 years ago.

There have been some recent innovations to this basic design that includes the use of plastic and composite materials to make them safer, improve the aesthetics and reduce the weight.

More modern designs of LPG cylinders using plastic and composite materials

This guide focuses on the safe and efficient distribution of all LPG cylinders circulating within the business - from the filling plant right through the distribution channel to the end consumer.

It contains three main chapters:

- Cylinder Distribution Channel
- Transporting Cylinders through the Distribution Channel
- Cylinder Installation at the Consumer

The goal of the Guide is to help minimise risks and hazards to personnel, property and the business through the proper attention to the handling, storage and distribution of cylinders in the distribution channel. Safety must be ensured and sustained by enforcing standards with skilled and trained personnel.

The target audience for the Guide are all stakeholders in the LPG business that have an interest in maintaining the safety of the cylinder sector.

Once LPG cylinders leave the filling plant, they are frequently in the custody of third parties; distributors, dealers, agents, retailers and consumers. The Guide will be of particular use for this group.

The movement of cylinders inside modern LPG filling plants can be achieved with minimum manual handling using equipment such as chain conveyors and pallets. However once cylinders leave the plant, they are inevitably handled manually.

According to the UK Health & Safety Executive, manual handling causes over a third of all workplace injuries. These include work-related musculoskeletal disorders (MSDs) such as pain and injuries to arms, legs and joints, and repetitive strain injuries of various sorts.

Even small cylinders when full can weigh over 10 kg

With domestic cylinders typically containing 8 – 15 kg of LPG the total weight of these can easily exceed 20 kg. Lightweight alloy steel has allowed cylinder wall thicknesses to be reduced but the total weight of even a small cylinder containing 5 kg of LPG will be nearly 10 kg.

The Guide provides advice on manually lifting cylinders without causing injury.

Chapter Three

Cylinder Distribution Channel

3.0 General

Cylinders are filled and distributed through the distribution channel to the consumer by a variety of means and, although they are designed for robust treatment, they incur wear and tear, and sometimes damage.

Therefore, before cylinders are re-filled it is very important that they are inspected, maintained, (sometimes repaired and painted), and when necessary, re-qualified. This can only be done by qualified personnel at a licenced filling plant facility.

RE-FILLING LPG CYLINDERS

'…LPG cylinders must never be re-filled unless they have been thoroughly inspected before filling by qualified personnel at a licenced filling facility…'

There are several business models that exist where the customer brings their own cylinder to a facility to be re-filled and then returns home with it without having had the cylinder checked. These include decanters and portable filling facilities.

This type of business model must be disallowed unless it includes procedures for thorough inspection and maintenance of the cylinder before refilling.

3.1 Distribution Channel Business Models

The distribution channel for LPG cylinders is a complex one and contains many stakeholders.

Once the cylinder leaves the filling plant the control starts to diminish.

The nature of the business demands good control over the cylinder. LPG companies should implement cylinder management practices that provides control over their investments and allows them to take effective responsibility for cylinder safety. One international LPG company set out some rules for controlling cylinders in their business. Their ten rules are reflected in this document and have been included as Appendix Five.

'Who owns the cylinder?', and 'who's responsible for maintenance of the cylinder?', are two key questions for the business. The type of business model will influence the answer to those questions.

In general, the channel is managed by third parties that are contracted by LPG distribution companies. This makes the control of activities more challenging.

LPG distribution companies can exert maximum influence by having a sole branded distribution channel.

Multi-branded distributors and outlets are not recommended. If distributors have several different brands within their operation it dilutes their focus and can only encourage bad practices such as cross filling and illegal cylinder acquisition.

There are two scenarios of cylinder ownership and they have different levels of asset control.

(i) Company owned cylinders

With this model the company is responsible for the cylinder asset. It is important therefore that the cylinder returns to the filling plant and be checked, maintained and if necessary repaired and re-qualified.

In order to exert control over the ownership, and ensure it always returns to the filling plant when it needs refilling, the customer can be asked to pay a deposit on the cylinder when it's issued.

This deposit would be applied throughout the distribution channel to dealers and retailers alike.

There is then a financial incentive for everyone to ensure the cylinder assets are kept under control and are always returned to their rightful owner.

(ii) Customer owned cylinders

When the customer owns the cylinder, it is a challenge to ensure it is maintained properly, and more importantly, every time it is refilled.

The exchange distribution model, where the customer swaps an empty cylinder for a full one at a retail outlet, does allow the cylinders to be returned to the filling plant for

proper inspection and maintenance. In this case the customer has ‘virtual’ ownership of a cylinder although not necessarily the one they bought.

LPG companies supplying cylinders to the exchange programme will be obliged to collect all empty ones left in the cages. These may or may not be cylinders of their own brand and will need to be returned to the correct owner.

In some countries the customer owned cylinder may be refilled at a decanting facility using a small bulk tank on a retail outlet or a portable filling facility. The challenge with this model is cylinder maintenance. The cylinder will cycle between the customers’ home and the decanting facility, with little or no maintenance being applied to the cylinder.

Unless the operators of these decanting or portable facilities are qualified, and the equipment is licenced, the cylinders must not be refilled because the cylinder will not be subjected to the necessary vigorous inspection and maintenance that is required.

The cylinders must always return to a filling plant where it can receive this proper treatment before it is re-filled.

Recent developments with the internet of things (IoT) has allowed the development of smart meters where full cylinders are placed on consignment with customers who can buy small quantities of LPG through smart phones. This model ‘ring fences’ the cylinder distribution channel, provides maximum control over the cylinder and removes the opportunity for the illegal filling of cylinders.

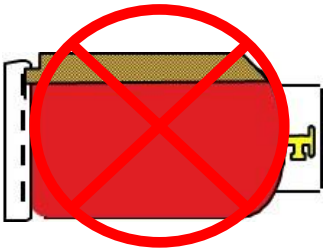
3.2 LPG and the Cylinder

LPG has some important characteristics that impact on the safe storage, handling and distribution of the product. These are explained in detail in Appendix One.

Some key ones are:

- LPG vapour is heavier than air and tends to gather in low areas such as drains, pits, cellars and other depressions. Care must be taken to avoid storing LPG cylinders where there are any low-lying areas nearby

- One unit of liquid LPG will create over 250 times the same unit as a vapour. Full LPG cylinders should never be positioned horizontally. If a full cylinder is placed in a horizontal position any leak at the valve will be a liquid leak and not a vapour one



Cylinders should never be placed in the horizontal position

- LPG has a high coefficient of expansion, which is why cylinders are never filled to the top. Typically, a full cylinder will hold only 80% of the capacity to allow for the liquid to expand when subjected to heat. Cylinders should be stored where possible with protection from the sun and the possible impact of a nearby fire

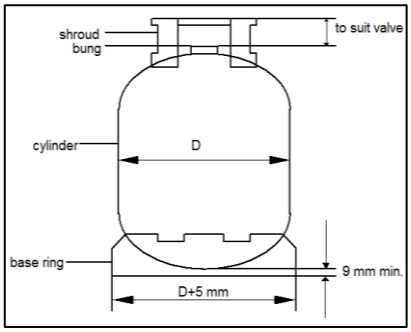
- The density of LPG liquid is about half the density of water and full LPG cylinders will float on water. Cylinders must therefore be properly secured to protect them from the threat of flooding

The body of an LPG cylinder is a pressure vessel, together with various other components including:

- The base-ring or foot-ring which allows the cylinder to stand upright

- The shroud (or collar) which protects the valve from impact

- The shroud also acts as a handle when carrying; it also supports another cylinder when it is stacked on top



Key components of an LPG cylinder

- The bung is fitted into the top of the cylinder to facilitate the installation of the valve

- The valve allows the gas to flow to the regulator and appliance

The cylinder valve may be fitted with a security seal to provide an assurance to customers that it has not been tampered with. The valve on an LPG cylinder is fitted at the top and will remain in contact with the vapour phase if kept upright.

After the cylinder leaves the filling plant it may be handled several times along the distribution chain before reaching the consumer. During this process significant damage may occur to the cylinder if it is not handled properly.

Security seal fitted to valve

A hazard warning label may also be applied with emergency contact details etc.

3.3 Manual Handling of Cylinders

There are many times during the journey from the LPG filling plant to the customer when an LPG cylinder must be physically lifted by hand. Even the smallest cylinder weighs several kilograms but the more common sizes (10 kg to 15 kg) will weigh over 20 kg when full.

To help prevent injuries when manually handling cylinders in the workplace employers must look at the risks of that task and put sensible health and safety measures in place to prevent and avoid injury.

For any lifting activity the following should always be considered:

- The individuals' capability
- The nature of the load
- Environmental conditions
- Training
- Work organisation

Practice lifting techniques using smaller packages

If an LPG cylinder must be lifted manually then:

- Reduce the amount of twisting, stooping and reaching
- Avoid lifting from floor level or above shoulder height, especially heavy load
- Adjust storage areas to minimise the need to carry out such movements
- Consider how carrying distances can be minimised
- Assess the weight to be carried and whether the worker can move the load safely or needs any assistance

Consider using lifting equipment:

- Consider the use of a lifting aid, such as a forklift truck, electric or hand-powered hoist, or a conveyor
- Think about storage as part of the delivery process – maybe heavy items could be delivered directly, or closer, to the storage area
- Reduce carrying distances where possible

Portable conveyor being used to load/unload cylinders from vehicle

Before handling LPG cylinders check first that the valve is fully closed and the protective cap (where fitted) is in place.

Do not 'walk' the cylinder by holding onto the valve stem or cap. Hold the top of the cylinder.

If possible, use a barrow with retaining chains, especially for industrial cylinders.

Never roll a cylinder on its side. Use a hand truck with a secure system to prevent it falling off.

Barrows with retaining chains are useful when moving 45 kg industrial cylinders over short distances

Safely handle cylinders by ensuring the following:

- Use spark-less tools and strictly maintain a no smoking area
- Operate in a well-ventilated area
- Wear personal protective equipment (PPE) including gloves, boots and safety glasses
- Constantly check for leaks using ears (hissing) and nose (smell)
- Report any damaged cylinders
- Treat cylinders with respect and take care to ensure they are not subjected to any impact
- Always store cylinders in an upright position
- Never try and catch a falling cylinder
- Always look for ways to handle cylinders with mechanical aids (e.g. pallet & forklift truck)

Portable barrow with retaining straps for securing 45 kg cylinders

3.4 Mechanical Handling of Cylinders

LPG cylinders should be handled with mechanical aids whenever possible to avoid personal injury. This includes trolleys, hand trucks, forklift trucks and trucks with tailgates.

Tailgate being used with operators wearing PPE

When using tailgates always be sure to:

- Clear the area of objects and people that could be hit by the lift; wear PPE
- Properly balance the cylinder(s) on the lift before operating
- Lock the lift gate in the 'travel' position before moving the vehicle

When moving cylinders with hand trucks ensure the area is free from obstructions. Make sure the hand truck is prevented from moving when being loaded and unloaded and when left unattended.

Hand trucks come in many designs and sizes depending on capacity. Some are constructed with rails or treads to allow their use on steps and stairways.

Pallets are a popular method for storing and transporting cylinders. They are commonly used within the filling plant but it's important that facilities are in place for off-loading pallets within the distribution chain.

The use of forklift trucks to handle cylinders not only reduces the risk of impact damage it reduces the risk of personnel injuries

Wooden pallets introduce a flammable substance into the storage area so fire resistant plastic ones would be preferred.

Open sided pallets must only be stacked two high. Pallets should only be moved by forklift trucks that have the capacity to lift the total weight. The name plate will list the type of forklift and lifting capacity.

Forklift trucks may be diesel or LPG fuelled provided they are suitable for zone 1 electrical area classification.

Forklift trucks operating on LPG is one of the only applications where an LPG cylinder may be used on its side.

3.5 Loading and Unloading of Trucks

Cylinders returning to the filling plant for unloading should always remain in an upright position. Empty cylinders should be placed properly onto conveyors to allow an orderly feed.

Filled and empty cylinders are counted in the same way as they enter and leave the plant.

Cylinders stored securely on a vehicle in cages

3.5.1 Loading

Cylinders that are transferred from the filling plant must only be done with vehicles that are permitted for the purpose of transporting LPG cylinders.

The vehicle engine must remain off during the transfer. Operators handling the cylinders must wear the appropriate PPE.

Cylinders must be handled with care to avoid deformation of cylinder, foot-ring and collar (shroud). They must never be thrown, dropped or rolled.

Conveyors discharging (or receiving) cylinders should be located as close as possible to the vehicle loading or unloading or the storage areas.

Cylinder being manually carried

Cylinders must always be placed in the upright position, in order that the valve is in the vapour phase.

Stacking of cylinders is allowed but only if they are under 20 kg capacity each. The stack should only be three high unless purpose-built pallets are used. Always check to ensure valves are not in contact with the cylinders above.

Cylinders of over 25 kg capacity shall be lowered or lifted mechanically by a tailgate or forklift truck unless the transfer is at the same height. If these are handled manually there should be two people involved.

Cylinders should always be restrained from moving after loading. If there are any leaking or overhanging cylinders on board, they must be removed.

There should be no sharp objects anywhere that might damage the cylinders.

If the cylinders are loaded manually, including the use tail lifts and trolleys, all efforts must be taken to avoid personal injury.

Vehicles should not be overloaded above their legal loading capacity.

Cylinders may be stacked with separating devices such as plywood sheets or pallets. There should be no more than three tiers for 6 -13 Kg cylinders and the cylinders must be secure and stable.

Large cylinders may be rolled on their base although this is to be avoided if alternative options are available

Larger sizes & heavier cylinders (above 25 Kgs) should be restrained to ensure they remain upright by using straps or chains.

Vehicles and trailer wheels must be chocked to prevent movement.

Prevent wheels moving with chocks

The docking board must be secure and capable of handling the weight.

Always use the horn, warning sounds, or warning lights, when reversing the trailer.

It is good practice to avoid the need to reverse by designing the facilities in such a way that always allows the vehicle to be driven forwards at all times.

3.5.2 **Unloading**

On receipt of the LPG cylinders they must be visually inspected for obvious defects such as dents, large amounts of corrosion and missing or loose safety caps.

This damaged cylinder should be rejected

Cylinders should not be accepted unless they can be identified with the appropriate labelling and be reconciled with the paperwork.

The use of a cylinder cart, with a secure chain, should be consider when transferring cylinders from vehicle into storage.

If they are fitted the protective caps must not be used to move or lift cylinders. The caps however must be secured before moving.

Cylinders must not be dropped or allowed to come into contact with each other to avoid damage to the paintwork.

Large cylinders may be rolled on their foot-ring but this should be avoided if possible to prevent damage.

Cylinders must be treated with respect, they must never be dropped, rolled horizontally on the body, or dragged along the ground.

Domestic cylinder being unloaded using a small barrow

Before moving cylinders, they should be secured with their protective caps in place (if fitted) and any security seals secured. Cylinders should not be left unsecured.

3.6 Cylinder Storage Space

The space allocated for storing LPG cylinders in the distribution channel must comply with local laws and regulations. The cylinder may be moved initially to a distributor warehouse but as it travels through the channel to the consumer it will travel through dealer outlets and retail shops.

The following guidelines can be applied in the absence of any local regulations.

- LPG cylinders should be stored in the open air, in a well-ventilated ground level location. They should not be stored in basements, cellars or pits

- Cylinders should always be placed on a hard, level and clean surface to prevent unnecessary damage to the underside.

Cylinders stored outdoors

- LPG cylinders should not be stored on the roofs of buildings

- LPG cylinder storage areas must always be readily accessible to facilitate the quick removal of cylinders

- Always allow access to all cylinders by leaving a corridor between two rows

- LPG cylinders in storage areas must be protected against excessive temperature, theft and physical impact, especially vehicles operating nearby. This should include the use of overhead roofing and impact barriers

Leave access rows when storing LPG cylinders

- Storing of more than a total of 400 kg of LPG indoors is not recommended

- To protect against fire, all weeds, long grass and any combustible materials should be at least 3 m from the nearest stacks of cylinders

- Hazardous products such as flammable liquids combustible, explosive, corrosive, oxidising or toxic materials, compressed gases and oxygen cylinders etc. should not be stored within 3 m of the LPG storage area

- Warning notices must be displayed at LPG storage areas showing the following information:

    - Highly flammable LPG
    - No smoking or open flames
    - Contact numbers in case of emergency

- Adequate fire protection equipment must be provided at the cylinder storage site i.e. fire extinguishers, fire hoses, fire blankets etc.

- Each storage area should be subjected to its own risk assessment that considers the vicinity of traffic, general housekeeping, absence of ignition sources and adequate warning signs

- It is good practice to keep full cylinders separate from empty cylinders and both should be clearly marked

- All LPG cylinder storage areas should have more than one exit in case of an emergency affecting the other

- The stacking of cylinders must be done with the following in mind:

    - Cylinders should only be stacked upright
    - The height should preferably not exceed three stacks
    - Different types should be stacked separately
    - Use small lots of rows and no more than 25 cylinders in length
    - All cylinders should be accessible in case of an emergency with any one
    - Larger cylinders over 22 kg capacity should not be stacked
    - The floor area should be clearly marked
    - LPG cylinders should be stacked more than 3 m away from other gases
    - Cylinders should be clearly labelled to show contents and associated hazards
    - 'Empty' cylinders should be stacked separately but considered 'full' for safety purposes

Cylinders stacked two pallets high with rows in between

As a guide, this table shows some recommended minimum separation distances depending on the total amount of LPG storage.

Total LPG Storage	Size of Largest Stack	Minimum Separation Distance
15 - 400 Kg	-	1 M
400 – 1,000 Kg	1,000	3 M
1,000 – 4,000 Kg	1,000	4 M
4,000 - 6,000 Kg	3,000	5 M
6,000 -12,000 Kg	3,000	6 M

3.7 Distributor Warehouse – Storage outside buildings

The space allocated for storing LPG cylinders outside buildings must comply with local laws and regulations.

- LPG cylinders stored outside of buildings must be at least 7.6m away from:
    - Nearest important buildings
    - Line of adjoining properties that can be built upon
    - Busy thoroughfares or sidewalks on other than private property
    - Line of adjoining property occupied by schools, churches, hospitals, athletic fields or other points of public gatherings
    - Dispensing systems

- LPG cylinders in storage must be secured by an adequate security fence to prevent trespassing and vandalism

- Access of vehicles and mechanical handling equipment into the storage area must be strictly controlled to prevent impact collision with cylinders

- Storage areas for full and nominally empty cylinders must be clearly identified and kept separate

- Regardless whether LPG cylinders are full or nominally empty they should be stored with their valves uppermost. Valves of both filled and empty cylinders should always be closed while in storage

- All electrical equipment including wiring, cabling, and enclosures installed in hazardous areas must meet the standards for the classification of the hazardous zone

- Distributor warehouses storing more than 450 kg of LPG should provide available water for fire hoses or fixed spray nozzles

3.8 Distributor Warehouse – Storage inside special buildings

- Cylinders may be stored inside purposely built buildings or rooms if no suitable outdoor storage is available. The building shall be used exclusively for LPG storage

- The maximum quantity that maybe stored inside special buildings shall not exceed 4500 kg

- Special buildings or rooms for storing LPG cylinders must not be located where the buildings or rooms adjoin the line of property occupied by schools, churches, hospitals, sports fields, or other points of public gathering

- The building must be single storey, ground level with no pits or floor openings and be constructed from non-combustible material i.e. brick masonry, concrete blocks, etc.

- Vents to the outside only shall be provided at both the top and bottom of the building and shall be located at least 1.5 m from any building opening. The amount of ventilation required shall comply with NFPA 58

- Electrical equipment including wiring, cabling, and enclosures installed in hazardous areas must meet the standards for the classification of the hazardous zone

A fire safety analysis must be conducted to determine the fire protection system best suited for the special building storing LPG cylinders.

3.9 Cylinders in Retail Outlets

LPG cylinders can be either delivered directly to the customer with home delivery service or the customer may collect from a retail outlet. These are the two most common methods.

The home delivery method relies on suitable small vehicles to make the last yard delivery. This varies from a two-wheeler bicycle to canoes and donkeys in some inaccessible remote areas (see also Chapter Five).

It is important that the mode of delivery is safe and fit for purpose and that the cylinder always remains in an upright position.

Cylinders stored in retail outlets awaiting sale should comply with the following guidelines:

- Cylinders stored outside buildings must be at least 3 m away from any flammable material, exits, staircase or openings in a building frequented by the public

- If the retail outlet is in a fuel service station, the storage area must be at least 6.1 m away from fuel dispensers

- LPG cylinders should be secured in lockable, ventilated metal cages which are designed to handle the full weight of the cylinders stored. The metal cage must always be kept locked and protected against unauthorized access

- Cylinders and cylinder cages must be located to avoid impact collision with vehicles

- At least one 9 kg dry powder fire extinguisher must be available near the cylinder storage area

3.10 Direct Distribution

LPG companies may choose to take responsibility for distributing cylinders to their customers themselves. An advantage with this method is directly controlling the distribution channel and having direct contact with the customer.

Rows of cylinders on vehicle separated by wooden sheet

However, the implication of dealing directly with the customer is the need for:

- Establishing and maintaining the customer data base
- Establishing and running a customer call centre
- Establishing and maintaining a delivery fleet
- Scheduling deliveries
- Maintaining company owned retail outlets

Regulations require all LPG vehicles to be properly marked. This is vital in the event of an emergency in order that the emergency crews have the information they need about the product being carried. Responding incorrectly to an incident can have serious effects.

These markings include labels, placards, orange panel, signs, marks. Letters, words, numbers or the abbreviations used to identify LPG and show the nature of danger posed by LPG.

All safety marks must be durable and legible under all conditions. They should be able to withstand open weather exposure without any substantial reduction in effectiveness.

Other markings need to show how the package must be handled (e.g. orientation labels).

Identification numbers and their placement is important for LPG transport vehicles. The vehicles must display identification numbers of the contents, either on the placard or on the orange panel beside the placard.

The product name – LPG, LP Gas, Butane, Propane, Mixtures etc. – must be on the shipping documents and packaging.

Placards, labels, identification numbers, markings and shipping documents are all different ways to communicate information regarding the hazardous nature of the product.

3.11 Indirect Distribution

It is often more common for cylinders to be distributed to customers through contractual arrangements with distributors and dealers.

These can be small family businesses that have been in the business for generations and have built up a long history with the LPG company.

They also will have a close association with the customer and developed trust, an important issue when deliveryman (and woman) must enter the home to complete their task.

It is important for the LPG supplier to have a sole branded contract with the third-party distributors and dealers.

Some of the key characteristics to look for when choosing distributors could include safety consciousness, financial capability, business acumen, trained and capable employees, customer service experience, warehouse availability etc.

Multi-branded dealers, who are handling more than one brand, cannot be relied upon to give total commitment.

Cages of branded cylinders at a retail outlet

In some situations multi-branded dealers have been known to be involved in illegal refilling and tampering with cylinders.

There needs to be a simple and transparent contractual arrangement in place that clearly sets out what is required from both parties. This might include:

- Commitment to safety
- Geographic area of operation
- Roles and responsibilities
- Sales volume targets
- Other measurable deliverables (customer support)
- Branding support
- Margins and commissions
- Response time to orders
- Modes of delivery
- Storage space requirements
- Customer data records

Chapter Four

Transporting Cylinders Through the Distribution Channel

4.1 General

Transporting cylinders is a safety critical activity. It is also a major expenditure item for the stakeholders involved in distributing cylinders in the LPG business.

Choosing the right vehicle will ensure the safe, efficient and cost-effective transportation of cylinders throughout the entire distribution chain.

The types of vehicles used vary widely in terms of their duty i.e. hauling cylinders to/from filling plants through to home delivery.

LPG cylinder vehicle

All LPG vehicles operating in the distribution channel should be in good condition, well ventilated and designed to cater for all the cylinders to be securely tied, restrained and be in an upright position.

4.2 Vehicles in the Distribution Channel

Some points to consider when selecting and operating vehicles for carrying LPG cylinders include:

- Vehicles must comply with all local laws and regulations applicable to the transportation of LPG cylinders

- LPG cylinders should always be carried on open vehicles to ensure there is adequate ventilation

- The use of closed type vehicles should be avoided unless special provision is made for ventilation at floor level

- Engine exhaust systems on such vehicles should be in front of the load

- Vehicles should be of adequate strength and have enough carrying capacity for their intended duty

- Vehicles should never be loaded beyond their Gross Vehicle Weight (GVW) or individual axle weight

Cages of cylinders on vehicle with restraining straps

- Security inspections should be carried out in addition to site safety inspections

- Staff should be trained to recognise and minimise security risks and to take action in the event of a security breach

- The use of closed vehicles for transporting cylinders is not recommended

- Where possible the vehicle loading platform should be at the same level as the unloading/loading bay platform at the filling plant

- Hazard warning labels should be displayed on the rear and both sides of the vehicle

- Drivers are not permitted to smoke in or near the vehicle when it contains any cylinders. Cigarette lighters, lanterns and portable cooking stoves are not allowed on or near the vehicle

- Apart from the crew there should be no passengers allowed in the vehicle

- Small pick-up trucks should carry no more than 500 kg of LPG. The vehicle should carry a 2 kg fire extinguisher in the cab and a 9 kg one fitted to the vehicle. There should be written instructions displayed on the vehicle when carrying LPG

- Vehicles up to 3.5 MT should carry no more than 2,000 kg of LPG. These vehicles should have two 9 kg fire extinguishers fitted and one 2 kg one in the cab. There should be written instructions displayed on the vehicle when carrying LPG

- For 3.5 MT to 12 MT vehicles they should carry no more than 6,000 kg of LPG. These vehicles should have two 9 kg fire extinguishers fitted and one 2 kg one in the cab. There should be written instructions displayed on the vehicle when carrying LPG.

A specific location should be allocated for parking LPG vehicles which must be away from buildings, storage facilities and filling operations.

That location should take into account the potential emergency conditions that might develop within the terminal or storage depot.

If the driver suspects a leaking cylinder the vehicle should be parked, the incident investigated and the fault reported.

Emergency services must be alerted in the event of an accident.

Vehicles used for hauling cylinders to/from filling plants and distributor warehouse should be the heavy-duty type and can be trailer or rigid depending on the operational requirements.

LPG vehicles should securely contain the cylinders during transit and when parked

They should be designed to carry free standing or palletised cylinders. Vehicles designed for pallets should be fitted with carrying platforms suitable for the size and number of pallets to be carried. They must prevent the pallets from moving while in transit.

Vehicles used for transporting free standing cylinders should be designed so that the structure restraining the cylinders is made of steel and the floor preferably made of wood to prevent damage to the cylinder.

The restraints must be designed to be strong enough to hold the cylinders under severe braking conditions and/or vehicle manoeuvring.

It is good practice for the side and end restraints to be made of steel and at least as high as the height of the cylinder stack.

It is also good practice to provide restraints over the top of the cylinder stacks to prevent cylinders from spilling in case of vehicle roll overs.

The floor height of the structure containing the cylinders should be the same height as the filling plant and warehouse platforms to expedite loading and unloading.

In Vehicle Monitoring Systems (IVMS) or devices such as Global Positioning Systems (GPS) and cameras can be used to track the vehicle and monitor driver performance.

Vehicles should be well ventilated and designed to secure the load

This is designed to improve overall road transport operation but the implementation and use of this technology should be done with full consent of the drivers.

4.3 Vehicles for Delivering to Retail Outlets and Customers

Vehicles used to deliver cylinders to retail outlets are typically less than 3.5MT GVW carrying smaller quantities of cylinders.

Small trailer designed to carry LPG cylinders

They should be designed to have the same basic criteria as larger hauling trucks i.e. open and ventilated and enough capacity for the load intended.

The cylinder containing structure should be separate from the cab and the restraints should be adequate to secure the cylinders.

If vehicles are fitted with tail lifts, they must be built to recognised standards i.e. EN 1756-1.

In some countries, it is common to see two and three-wheeler vehicles being used to deliver cylinders to customers.

It is important that the structure containing the cylinders is strong enough to carry the load. The cylinders should be evenly spread to ensure the vehicle is balanced.

If two-wheelers are allowed by local regulations, they should be restricted to carrying small quantities of cylinders.

Carrying many, or large, cylinders on a motorbike will increase the risk of a road accident.

LPG is portable and is often the only modern energy available for remote rural communities. In some countries these communities are inaccessible to even two wheelers and other means must be found to distribute cylinders.

These methods may include small boats, donkeys and even hand carry (see Chapter Five). In all cases it is important to remember the basis properties of LPG and ensure the cylinder is always carried securely in an upright position (see Appendix One).

Except in emergencies, LPG vehicles must not be left unattended on public highways or out of sight of the driver.

Journey schedules must be arranged to minimise the time spent parking on streets, especially on highly used roads.

Meals or snack breaks should be planned to minimise parking vehicles in congested areas.

If night parking on roads is allowed, or unavoidable, a minimum distance of 15 m from any building should be selected with sufficient lighting to illuminate the entire vehicle.

Parking should be away from interference by unauthorised persons and obvious sources of ignition.

Vehicles should be parked in a safe area as close as possible to the point of delivery.

4.4 Drivers and Driver Training

Drivers of LPG vehicles, whether they be forklift trucks or LPG trucks, must be properly trained.

Drivers must check the vehicle operating manual – which should always be kept on the vehicle - for specific operational warnings.

Seat belts must always be used - even when driving forklift trucks - when the vehicle is in operation.

Always wear seatbelts, even on a forklift truck

Always check the load is balanced and secure before lifting and moving. Beware of the total surroundings and avoid loose loads.

Avoid using damaged pallets.

Drivers should be trained and be totally familiar with activities that includes:

Warning signs

- Being fully familiar with LPG and its properties (see Appendix One)
- Pre-trip inspection (see Appendix Two for examples)
- Use of vehicle controls and equipment
- Operation of emergency equipment
- Operation of the vehicle
- Defensive driving techniques
- Manual handling of cylinders
- Requirements for reporting incidents
- Loading and Unloading procedures

Personnel engaged in transporting LPG cylinders must be made aware of the hazards on board and the potential consequence of an incident on the road. They must be trained on the following:

- Main characteristics of LPG which affect safe handling and in procedures for dealing with emergencies
- Proper operation of LPG vehicles
- Company's safety requirements and operating procedures.

Drivers should be recruited based on their competence and relevant experience particularly if they are assigned to drive cylinder hauling trucks.

Drivers should be assessed and given adequate training prior to driving on the road.

Vehicle crews must report any incident or accident that occurred while on the road. They must also be required to wear appropriate Personal Protective Equipment while handling cylinders e.g. safety shoes and gloves.

No crew from the vehicle must travel within the cylinder containing structure of a vehicle (whether the vehicle is full or empty) under any circumstances.

4.5 Emergency Planning

All vehicles must carry a printed notice in the cab, detailing emergency procedures and main contacts for the crew.

The vehicle must also be equipped with a first-aid kit and a 2kg dry powder fire extinguisher inside the cab.

In addition, a 9 kg dry powder fire extinguisher outside the cab must be provided for vehicles greater than 3.5MT GVW. This must be easily accessible to the crew and protected from the weather.

All fire extinguishers must be inspected regularly and marked with the date of last inspection.

Fire extinguishers must be fitted and accessible on LPG vehicles

If a leak occurs the cylinder should be isolated, and the leak stopped if possible. If it can't be stopped the cylinder should be isolated away from people, buildings, drains & sources of ignition. The point of the leak should be kept uppermost to restrict it to a vapour leak.

A small fire from a cylinder may be smothered with a wet cloth or dry powder extinguisher, ONLY if it is possible to stop the leak.

Any leaking cylinder, and adjacent cylinders which cannot be moved to a safe place, can be cooled with water.

LPG fires are best controlled rather than extinguished until the source of the leak has been cut off.

Due regard should be taken of the possibility of the fire escalating with jet flame impingement from pressure relief valves

If possible, seek support from the emergency services. It's important to provide them with precise instructions on:

- The exact location of the incident
- Whether the incident is a spillage, fire or contamination
- Number of casualties & extent of them

If possible and if it's safe to do so:

- Move the cylinder or vehicle to a safer location
- Remove any ignition sources
- Wear PPE & equipment to protect from LPG cold burns

Appendix Three contains more details of emergency procedures for various situations.

4.6 Loading and Unloading

Loading and unloading cylinders from vehicles must be carried out without risk of injury to personnel and damage to cylinders and vehicles. The following guidelines are good practice.

- Vehicles must not be overloaded by weight or volume

- Cylinders must never be dropped or thrown onto or off the vehicle when they are being manually loaded or unloaded

- They must never be rolled horizontally along the ground

- Cylinders can be rolled on the foot ring or moved in a properly designed pushcart

- Cylinders that are not equipped with a permanently fitted shroud must be fitted with removable caps when transported to protect the valve

- Cylinders (full or nominally empty) must be loaded with their valves always in the upright position to ensure that the pressure relief valve (if provided) is in contact with the vapour space and if there is a leak, it is not a liquid leak

- Cylinders stacks should be stable, and stacks should not be higher than what the restraints can secure

- Cylinders of >35 kg capacity must not be stacked more than one high and must be restrained separately from other sizes of cylinder

- Cylinders, or cylinder pallets, must be secured against accidental movement which may cause damage. This is particularly important with part loads

- Cylinders and/or pallets should not be subjected to superimposed loads which might damage them

- Small cylinders (less than or equal to 5 kg) must be carried in properly designed crates or pallets, which must be securely restrained

Cylinders should be secured in transit

- Cylinders should not be transported together with corrosive or other materials that may inflict damage

4.7 Maintenance and Inspection

All vehicles carrying LPG cylinders must be subjected to regular inspection and maintenance to maintain them in good running order and to avoid unplanned maintenance.

The maintenance schedule should follow the recommendation of the original vehicle manufacturer. A record of the maintenance conducted should be kept for each vehicle for future reference.

Aside from regular maintenance, vehicles must be subjected to daily inspection checks before they leave their base.

The driver must conduct this inspection to check if the vehicle is roadworthy and compliant with the requirements for the safe transport of cylinders. An example of a vehicle checklist is in Appendix Two.

Some of the items to be checked include:

- Tyres are to be correctly inflated with sufficient tread depth
- Foot brake, hand brake or operational and air pressures are correct
- Levels of engine oil, radiator coolant, and screen wash are correct
- Horn, lights, windshield wipers are all working correctly
- Fire extinguishers are sealed and fitted in a way to provide protection, are easily accessible and within test date
- Fire extinguishers must also bear a mark of compliance and an inscription indicating the date of next inspection
- Seatbelts are in good condition and operational

Chapter Five

Cylinder Installation at the Consumer

5.1 General

The last yard of the cylinder distribution channel is the installation of the cylinder, to connect with the LPG appliance, at the customer's premises and checking to ensure it has been fitted correctly with no leaks.

Once fitted, the customer then has the responsibility to ensure the cylinder and appliance are working correctly until the contents have been used and the cylinder is empty. They will need to be educated about that and also what to do in the event of an emergency.

This is not an onerous task and will simply entail periodic checks to make sure there are no leaks and the cylinder, regulator, hose and appliance are working correctly.

The customer must be aware of what to do, and who to call, if there is an emergency.

5.2 Home Delivery

The gross weight of a full LPG domestic cylinder can be over 25 kg which makes customer collection physically demanding.

Home delivery of LPG cylinders is therefore quite common in the residential LPG sector.

Orders are typically placed at a centralised customer service centre managed by the LPG company. The cylinder is then dispatched to the customer by the deliveryman (or woman) who brings the full LPG cylinder to the customer's door.

The empty cylinder is removed and replaced with the full one and the checks are done. In some case the order is transmitted to contracted distributors or dealers covering the customer's location to handle the delivery.

Delivery of the cylinder to the customer

The practice will be dependent on the business model used by the LPG company.

One advantage of home delivery is the opportunity to have face to face time with the customer. There will be opportunities to explain safety instructions, and what to do in an emergency.

Some key messages to the customer will include:

- If there is a leak LPG vapour will fall to the ground
- If LPG can be smelt carefully open the window and doors to allow the gas to escape
- Do not light a match or create any other ignition source (e.g. don't operate light switches)
- Call the emergency number provided by the supplier
- Follow their instructions

5.3 Customer Collects

In some cases, the customer will be responsible for collecting the full cylinder and bringing it back to their home to be fitted.

This will be the case with the cylinder exchange programme where the customer exchanges an empty cylinder for a full one at the retail outlet.

When the cylinder is under 5 kg capacity this is possible.

When the customer collects the cylinder in an exchange programme, they are responsible for disconnecting and connecting the cylinders and transporting them to and from the retail outlet.

Customer carrying 3 kg cylinder

The challenge for the customer is to carry and transport the cylinder in an upright position when often the cylinder is over 10 kg capacity it will likely be taken in a private vehicle. The cylinder may be over 60cm tall and keeping it upright from the retail outlet to the home will be a challenge.

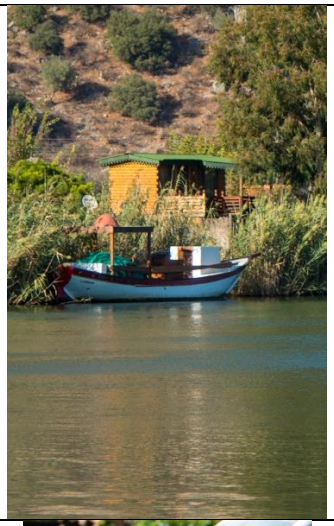
Cylinders are sometimes laid in the boot of a car horizontally which is particularly dangerous when the cylinder is full.

Keeping the cylinder secure is one issue but the other is the possibility of a liquid LPG leak in the vehicle if the valve is not gas tight or has been accidentally opened. Keeping the windows open will prevent any accumulation of gas.

Small cylinders are easily carried home

Examples of some more different methods of getting LPG cylinders home are shown here. They may not all be in full compliance with good business practices, but they all have the undivided attention of the carrier.








5.3 Safety at Customers' Premises

The LPG installer is responsible to ensure that new or replacement appliances are connected, tested, adjusted and in safe working order.

Appliance operating instructions should be handed to the customer and explained by the installer.

LPG appliances must not be connected to other gas supply systems, such as natural gas.

Adequate ventilation must be provided to allow enough air for satisfactory combustion and to ensure ample dispersal of the burnt gases. This is particularly important for un-flued appliances.

Installations in recreational vehicles and boats must comply with the installation code applicable to fixed appliances.

Cylinder compartments must be sealed from the interior of vehicles/boats and vented to the outside in case of leakage.

Cylinder valves must be closed when not in use and when a vehicle is in transit.

Gas appliances must never be used in a moving vehicle.

APPENDIX ONE
LPG PROPERTIES AND HAZARDS

Liquefied Petroleum Gas (LPG) - Comprises Commercial Propane and Commercial Butane, and mixtures thereof. They are hydrocarbon gases that can be changed into a liquid and changed back into a gas by the simple application and release of pressure

Density – LPG vapour is heavier than air and tends to gather at low areas such as drains, pits, cellars and other depressions. As a colourless liquid, LPG occupies around 0.4% of its vapour volume, but is about half the density of water and will float on water before vapourising

Cooling effect – LPG liquid vapourises and cools rapidly; it can therefore inflict severe cold burns if it comes in contact with bare skin.

Non-toxic – LPG is not toxic. However, it has an anaesthetic effect when mixed in high concentrations with air. The greater the concentration (i.e. as available oxygen declines), the greater the risk of asphyxiation.

Smell - What people know and recognise as the 'LPG smell' is usually added to LPG before distribution. This smell can be detected if the LPG content of air is as little as 0.4% (or just 20% of the lower limit of flammability). However, odour is not the only means of detection. Large leaks will also be obvious through hissing or condensation or frosting around the leak; small leaks will show up as bubbles if detergent mixed with water is applied to the suspected leak area. **NEVER try to detect leaks with a naked flame or other kinds of ignition!**

Flammability – LPG can ignite when it forms between 2 and 10% of a vapour/air mixture, so the risks associated with poor handling, storage or usage should be obvious. Uncontrolled ignition of LPG can cause serious fires or explosions (i.e. if ignited within a confined space). A fire started some distance from an LPG leak can very quickly travel back to the source of the leak itself. An LPG cylinder involved in a fire may overheat and rupture violently. The power and intensity of an LPG fire or explosion should never be underestimated.

Liquid Expansion – LPG liquid has a high coefficient of expansion. Tanks, cylinders, pipelines and equipment must be protected against the high pressure resulting from liquid expansion with temperature rise.

The table overleaf shows some typical physical properties of LPG

TABLE OF CHARACTERISTICS FOR LPG

Typical Characteristics of Propane and Butane **PHYSICAL PROPERTY**		**COMMERCIAL PROPANE**	**COMMERCIAL BUTANE**
Litres/tonne of liquid at 15°C Litres/ton of liquid Litres/kg of liquid US barrels/tonne		1,965 – 2,019 1,996 – 2,051 1.96 - 2.02 12.4 – 12.7	1,723 – 1,760 1,750 - 1788 1.72 - 1.76 10.8 – 11.1
Relative density (to water) of liquid at 15°C		0.50 - 0.51	0.57 - 0.58
Ratio of gas to liquid volume at 15°C and 1015.9 mbar		274	233
Relative density (to air) of vapour at 15°C and 1013.25 mbar		1.40 - 1.55	1.90 - 2.10
Volumes of gas/air mixture at lower limit of flammability from 1 volume of liquid at 15°C and 1015.9 mbar		12,450	12,900
Boiling point °C		Minus 45	Minus 2
Vapour pressure at 0°C	barg	4.5	0.9
Vapour pressure at 15°C	barg	6.9	1.93
Vapour pressure at 38°C	barg	14.5	4.83
Vapour pressure at 45°C	barg	17.6	5.86
Upper limit of flammability,	% v/v	10.0	9.0
Lower limit of flammability,	% v/v	2.2	1.8
Gross calorific value	MJ/m^3 dry	93.1	121.8
	BTU/ft^3 dry	2,500	3,270
	MJ/kg	50.0	49.3
	BTU/lb	21 500	21 200
Net calorific value	MJ/m^3 dry	86.1	112.9
	$BTUu/ft^3$ dry	2,310	3,030
	MJ/kg	46.3	45.8
	BTU/lb	19,900	19,700
Latent heat of vapourisation	kJ/kg at 15 °C	358.2	372.7
Latent heat of vapourisation	BTU/lb at 60 °F	154	160

APPENDIX TWO
LPG VEHICLE CHECK LIST

TRUCK CONDITION		EQUIPMENT AND FACILITIES ON TRUCK	
1. Oil Pressure		1. Side and Tail Boards OK	
2. Water Temperature		2. Platform Condition	
3. Main Lights		3. Cylinder Security Straps	
4. Indicator Light		4. Fire Extinguishers	
5. Horn		5. Hazard Warning Signs	
6. Speedometer		6. Transport Safety Documents	
7. Battery Check		7. Breakdown Warning Signs	
8. Tire Condition		8. Emergency Contact Details	
9. Tire Inflation		9. PPE for Operators	
10. Wipers, OK			
11. Mirrors, OK			
12. Foot Brakes			
13. Hand Brakes			
14. Lube Oil Level			
15. Water Level			
16. Doors, Windows			
17. Accident Report List			
18. Steering			
19. Tool Kit			

APPENDIX THREE
LPG EMERGENCY PROCEDURES

Leak suspected - Location Uncertain

- Check the entire system for any indication of gas leak, such as smell or hiss
- Test with soapy water solution, which will bubble at any point where gas escapes
- Never use a match, flame or plain water to test for a leak
- If the leak has been indoors, fully ventilate the room before further use of appliance
- Do not interfere with any part of a fixed installation

Leak Detected - No Fire

- If possible, stop the leak by shutting the cylinder valve
- Ventilate the area thoroughly until the air is clear
- If it's not possible to stop the leak, remove the cylinder carefully to a safe outdoor location
- Keep the leak uppermost so that only vapour and not liquid escapes
- Keep hands and face clear of any stream of escaping liquid and where possible, wear thermally insulated gloves
- If the cylinder cannot be removed, disperse gas with fine water spray and provide maximum ventilation
- Keep possible ignition sources at least 20 metres away until cylinder is empty
- These sources could include open fires: non-flameproof electrical appliances, camera flash, telephone, radio, vehicle engines, and any other equipment that can generate a spark

Leaking Cylinder or Appliance - On Fire

- If the valve is undamaged and it's safe to do so, close it and let the fire go out. Do not use again until inspected
- If the valve cannot be closed, call the fire brigade, police or gas dealer, advising location, that it is LPG and cylinder size
- Keep cylinder cool by water hose but DO NOT attempt to extinguish flame
- Unburnt gases in confined space may explode if reignited
- Keep clear and await assistance

- If there is any possibility of cylinder(s) being engulfed by fire, evacuate the adjacent area

Cylinder Exposed to Excessive Heat

- Keep cylinder cool with a water hose, sprayed from the maximum possible distance
- Remove from heat source if safe and possible to do so

APPENDIX FOUR
SAFETY GUIDELINES - LPG SITES

Makeen Energy, (http://makeenenergy.com) is a company with a portfolio that includes equipment, services and spare parts, facility management, engineering and project management for LPG filling facilities.

They employ approximately 1,000 people across 6 continents and operate in over 140 countries. Makeen Energy '…put safety first…'.

Makeen Energy have produced a small safety booklet that highlights the precautions that need to be taken when on an LPG site where there is a hazardous area with an explosive gas atmosphere.

The Makeen Energy Safety Booklet

The booklet points out important safety measures to remember when entering classified areas on LPG sites.

There are eight key guidelines to follow. In addition, personnel must follow specific rules regarding tools, clothes, work procedures, etc.

They are set out below:

1.0 USE YOUR COMMON SENSE AND LOGICAL REASONING

When on an LPG site you should always use your common sense and logical reasoning. If you experience or notice something that seems irregular or dangerous you must report it to the local staff immediately

2.0 KNOW – AND FOLLOW – THE LOCAL INSTRUCTIONS

It is your responsibility to know – and follow – the local instructions on the LPG site. Importantly this includes precautions in the event of a fire or an explosion. Everyone must help ensure that the local instructions are strictly observed at all times.

3.0 KNOW THE LOCAL SAFETY EQUIPMENT AND EMERGENCY PROCEDURES

Make yourself familiar with the safety equipment on the LPG site – both its location and its use – as well as the local emergency procedures and evacuation plans. As a part of the site's safety measures you must always wear anti-static clothes, anti-static footwear, safety glasses and hearing protection when entering a classified hazardous area on an LPG site.

4.0 NEVER STAY ALONE

When staying in a classified hazardous area on an LPG site you should never be alone.

5.0 DO NOT BRING FORBIDDEN ELECTRICAL ITEMS

In a classified hazardous area on an LPG site it is only allowed to bring along approved electrical equipment. If you need to take any electrical items into the area you must first get local approval.

6.0 NEVER USE AN OPEN FIRE

All kinds of open fire are strictly forbidden in the classified hazardous area on an LPG site – including smoking, matches, lighters and any form of welding, grinding, etc. Normally you can leave forbidden items at the site entrance.

7.0 DO NOT CONSUME ALCOHOL OR DRUGS

Intoxication or consumption of spirits or drugs is not allowed on an LPG site and in no way will be tolerated

8.0 TREAT AND REPORT ACCIDENTS AND NEAR MISSES

Any accident or near miss on an LPG site must be reported to the local staff. In the event of minor accidents you should always clean and treat cuts, grazes, dust in the eye, etc. immediately to prevent possible complications or infections

BE CONSCIOUS OF SAFETY – PREVENT ACCIDENTS

APPENDIX FIVE
CYLINDER MANAGEMENT

One major international LPG company suggested the management of the LPG cylinders was so important that they set out ten rules to follow:

(i) OWN YOUR CYLINDERS - This is the only framework within which you can take effective and sustainable responsibility for cylinder safety

(ii) SET CYLINDER DEPOSITS AT 130% OF THE CYLINDER COST – The deposit must cover the cost of all cylinders in the distribution channel

(iii) CLEARLY IDENTIFY YOUR CYLINDERS – Permanent marking (embossing) to recover property, to project the brand and mitigate illegal filling

(iv) LOBBY FOR HEALTHY REGULATIONS AND ENFORCEMENT – to prevent pirate filling and illegal swapping of brands

(v) KNOW YOUR CYLINDER POOL – know how many cylinders you have and where they are

(vi) USE METAL MANAGEMENT TO IMPROVE THE CUSTOMER PROPOSITION – to improve cylinder condition

(vii) DESERVE CUSTOMER LOYALTY – through improved cylinders that look safe

(viii) REMIND THE DISTRIBUTION NETWORK REGULARLY ABOUT METAL MANAGEMENT RULES – information to distributors and retailers, campaigns

(ix) MANAGE DISTRIBUTORS – well prepared and mutually beneficial contracts. No brand swapping, over stocking

(x) BUILD A STRONG LPG INDUSTRY – Champion good business practices. Deal strongly with any illegal activities

Oryx Energies suggest the management of LPG cylinders in the distribution channel can be carried out by following these ten rules:

Rule	Comments
1. Cylinders to be owned by your company	This is the only framework within which your company can control its own investments and take effective responsibility for cylinder safety. Most cylinder management rules depend on this one.
2. Clearly identify your company's cylinders	• To reclaim property (embossing) • To promote your brand and inform customers, the network, competitors (brand logo and colours) • To prevent involuntary brand swapping and, indirectly, pirate filling.
3. Know your cylinder pool	This is the basis of managing cylinder circulation : • How many cylinders your company has • Where they are • Principles of your distribution channel
4. Keep focus on cylinder management	• Rigorous management of your own working stock • Frequent reconciliation of partners working stocks • Monitor cylinders at customers • Set and execute efficiency targets
5. Include cylinder management in distributor management and keep distributors engaged	• Include cylinder terms of use in the contract • Set and execute turnaround and quality targets • Check cylinder handling at distributors' premises and during deliveries • Check respect of deposit process rules • Engage distributors in managing local markets – collecting your company's cylinders, acting against unmanaged swaps
6. Act quickly and rigorously to resolve any differences in stock reconciliation	• Delays make resolving differences in reconciliations more difficult • Resolve any difference at partners' stock according to contract, request damage recovery, take legal action if needed • Rigorous actions confirm your focus on cylinder management, develop the same at the distributor level and help to avoid future losses
7. Lobby for healthy legislation and its enforcement, and help build a strong LPG industry	This will help to: • Clarify and protect cylinder ownership • Continue to invest in new cylinders • Create fair market conditions - stop pirate filling – • Increase safety standards
8. Monitor the market, take legal actions against illegal use of your company's cylinders	Not protecting cylinder ownership and rights increases illegal behaviour in the market, including pirate filling
9. Reinforce customer loyalty	Customers should prefer your brand and choose your cylinders instead of the ones of your competitors. To ensure this, you will need: • Well branded cylinders • Better looking cylinders • High quality and right quantity – cylinders and LPG product • Availability – reliable supply i.e. no stock outs at retailers • Top class customer service
10. Understand customer behaviour and the impact on cylinder efficiency	• Learn your cylinder turnaround for all customer segments • Regularly review and monitor cylinder turnaround • Target the right customer segments

APPENDIX SIX
EXAMPLES OF TYPICAL BAD PRACTICES

(i) ILLEGAL FILLING OF CYLINDERS

An extremely dangerous practice with a high probability of causing LPG leaks. The cylinders being filled are from different companies and will not have been subjected to any checks or maintenance. There are no scales and so the cylinders will not be accurately filled. Potential investors seeing this type of activity will be put off because any investment in cylinder assets will be at risk. The illegal fillers will have taken the cylinders out of the market to avoid investing themselves.

(ii) CONGESTED STORAGE

These cylinders have been stacked too high and there are no aisles to get access to the cylinders at the back of the store-room. The number of cylinders shown would contain over 500 kg of LPG, an excessive amount for this facility. If any of the stacks fell they would cause injury to anyone present.

(iii) MULTI-BRANDED DISTRIBUTORS

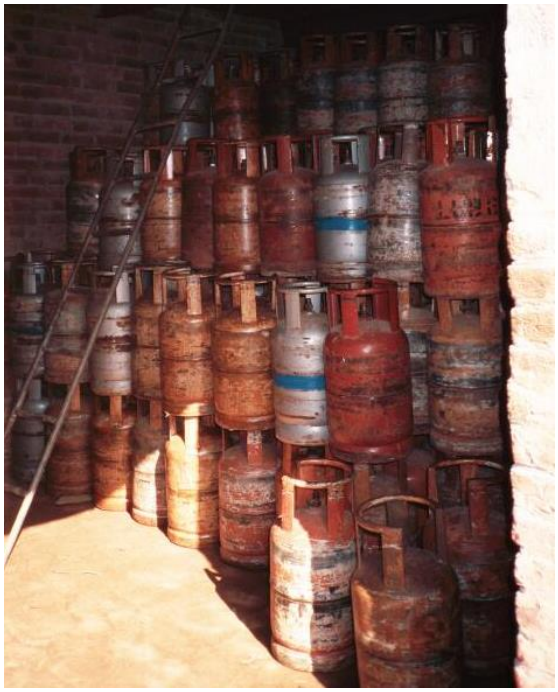
An LPG company's control over their cylinders in the distribution channel diminishes if that channel is handling other brands. Good practice is to have a dedicated single branded channel supported and enforced by contractual arrangements. If a distributor is handling other brands its support to a particular brand is not only diluted, it encourages the possibility of activities such as illegal filling and re-branding.

(iv) DANGEROUS DELIVERY OF CYLINDERS

Cylinders should never be stored in the horizontal position because it puts the valve in contact with the liquid phase creating the possibility of a liquid leak of LPG which is over 250 times worse than a vapour phase leak. This motorcycle here is being used for delivering LPG cylinders to customers and not only are they horizontal, they are also very unstable with just a single elastic strap securing them in position. If the motorcycle was involved in an accident the consequences would be very serious if the cylinders were damaged and released their contents.

(V) DANGEROUS STORAGE OF CYLINDERS IN THE CHANNEL

The storage room here have several issues that demonstrate bad practices. It contains different brands, it is over stocked, there is no access to the cylinders at the back of the storage area in the event of a leak, and there is a ladder with no hand rail which would be a risk



(VI) DANGEROUS HANDLING OF CYLINDERS

These cylinders are being thrown off the back off this distributor truck causing physical damage to the shroud and foot rings. The cylinders are also stored in a horizontal position on the back of the vehicle and the person isn't wearing any PPE.

REFERENCES

Safety Guidelines – Makeen Energy (https://makeenenergy.com/)

Oryx Energies (https://oryxenergies.com/)

UK HSE (https://www.hse.gov.uk/)

WLPGA Guidelines and Guides (https://wlpga.org)

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