

A



Promoting Propane Safety ...Through Better Understanding

[About Propane](#)[Propane Tanks](#)[Regulators](#)[LP Gas Appliances](#)[Propane FAQ's](#)

- ▶ [Propane Tanks Explained](#)
- ▶ [Propane Gas Prices](#)
- ▶ [LPG Bottles and Cylinders](#)
- ▶ [Propane Leak Testing](#)
- ▶ [Reading Your Tank Gauge](#)
- ▶ [LP Gas Appliance Conversions](#)



Propane 101

Designed by propane dealers so that current and potential users of propane gas may better understanding what propane is and what it does. Through our experience and knowledge, we aspire to improve the relationship between LP Gas marketers and consumers by expanding awareness of not only propane as a fuel but also the activities of gas marketers in the propane gas industry.

Propane 101 - What Propane Gas Users Need To Know

Propane Safety Begins With Better Understanding

Propane 101 is designed with one simple goal...to educate consumers about propane so that they may better understand this valuable and efficient fuel as well as promote a more effective relationship between gas customers and their suppliers. The information within is an expanding resource that will attempt to explain propane, gas systems and the uses of propane in the commercial, industrial and residential markets.

Propane is used in a number of different capacities throughout the world. Propane is a portable energy source used for fueling processes that keeps the world moving. It is a clean burning natural resource used by millions of people on a daily basis and when used properly, propane is one of the safest sources of energy available today.

Propane 101 is designed for and geared toward average citizens using propane or considering the use of propane as an energy source. This site promotes the understanding of LP Gas in a non-technical manner so that people can better identify with what occurs within the propane industry. In short, Propane 101 is propane information in simple terms.

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B



Promoting Propane Safety ...Through Better Understanding



[Home](#) [About Propane](#) [Propane Tanks](#) [Regulators](#) [LP Gas Appliances](#) [Propane FAQ's](#)

[Propane Statistics](#)

[Propane Prices](#)

[Propane Liquid and Vapor](#)

[Propane Volume Correction](#)

[Propane Grades and Quality](#)

[Propane - Green Energy Fuel](#)

[Propane Vs Other Fuels](#)

Propane Liquid and Propane Vapor

Before propane is used, it exists in one of two forms, liquid or vapor. Both liquid propane and vapor are usable but cannot be used interchangeably. In other words, a propane system designed to use vapor can't utilize propane in its liquid form and vice-versa. Additionally, the characteristics of propane liquid and propane vapor are so different that the primary properties we are concerned with are as different as night and day. With propane liquid, temperature is the primary factor whereas weight is the main concern regarding propane vapor. Think of it this way, water is liquid and steam is water vapor. The same holds true for propane and is explained in detail below.

Propane Liquid

Propane exists in its liquid form at or below its boiling point (-44°F) as well as when it stored under pressure. To further explain, if the temperature outside is -45°F, propane will be a liquid and you would be able to pour it out of a bucket. But as soon as the temperature rises to -44°F, the propane begins to boil and thus give off vapor. If the temperature outside is colder than -44°F, propane exists as a liquid. It's still propane but it looks a lot like water while at this cold temperature. It's colorless, odorless and tasteless...but who would take a drink of a any liquid that is 45 degrees below zero? Who would stick their finger in a glass of anything that is 45 degrees below zero? Holding a handful of ice can be quite uncomfortable (or painful) after some time but think how painful it would be if that handful of ice was almost 75 degrees colder.

Because propane boils at a temperature that is over 70 degrees lower than the freezing point of water, it has the ability to freeze skin tissue in a very short period of time (severe frostbite). The temperature properties of liquid propane are such that being aware of possible danger when dealing with propane in its liquid state is extremely important.

Propane Vapor

Propane becomes a vapor at temperatures above -44°F. Similar to water when it boils and gives off steam, propane gives off vapor when it boils. One may refer to propane vapor as "flammable steam" for simplicity. However, for the propane vapor to be ignited, there must be the right mix of air and vapor. Propane vapor is heavier than air and will sink to and collect in the lowest point it can find. If propane is vented to the outside air, it will quickly dissipate with the slightest movement of air. Conversely, if propane is vented into an air tight structure with no air movement, the propane vapor will collect on the floor and rise vertically if more propane is vented into the structure.

This is extremely important to know because if there is a propane leak in a house or building, the propane vapor will seek the lowest possible point where it will collect. Keep in mind that one gallon of propane will produce over 36 cubic feet of vapor and this vapor will settle in the lowest possible place. If the propane vapor level continues to rise, it may ignite if finds a source of ignition. The weight of propane vapor being heavier than that of air is a characteristic of propane gas that needs to be understood by all LP Gas users, not just propane companies and their employees.

Vapor Service vs. Liquid Service

Propane vapor service and propane liquid service are completely different from one another. Most all propane

applications use vapor for service requirements. The importance in knowing the difference between liquid service and vapor service is strictly for safety and usability. Appliances such as water heaters, furnaces and gas grills are used in vapor service. If these appliances were to have liquid propane flow to their burners, the result could possibly be a fire or similar danger. This is why propane cylinders should be positioned upright when grilling. Turning a cylinder on its side or inverting it while being used on a gas grill or fryer is not a smart thing to do.

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C



Promoting Propane Safety ...Through Better Understanding



Home

About Propane

Propane Tanks

Regulators

LP Gas Appliances

Propane FAQ's

Understanding Propane Tanks

[Fill Valve](#)
[Safety Relief Valve](#)
[Service Valve](#)
[Fixed Liquid Level Gauge](#)
[Float Gauge](#)
[Manufacturers Nameplate](#)
[Vapor Return Valve](#)
[Liquid Withdrawal Valve](#)
[Interactive Propane Tank](#)

[Propane Tank Sizes](#)
[Underground Propane Tanks](#)
[Propane Tank Installation](#)
[Propane Tank Protection](#)
[Propane Cylinders](#)


Understanding Your Propane Tank

Propane tanks have a multitude of connections including valves, gauges and other attached appurtenances that look interestingly complex. We'll introduce you to your propane tank in this section and provide explanations for the necessity and functionality of each of these connections. Every single piece and part of a propane tank serves a specific purpose designed for safety and consumer protection.

The primary focus of this section is ASME propane tanks that are filled on site at a residential or commercial installation. If seeking information on DOT cylinders or other bottles, see [propane cylinders](#).

Propane Tanks Standards

Propane tanks come in many different sizes and are manufactured by many different companies around the globe. These tank manufacturers are required to adhere to the ASME (American Society of Mechanical Engineers) rules for construction of propane pressure vessels intended for use within the United States. The rules in the U.S. are generally more stringent than in other countries with regard to the fabrication of LP Gas pressure vessels. Rules governing the installation of propane tanks are enforced at the national, state, and local levels ensuring all applicable codes and regulations are adhered to for the safety and protection of consumers and the general public. Similarly, propane tank design and appurtenance engineering is undertaken with safety, protection, service and efficiency in mind.

Basic Propane Tank Requirements

Several things that customers should know about their propane tank easily seen without having to know the technicalities of propane tanks and the regulations tanks are subject to. Listed below are simple tank related safety and compliance items consumers can see for themselves without having to know technical details.

- [Manufacturers Nameplate](#) - Containers without nameplates are not permitted to be filled
- [Tank Paint Color](#) - Propane tanks are required to be painted a reflective color
- [Regulator Position](#) - Propane regulator must be covered and protected or pointed vertically down
- Level Placement - The tank must be placed above the soil and on level ground

Propane Tank Parts

The visible parts of the propane tank as shown in the picture above play a vital role in the usability and serviceability of the gas tank. All of these parts are attached to the tank at the manufacturer with threaded fittings. These specialized propane tank parts consist of the following replaceable fittings and connections.

- [Fill Valve](#) - Point at which hose from delivery truck is attached to the tank for re-fueling
- [Relief Valve](#) - Safety relief mechanism designed to vent propane in an over-pressure situation
- [Service Valve](#) - Point at which propane is converted to vapor for use with appliance(s)
- [Fixed Liquid Level Gauge](#) - Indicates the level of propane is at or above 80% capacity
- [Float Gauge](#) - Presents a visible indication of the propane volume in the tank. Also called a dial gauge
- [Vapor Return Valve](#) - Connection used during propane delivery to remove excess tank pressure
- [Liquid Withdrawal Valve](#) - Used to withdraw liquid propane from the tank

Also see the [Interactive Propane Tank](#)

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D



Promoting Propane Safety ...Through Better Understanding



[Home](#) [About Propane](#) [Propane Tanks](#) [Regulators](#) [LP Gas Appliances](#) [Propane FAQ's](#)

[Understanding Propane Tanks](#)

[Propane Tank Sizes](#)

[Underground Propane Tanks](#)

[Propane Tank Installation](#)

[Propane Tank Protection](#)

Propane Cylinders

[Propane Cylinder Requirements](#)

[Industrial Propane Cylinders](#)

[Consumer Propane Cylinders](#)

[OPD Cylinder Valves](#)

[Propane Cylinder Filling](#)

[Propane Cylinder Storage](#)

[Propane Cylinder Usage](#)

Propane Cylinders

The most common type of LP Gas container is the propane cylinder, commonly known as a bottle. Cylinders range widely in size and use. Most people are familiar with propane bottles as the source of fuel for their gas grills. Industrial LP Gas consumers are also familiar as forklifts are commonly powered by propane and use cylinders as a portable gas supply source. Cylinders fall into two groups of propane service, [liquid and vapor](#). Cylinders in liquid service are commonly found on forklifts while bottles in vapor service are easily spotted fueling a gas grill.



General Cylinder Requirements

Like large propane tanks, cylinders are subject to rules and regulations set out by Federal and State governments. Propane companies must adhere to these rules when not only filling cylinders, but determining if cylinders are safe and legal to fill. The requirements include protection from rust and damage that may dent the cylinder. Propane bottles, like ASME stationary LP Gas tanks, must be painted a reflective color to avoid overpressure situations. For more detailed information, see [Propane Cylinder Requirements](#).

Cylinder Certification and Recertification

Cylinders are subject to recertification (also known as requalification) twelve years from their date of manufacture and every five years after that. For example, a cylinder manufactured in January of 2000 will have to be recertified in January of 2012 meaning if you take your bottle to the propane company in April of 2012 to be refilled, it will have to be requalified by authorized personnel before it can be filled. The recertification process is simple and does not take too long to complete. Think of cylinder recertification as an inspection similar to that of your car. A vehicle has to be inspected annually so that it may continue to operate safely on the road. Similarly, a propane cylinder must be inspected so that it may continue to operate safely in LP Gas service.

Understanding Propane Cylinders

Propane bottles all have the same operational and safety mechanisms in place that are required on ASME LP Gas

tanks. Bottles are also required to have readable markings identifying them for propane use. All propane cylinders have:

- Relief Valves
- Service Valves
- Bleeder Valves (Fixed Liquid Level Gauge)
- Stamped Markings or Nameplates
- Protective Collars (Neck Ring)
- Foot Rings

Propane Cylinder Care

Propane cylinders must be cared for so that their usable life is extended. Cylinders will last longer than their normal life expectancy if they are properly maintained and taken care of. It is recommended that propane cylinders be located in a place that they won't be banged or dented (see [propane cylinder storage](#)) such as an area of high traffic or a location prone to flooding or water puddling. Additionally, cylinders that are handled roughly can damage the foot ring or neck ring which will cause the cylinder to be unsuitable for filling and unusable. See [pictures of damaged propane cylinders](#) that are unfit for continued service.

Bottle Corrosion and Rust - Because most consumer propane cylinders are made of steel, they are subject to rust. Rust can lead to pitting in the cylinder exterior and render the cylinder useless if the rust or pitting is excessive. If rust is noticed on the cylinder, a wire brush can be used to remove the rust followed by painting over the spot where rust was removed. The most common place rust is found is on the bottom of the cylinder and around the foot ring of the cylinder so it's important to keep these areas clean and painted.

Transporting Cylinders - Propane bottles are usually transported in the back of a truck and more often than not, they are unsecured and free to roll around. Transporting unsupported bottles exposes them to potential damage such as dents and possible harm to the valve. Ensure that cylinders are secured prior to transporting them. In the case of a 20 pound or 30 pound bottle, a milk crate can be used to keep cylinders upright and protected from most damaging effects of transportation.

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E



Promoting Propane Safety ...Through Better Understanding



[Home](#) [About Propane](#) [Propane Tanks](#) [Regulators](#) [LP Gas Appliances](#) [Propane FAQ's](#)

[Understanding Propane Tanks](#)

[Propane Tank Sizes](#)

[Underground Propane Tanks](#)

[Propane Tank Installation](#)

[Propane Tank Protection](#)

Propane Cylinders

[Propane Cylinder Requirements](#)

[Industrial Propane Cylinders](#)

[Industrial LPG Cylinder Parts](#)

[Forklift Cylinder Mounting](#)

[Forklift Cylinder Valves](#)

[Consumer Propane Cylinders](#)

[OPD Cylinder Valves](#)

[Propane Cylinder Filling](#)

[Propane Cylinder Storage](#)

[Propane Cylinder Usage](#)

Industrial Propane Cylinders - Forklift Bottles

Propane cylinders are commonly seen on forklifts and alongside buildings and warehouses in storage racks for use on lift trucks and propane floor buffers. These propane cylinders are either exchanged in a bottle swap program or filled from a bulk propane delivery truck. A scale is not required to fill these types of propane cylinders which is why a bulk delivery truck can deliver into these cylinders at the consumer site.



Industrial Propane Bottles/ Forklift Cylinders Operation

Propane powered forklifts primarily use 33 pound cylinders as their fuel source and are equipped for liquid service. Because the cylinders are designed for liquid service, they have to be placed properly on the lift truck to operate correctly. Improper cylinder installation can result in loss of power and eventually complete loss of engine functionality. Although industrial propane cylinders are within the 4-40 pound class, they do not require [OPD valves](#) in order to be refilled. When a 33 pound forklift cylinder is properly mounted on a lift truck, it will generally provide around 8 hours of continuous operation.

Understanding Industrial Propane Cylinders

[Industrial Propane Cylinder Parts](#) - Explaining the connections and fittings on industrial and LP Gas forklift bottles. These parts are uniform on all 20, 33 and 40 pound industrial propane cylinders.

[Mounting \(Installing\) Forklift Cylinders](#) - Proper mounting of forklift cylinders ensures full utilization of the bottle. Learn about both correct and incorrect installation of LP Gas lift truck cylinders and why proper mounting is important.

[Propane Forklift Cylinder Valves](#) - Cylinder service valves on forklifts control liquid flow to the lift trucks LP Gas engine system. This valve sometimes causes confusion and frustration for lift operators after the service connection is made. Learn about the details of this valve and troubleshooting the leaks that may form on propane forklift valves.

The table of dimensions below consists of average industrial propane cylinder measurements. These dimensions are not precise cylinder measurements but rather approximate measurements of both steel and aluminum industrial gas bottles. Contact the cylinder manufacturer for exact dimensions and measurements.

	20# Steel	20# Alum	33# Steel	33# Alum	43# Steel	43# Alum
Capacity (gallons)	4.7gal	4.7 gal	7.9 gal	7.9 gal	10.3 gal	10.3 gal
Weight (empty)	26.5 lbs	19.5 lbs	35 lbs	23 lbs	40 lbs	27 lbs
Weight (full)	46 lbs	40 lbs	69 lbs	56 lbs	83.5	70.5 lbs
Overall Height	19.5 inches	20.5 inches	27 inches	28.5 inches	33 inches	34 inches
Diameter	12.5 inches	12.5 inches	12.5 inches	12.5 inches	12.5 inches	12.5 inches

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F



Promoting Propane Safety ...Through Better Understanding



[Home](#) [About Propane](#) [Propane Tanks](#) [Regulators](#) [LP Gas Appliances](#) [Propane FAQ's](#)

[Understanding Propane Tanks](#)

[Propane Tank Sizes](#)

[Underground Propane Tanks](#)

[Propane Tank Installation](#)

[Propane Tank Protection](#)

Propane Cylinders

[Propane Cylinder Requirements](#)

[Industrial Propane Cylinders](#)

[Consumer Propane Cylinders](#)

[OPD Cylinder Valves](#)

[Propane Cylinder Filling](#)

[Propane Cylinder Storage](#)

[Propane Cylinder Usage](#)

Using Propane Cylinders Properly and Safely

Propane cylinders are a portable source of energy providing fuel for the applications for which they are intended. However, because they are portable and easily refilled, propane bottles are sometimes used in settings for which they are not intended.

Although it may seem harmless, the improper use of a propane cylinder can place users, homes or property in potentially dangerous situations. As discussed in detail below, the two primary factors that make up proper cylinder use are:

1. The application for which the cylinder is being used
2. The location where the propane bottle is used

Propane Cylinder Applications

The proper use of a propane cylinder involves the appliance(s) being serviced. Propane appliances and equipment that utilize cylinders are specified as such and are not to be used as a replacement for an empty bulk propane tank for several reasons that center around fixed piping systems, regulators and use specific application. Also, bottles that are used in vapor service such as a barbeque grill or fish fryer cannot be replaced by a forklift propane cylinder, as LP Gas forklift cylinders use liquid propane for their specific engine fuel applications (see [Propane Liquid and Vapor](#)). The lesson to be learned here, as outlined below, is that LP Gas cylinders are not interchangeable with ASME bulk propane tanks or with other types of cylinders that are approved for specific LP Gas applications.

Connecting a Propane Bottle to House Line - Propane cylinders are often thought to be an acceptable temporary replacement for residential propane tanks in the event the bulk tank is empty. However, propane cylinders are designed and used for portable applications and are not designed for use in fixed piping systems, such as that of a home. First of all, if the bulk propane tank is empty, service has been interrupted and a [leak test](#) must be performed prior to placing the system back in service. Second, propane bottles are designed for use in conjunction with a [bottle regulator](#) that delivers LP Gas pressures at a rate much lower than the rate required by household propane appliances. Bottle regulators are not interchangeable with tank regulators and vice-versa; this is very dangerous. Additionally, trying to fuel a household propane system with a cylinder would be like trying to illuminate a stadium with a lamp light. There is not enough container surface area (in a bottle) that will [vaporize](#) the liquid propane at a rate required by the downstream appliances. Also, attempting to connect a [propane forklift cylinder](#) to a house line will result in liquid propane being delivered to appliances. Liquid propane being delivered to appliances through a piping system designed for vapor distribution will burn a house down.

Connecting Liquid Service Cylinders to Vapor Lines - As mentioned above, connecting a propane cylinder designed for liquid service, such as a forklift cylinder to a vapor system or vapor line will result in fire danger. The same is true for outdoor appliances and equipment that work by using propane vapor. Grills, fish fryers and patio heaters are propane vapor service appliances that will be damaged by the introduction of liquid propane as well as create a very hazardous situation. In the same regard, do not turn cylinders over during operation. This will introduce liquid into propane gas lines, regulators and burners that are only to be used with propane vapor. Using LP Gas cylinders and bottles improperly or using them for an application for which they are not designed will harm equipment, appliances and can seriously burn users and bystanders.

Location Of Propane Cylinder Use

Everyone is familiar with the phrase "location location location" when discussing topics ranging from "where to live" to "where to fish". If in doubt about where to use a propane cylinder, remember the phrase "outdoors outdoors outdoors". The only place to properly use a propane gas cylinder of any size is outside, as required by NFPA 58. Using a cylinder indoors is not only illegal, it is terribly unsafe. Keep in mind that a full propane barbeque cylinder contains enough liquid to produce over 300 cubic feet of vapor. A fuel source such as that should not only be stored outdoors, it should never be used indoors. See [Propane Cylinder Storage](#) for information about where bottles should be kept when not in use.

When using cylinders outdoors for whatever approved purpose or application, keep the propane bottle away from other sources of heat and use in a well ventilated area. Additionally, make sure the cylinder relief valve is not pointed at any source of ignition. Use the appropriate length of hose between the appliance and cylinder and be sure that the bottle is of course, upright when in use. Although unenclosed, covered patios are generally accepted as safe for propane bottle use and storage, garages and similarly enclosed spaces are not viewed as safe places for bottle usage or storage. Extra precautions for propane cylinder use include keeping clear of flammable and combustible materials, keeping a safe distance from building openings and walls and having a fire extinguisher in case of emergency. Although not widely known or publicized, a very important rule when using cylinders is to make sure they are stable and not moved while in use. If the cylinder is jarred or moved while actively being used, liquid propane may escape through the cylinder service valve resulting in excessive flames.

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