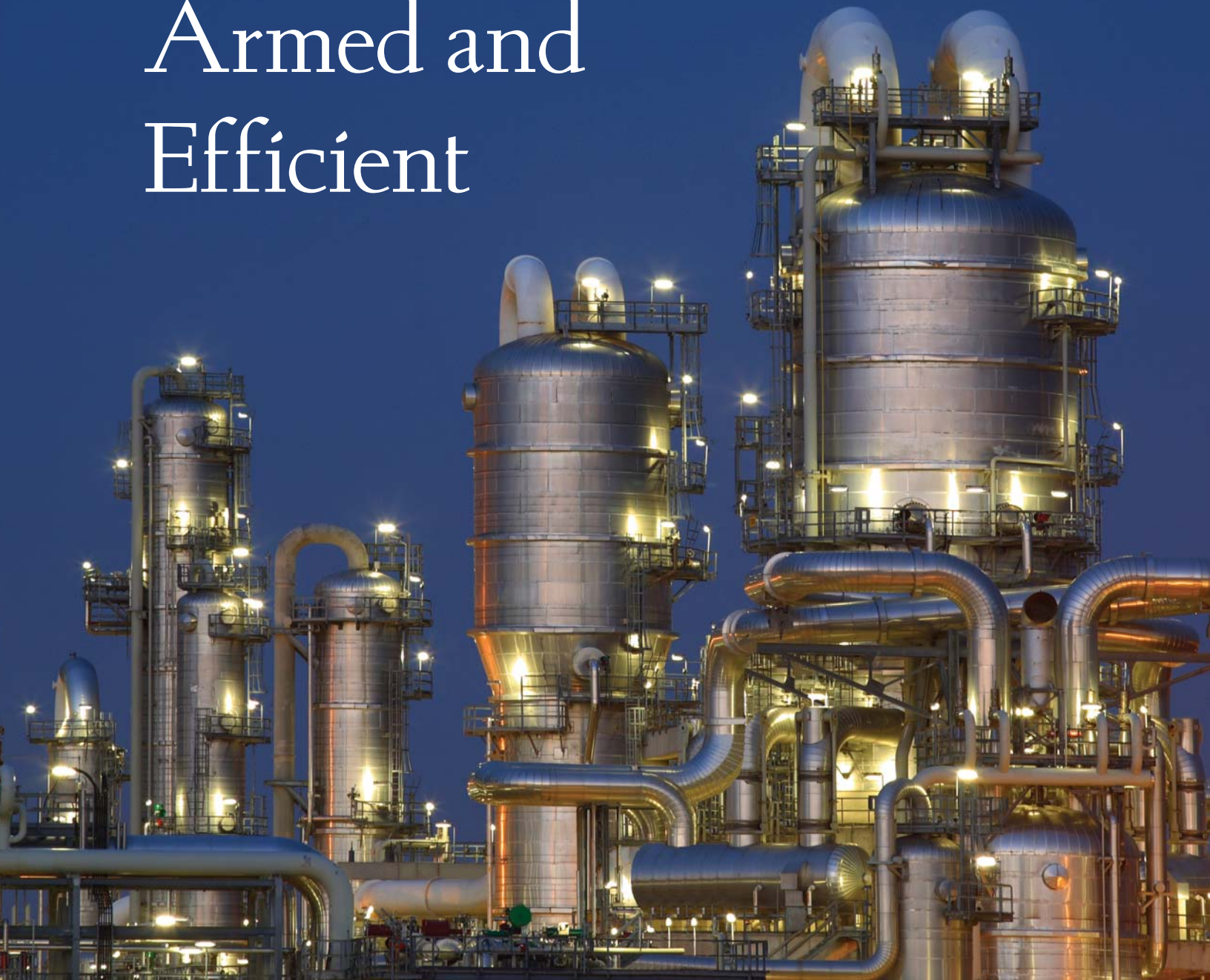


# Armed and Efficient



How LPG Loading Arms Can Increase Safety and Throughput

## Overview of LPG

LPG stands for Liquefied Petroleum Gas. LPG is actually a family of gases that includes butane, propane and pentane. Liquefied petroleum gas is partly a byproduct of petroleum refining and is usually derived from fossil fuels sources. Basically, it's manufactured during the refining process of crude oil.<sup>1</sup> Nationwide less than half of LPG comes from petroleum refining and the rest comes from natural gas processing. LPG is made up of hydrocarbons that are vapors at normal temperatures and pressures, but the hydrocarbons will turn to liquid at moderate pressures. Because it's widely available, LPG is the least "alternative" of alternative fuels.<sup>2</sup>



This clean-burning fossil fuel can be used for pretty much anything from barbeque grills, to heating homes in rural areas to powering internal combustion engines. While school buses and other "fleet" type vehicles use LPG it hasn't quite hit the mainstream in the U.S. but is used more in Europe and India. LPG-fueled vehicles produce significantly lower amounts of some harmful emissions. It's often less expensive than gasoline and can be used without degrading vehicle per-

formance which is certainly beneficial for the consumer. The best part is about 90% of the LPG used in the United States comes from domestic sources.<sup>3</sup>

Varieties of LPG include mixes that are mostly propane, mostly butane or a mixture of both. Propylene and butylenes may be present in small concentrations. Because LPG is odorless, an odorant must always be added so a leak will be evident. In the

United States, odorants approved for use in LPG are thiophene, ethanethiol or amyl mercaptan. At normal temperatures and pressures LPG evaporates quickly so it is stored as a liquid in pressurized steel cylinders that are usually filled to between 80% and 85% of their total capacity to allow for thermal expansion.<sup>1</sup>

### Advantages and Disadvantages

LPG provides only about 3% of the energy consumed in the United States. It burns cleanly with very few sulfur emissions and poses no hazard of ground or water pollution. In other parts of the world LPG is used for cooking, refrigeration, motor fuel (autogas) and heating homes in rural areas.<sup>1</sup>

The advantages of using LPG, or propane as it is most often referred to, are many:

- It's a domestically sourced fuel.
- Less expensive than gasoline.
- Lower toxic emissions than gasoline in carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>) and non-methane hydrocarbon (NMHC).<sup>3</sup>
- Helps relieve some of this country's petroleum dependency issues.<sup>2</sup>

The picture isn't perfect though. LPG does have some disadvantages, which can be easily remedied if its usage becomes more widely accepted.

- Limited availability of LPG-powered vehicles (However, vehicles can be converted by certified installers.)
- Currently not as readily available as gas or diesel.
- Mileage is less than with gas or diesel fuel.<sup>3</sup>

### Shipping and Storage

Propane is shipped from its point of production to distribution terminals by way of a pipeline, truck, barge

and/or railroad system.<sup>4</sup> Propane is stored as a liquid in sturdy tanks at about 20 times the normal atmospheric pressure. These tanks are tougher than sheet metal or plastic gasoline tanks. They also have a built-in shutoff valve to seal the tank if the fuel lines start leaking. These factors make storage much safer. LPG fires happen most often on barbecue grill tanks due to leakage created when the operator improperly hooked the tank up. In a vehicle, the tank is a permanent part of the construction so it's immune to this specific cause of fire.<sup>2</sup>

### Safety First – Proper Loading Techniques

Petroleum products require extra knowledge on the part of the handler. Improper loading can be extremely dangerous as the vapors of petroleum fuels are what catch fire, not the liquid. A fire or explosion can occur if these vapors are ignited by a spark, open flame or even static electricity.<sup>5</sup>

Instructions for drivers loading/unloading petroleum fuels are always focused on safety and accuracy:

- Chock wheels on trailer.
- Connect ground using dual ball ground plug.
- Verify proper ground connection by checking the indicator lights.
- For added safety, a computerized loading system will not allow loading until the proper ground connection is established.
- Connect LPG hose or loading arm to trailer.
- Open valves on trailer.
- Open LPG loading valves (hand operated)
- If an overfill or spill occurs for any reason, shut off product valve immediately.
- Once the loading/unloading process is complete disconnect hoses.
- Disconnect ground.<sup>5</sup>

The most important part of the loading process, besides safety, is the metering system. There are a few significant differences in LPG loading compared to other fuels. Flow parameters and system pressures play a key role in the loading process. Because LPG has a low vapor pressure, attention must be given to ensure the product remains in a consistent liquid state. Finally, since LPG is colorless and odorless an injected odorant is a must for identifying leaks.<sup>6</sup>

The four basic components of a metering system include a storage tank, pump unit, metering unit, and piping to connect the components. The system is closed and there cannot be any leakage of liquid or vapor. It must also be designed and constructed to withstand high pressure. Pressure relief valves permit a controlled venting of product to the atmosphere when internal pressures are too high. As the liquid product passes through the metering unit the quantity of liquid is measured. This allows both the operator of the system, and the buyer of the product, to verify the amount of liquid being delivered.<sup>7</sup>

### Hoses and Loading Arms

Fuel loading and unloading for LPG and other fuels is usually done in different configurations depending on preferences, budgets and safety regulations. Loading or unloading trucks or rail cars can be done using top or bottom loading hoses or top or bottom loading arms. LPG hose construction is dependant upon the product being transferred and the operational parameters. For example, refrigerated LPG requires a different set of hose system transfers to LPG being loaded at ambient temperatures or to LPG transferred offshore. Marine hoses must operate in demanding environments and all weather conditions.<sup>8</sup>



There are times when hoses are the best solution for the job. Certain chemicals such as hydrochloric acid and bleach require hoses that are specially lined to avoid corrosion. Hoses are more flexible than loading arms but they are also more likely to wear out. Hoses are heavy, bulky and create a fall hazard. They're a constant cost because they have to be replaced often.

Loading arms protect workers and the environment from the harmful effects of hose pull-apart, rupture and failure. They also make quicker connections and can load/unload faster meaning better throughput for the company. So in most instances, loading arms are the best choice because:

- Hoses can create trip and fall risks.
- Hoses wear out from being dragged across concrete.
- They can develop leaks.
- Hoses are heavy requiring extra time and energy for employees to maneuver.

LPG loading arms have one arm for liquid and one for vapor return. The arms have swivel joints so they are easy to maneuver and won't leak. Unlike hoses, a loading arm usually folds away to store, making it more compact and out of the way. These arms are designed

to provide efficient loading while keeping occupational health and safety in mind. A balance mechanism ensures the loading valve remains horizontal at all times to accommodate different adaptor heights.<sup>9</sup> LPG loading arms are critical equipment since 90% of LPG storage system accidents occur in the unloading area.<sup>10</sup>

Loading arms improve throughput by:

- Taking less time to set up and maneuver.
- Increasing safety because they won't leak creating a fire or explosion hazard.
- Being simple to store, compact and out of the way when not in use.
- Providing more efficient loading.

Loading arm safety devices can include:

- Emergency disconnection.
- Fire suppression valves.
- Safety break.
- Settled valve.
- Pressure switch.
- Overfilling detection sensors.
- Dead-man control.
- Vehicle grounding system.
- Metering defaults.<sup>11</sup>

## Conclusion

When transferring LPG to a truck, railcar or barge, loading arms are usually the safest and most streamlined choice. Because of their swivel joints, loading arms do not leak, they are easy to store, quicker to connect and their added safety measures such as a no trip hazard, no heavy lifting, no ruptures, all add up to improved throughput for your company.

Weighing Technologies Inc. is an authorized dealer/reseller of Carbis Solutions Inc. products

## ENDNOTES

- 1 Liquefied Petroleum Gas, Updated November 2011. [http://en.wikipedia.org/wiki/Liquefied\\_petroleum\\_gas](http://en.wikipedia.org/wiki/Liquefied_petroleum_gas)
- 2 Liquefied Petroleum Gas (LPG), 2002. <http://altfuels.org/backgrnd/altftype/lpg.html>
- 3 Propane Basics, US Department of Energy, March, 2010. <http://www.afdc.energy.gov/afdc/pdfs/46996.pdf>
- 4 Propane: Liquefied Petroleum Gas (LPG), Domestic production and imports of LPG: EIA. 2011. <http://www.fueleconomy.gov/feg/lpg.shtml>
- 5 Conway Underground East Driver Instructions, March 2007. [http://www.williams.com/midstream/docs/cue\\_driver\\_instructions\\_for\\_lpg\\_truck\\_loading\\_terminals.pdf](http://www.williams.com/midstream/docs/cue_driver_instructions_for_lpg_truck_loading_terminals.pdf)
- 6 Guide to Marketing Terminals, LPG Loading, Updated October, 2011, FMC Technologies. <http://info.smithmeter.com/literature/docs/sbsm007.pdf>
- 7 "The Nature of LPG Products, Their Storage, Measurement, and Delivery" National Institute of Standards and Technologies, May 2005. <http://ts.nist.gov/WeightsAndMeasures/upload/LPG-Chptr2May-05.pdf>
- 8 "Hoses for Liquid Petroleum Gas", Contitech Fluid Technology. [http://www.dunlop-oil-marine.co.uk/pages/offshore-marine-hoses/loading-hose-applications/lpg-transfer/lpg-transfer\\_en.html](http://www.dunlop-oil-marine.co.uk/pages/offshore-marine-hoses/loading-hose-applications/lpg-transfer/lpg-transfer_en.html)
- 9 LPG loading operations management presentation, September, 2011, MECI Satam Metering Solutions. <http://www.tankstorageinternational.com/pdf/presentations/Satam.pdf>
- 10 "LPG-Propane Loading Arm", Oil and Gas Plant Engineers. <http://www.ogpeindia.com/lpg-propane-loading-arm.html>
- 11 "LPG Loading Arm", C & N Petroleum Equipment. [http://www.candnpetro.com/lpg\\_loading\\_arm.html](http://www.candnpetro.com/lpg_loading_arm.html)