



# Dispensing Propane Safely

## Training Manual

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## About the Program

*Dispensing Propane Safely* is an employee training program funded by the Propane Education & Research Council (PERC) that details the many tasks associated with the safe and effective dispensing of propane into several types of propane cylinders and tanks. The program is organized into modules that allow you to select what material is covered based on your job responsibilities. The following training tools are available:

- DVD
- A CD training manual which includes detailed dispensing instructions, quizzes, answer keys, and an employee completion certificate

### **The first five modules in the program apply to almost all propane dispensing operations, including those at retail locations:**

1. Introduction
2. Properties and Characteristics of Propane
3. Dispensing Station Equipment
4. DOT Cylinders
5. Inspecting, Filling, and Labeling Small Cylinders

### **Additional modules that can be selected based on job requirements:**

6. Refueling, Maintaining, and Troubleshooting Forklift Cylinders
7. Refueling ASME Motor Fuel and RV Tanks
8. Emerging Technologies
9. Retail Cylinder Exchange Operations

A Spanish language version of the DVD is also available.  
Contact PERC (202-452-8975) for more information.



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The material and other information included in this program are intended to provide general guidance only on the subject matter addressed. They are not intended to be a substitute for the personal instruction, guidance, and advice of a professional with training and experience in the safe and proper use of propane.

# 1. INTRODUCTION

Propane dispensing stations offer a convenient fueling source for residential, recreational, and commercial users of propane, and can be found at many locations, including hardware stores, lawn and garden centers, campgrounds, rental equipment companies, industrial sites, and gas stations. Motor homes, campers, autogas vehicles, barbecue grills, and forklifts are just a few of the vehicles and equipment served by propane dispensing stations.

For the safety of you, your customers, and your employees when dispensing propane, you should know about the fuel, equipment, regulations, and processes that are involved in filling various types of propane containers and cylinders. This program will discuss general information about dispensing propane safely, and also go into detail about the specific processes involved in filling various types of propane containers and cylinders.

## Propane Dispenser Operators

Propane dispenser operators play an important role in safely and efficiently providing propane to customers.

Their responsibilities include:

- Understanding the regulations, routine inspections, and operation of the dispensing equipment.
- Inspecting customer containers to ensure that they are safe for filling.
- Filling containers to their proper levels and preventing containers from being overfilled.
- Maintaining the security of the propane dispenser and transfer area to control ignition sources and prevent tampering or release of propane.
- Shutting down and securing the dispenser in the event of an emergency.

Informing customers about cylinder and container safety is also an important responsibility for the dispenser operator. Operators should make sure that all customers understand how to transport cylinders safely. Important safety tips for your customers include:

- Always transport and store a cylinder in a secure and upright position so it will not fall, shift, or roll.
- Never keep a filled cylinder inside a hot vehicle.
- Always proceed directly to your destination and immediately remove the cylinder from your vehicle.

A good resource to give your customers is the pamphlet *"Important Propane Safety Information for Users of Small Cylinders."* Visit **[propanesafety.com](http://propanesafety.com)** to download the pamphlet or to order copies.



## Program Elements

This program offers a training manual and DVD, which are organized into a modular format that allows you to select material based on your job responsibilities. There is also an optional quiz for each module and documentation material for your employer.

The first three modules apply to all dispenser operators and cover:

- Introduction to Dispensing Propane Safely
- Properties and Characteristics of Propane
- Dispensing Station Equipment

Modules that can be selected based on job requirements include:

- DOT Cylinders
- Inspecting, Filling, and Labeling Small Cylinders
- Refueling, Maintaining, and Troubleshooting Forklift Cylinders
- Refueling ASME Motor Fuel and RV Tanks
- Emerging Technologies
- Retail Cylinder Exchange Operations

## Dispenser Training Requirements

There are specific training and inspection requirements published in national codes (i.e., NFPA 58) and by government agencies and organizations such as the United States Department of Transportation (DOT), Department of Labor (DOL), Occupational Safety & Health Administration (OSHA), and the Compressed Gas Association (CGA). For more information on these requirements see the resources section (Module 10).



## 2. PROPERTIES AND CHARACTERISTICS OF PROPANE

Safe dispensing of propane involves knowing its properties and characteristics and being aware of safety procedures.

### Properties and Characteristics

A Material Safety Data Sheet (MSDS) is available from propane suppliers or distributors and must be available and accessible to all employees at the workplace. The MSDS provides important information on propane including physical properties, health effects, first aid, safety precautions, and personal protective equipment (PPE).

This program will discuss information from the MSDS that relates to your job of dispensing propane safely.

Propane is either a liquid or a gas depending on the amount of pressure it is stored under. To keep propane as a liquid above its normal boiling point, it must be stored and transported in pressure-tight containers. Liquid propane stored in containers at ambient temperatures will boil off and become a vapor that occupies empty space in the container. This vapor is what is used in customer appliances and equipment.

Like water, liquid propane will expand when heated. However, liquid propane will increase in volume nearly 17 times greater than water will. To allow for this expansion, propane containers are filled typically to only 80% of their capacity.

If liquid propane is released into the air, the lack of pressure quickly causes it to vaporize and expand to 270 times its original volume. Therefore, liquid propane leaks can be more hazardous than vapor leaks.

Propane is non-toxic, but its vapor is still dangerous to inhale because it displaces oxygen. Since propane vapor is 1-1/2 times heavier than air, propane released in a confined space may initially remain in low-lying areas. However, if there is sufficient air movement, especially outdoors, the vapor will quickly dissipate in the air.

When released into the atmosphere, liquid propane has a refrigerating effect that makes everything it touches extremely cold. This means if it comes in contact with your skin, it can cause third-degree or deep-freeze burns. For this reason, you should wear gloves or other PPE resistant to propane when filling containers. Your employer may require additional safety equipment, depending on your specific responsibilities. For more information on PPE see the resources section (Module 10).

Every time propane is released, there is potential for hazard. Three ingredients are needed to start and sustain combustion—propane, oxygen, and an ignition source. All three ingredients must be present for combustion to occur, and the ignition source must provide enough heat to the propane-oxygen mixture to raise the temperature of propane to its ignition point.

In order to minimize possible ignition sources that could lead to combustion, customers should be restricted from the immediate area around the liquid propane transfer areas.





## Detecting Propane

Propane has a strong, unpleasant smell like rotten eggs, a skunk's spray, or a dead animal. Propane distributors deliberately add this odor so employees and customers can easily detect a potentially hazardous propane leak.

Some people may have difficulty smelling propane due to several factors. Decreased sense of smell with aging; medical conditions; or the effects of medication, alcohol, tobacco, or drugs can diminish one's ability to smell propane.

On rare occasions, propane can lose its odor. This can be caused by the presence of air, water, or rust in the cylinder or container.

Since there is a possibility of odor loss or problems with your sense of smell, you should respond immediately to even a faint odor of gas. If for any reason you cannot recognize the smell of propane, notify your supervisor immediately.

Both you and your customers' safety could depend on your ability to smell propane in the event of a leak.



Recognize the smell of propane

## What You Should Know before Dispensing Propane

### Good Housekeeping Practices

Good housekeeping is an important part of safety everywhere. Wet, slippery, and oily floors, and tools left lying around, can cause injury. Poor housekeeping can also hide defects in electrical wiring, piping, and equipment.

Good housekeeping practices at a dispensing location should include:

- Keeping the dispensing area clear except for objects necessary for operations.
- Reporting product and oil leaks immediately.
- Keeping driveways and fire hydrants clear of anything that could limit fire truck access.
- Storing cylinders properly.
- Checking fire extinguishers to make sure they are fully charged and accessible.



Storing cylinders properly



Keeping the area clear



Checking fire extinguishers

## Static Electricity

All employees should be aware of the potential danger of unwanted static electricity at the dispensing location. In the right conditions static discharge or spark may cause the ignition of some fuels, including gasoline and propane.

In order to reduce the risk of ignition from static discharge, identify where Static Discharge Control Areas are and where static electricity may be coming from. This is typically any area where propane vapor may be present.

### Static Discharge Prevention Quick Tips

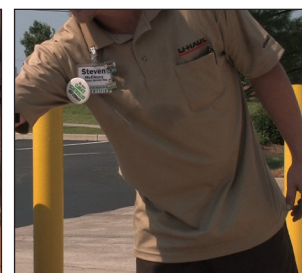
If you are working in or near a Static Discharge Control Area, there are a few simple measures you can take to limit your chances of producing a static spark:

- Wear **static-safe footwear** or temporary foot grounders.
- Wear **cotton and cotton blends**.
- **Never** put on or remove garments inside a Static Discharge Control Area.
- **Remove all** plastics and other synthetic materials from the area.
- **Make sure** all your equipment is properly grounded.
- **Limit access to the area** to only those people necessary to conduct normal business activities.

For more information on controlling static electricity visit [propanesafety.com](http://propanesafety.com) to download a copy of the "Static Electricity in the Propane Industry" booklet.



Static-safe footwear



Cotton and cotton blends



Limit access to the area

## Fire Extinguishers

It is a code requirement that at least one fire extinguisher be easily accessible at the filling site. Each extinguisher should be at least an 18 lb. dry chemical model with a B:C rating. In workplaces where employees are expected to know how to use fire extinguishers, OSHA requires employees to be trained on fire extinguisher use and operation upon initial hiring and annually thereafter.

It is important to note that fire extinguishers are not intended to put out propane fires and can only cover a limited area when used. They are effective, however, for small fires, such as those involving combustible materials, and can be helpful in creating an escape route for personnel.

A monthly visual inspection of all fire extinguishers is required. This includes checking the extinguisher to be sure it is fully charged and has a tag showing the date of its last annual inspection. If the extinguisher is due for inspection, low on charge, damaged, or missing an inspection tag, stop filling operations and notify your supervisor immediately.



Monthly visual inspection of fire extinguisher



# UNCONTROLLED PROPANE LEAKS AND FIRES

Any uncontrolled release of propane or fire can be extremely dangerous. If your facility is equipped with an emergency shutdown device, make sure you are aware of its location. In the event of a propane emergency, you should always place personal and customer safety first.

Follow these steps:

## 1. Shut down the dispenser.

If there is an emergency shutdown device, activate it.



## 2. Evacuate the area immediately.

Everyone in the building, or area affected by the emergency, should evacuate immediately to a safe distance from a spill or leak. Do not re-enter the area.

## 3. Call for help.

After you are at a safe distance from the affected area, call 911 or your local fire department.

## When Help Arrives

Emergency responders, including firefighters, HAZMAT crews, and emergency medical technicians are the only personnel qualified to provide leadership in emergencies involving propane. Once the emergency response team arrives, do not interfere.

After a fire, do not operate a dispenser that has been exposed to fire until it has been thoroughly inspected and repaired by a qualified technician approved by your propane supplier.

Your company may have specific instructions for you to follow in both routine and emergency situations, so you should always consult your supervisor for more information.



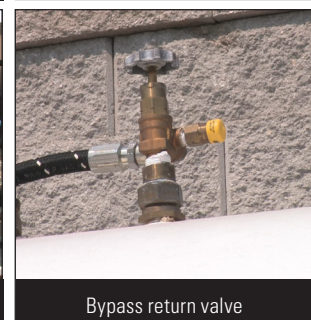
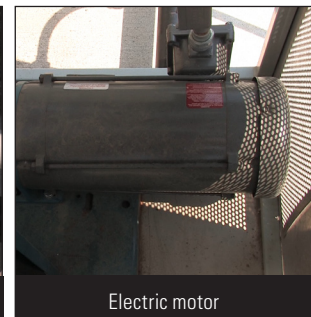
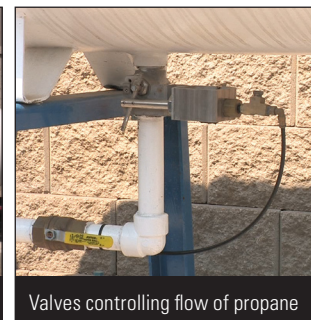
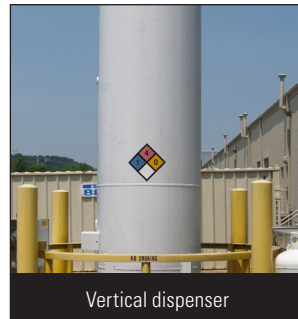
### 3. DISPENSING STATION EQUIPMENT

In order to dispense propane safely, you should be familiar with the equipment you are working with and how to use it. The following section describes equipment that is common to most dispensing stations. If you have a large dispensing facility, or bulk plant, see Module 10 and review the “Bulk Plant Equipment” section.

There are two common types of propane dispensing station set-ups: **vertical tank dispensers** and **horizontal tank dispensers**.

Dispensing equipment often varies by facility. Your system may or may not have all of the following components:

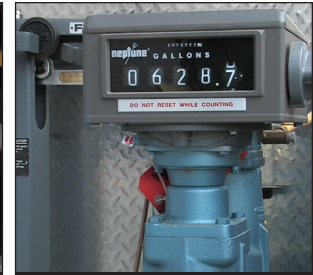
- An **ASME storage tank** that supplies propane to the dispensing equipment.
- **Valves to control the flow of propane** through the piping system.
- **Extra-heavy piping** and forged-steel pipe fittings.
- A propane pump, driven by an explosion-proof **electric motor**.
- A **platform scale** for weighing cylinders during and after filling.
- **Automatic pump bypass return valve(s)**, to protect the pump, piping, and hoses against excessively high pressures when the hose end valves are closed and the pump is running.



- **Electrical wiring**, fixtures, and switches to control the propane pump motor and provide for emergency shutdown.
- A **metering system** for measuring liquid propane transferred into containers.
- Propane **transfer hose assemblies** for cylinder filling and ASME tank filling.
- **Hose end adapters** to accommodate the different valves used on DOT cylinders and ASME tanks.
- An **emergency break-away device** for vehicle-mounted containers that is designed to provide protection in case of a pull-away by stopping the flow of gas if a customer drives away with the hose attached.
- A fenced enclosure, a **lockable cabinet** to secure the dispenser, or devices to secure the valves should be used to prevent unauthorized operation of equipment when not in use. Depending on the site and enclosure, traffic barricades may also be required.



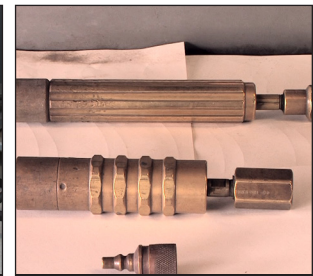
Electrical wiring



Metering system



Transfer hose assemblies



Hose end adapters



Emergency break-away device



Lockable cabinet



## Shutdown Components

There are two types of shutdown systems:

**Manual shutdown dispensers** stop the flow of liquid into cylinders by manually closing one or more valves. They rely on the operator to determine when the maximum permitted filling limit for a cylinder is reached.

**Automatic shutdown systems** are used primarily where several cylinders are being filled simultaneously, such as at a cylinder dock, to reduce the possibility of overfilling cylinders. They normally consist of a sensor or trip lever mounted on the balance beam of a scale and a master control valve that stops the flow of liquid propane to the dispensing hose.

The dispenser tank in your facility may be equipped with an **internal excess flow valve** in combination with a positive shutoff valve. Internal valves that incorporate excess flow protection are also common, and may include thermal and remote shutoff capabilities.

**Remote shutdown stations** may also be installed to provide a greater level of emergency support away from the pump and transfer location.

**Ball valves** control the flow of propane from the supply tank through the piping. A ball valve is open when the valve handle is parallel with the piping. It is closed when the handle is perpendicular to the piping.

**Globe valves** are similar to water faucets and are operated by turning the handwheel counter-clockwise to open and clockwise to close. They must be either fully open or fully closed.

**Hose end valves** stop the flow of propane as part of the container filling operation. As another safeguard against overfilling, hose end valves are quick-closing or snap-acting. Many also have a safety latch to prevent accidental opening when the valve is not connected for filling.



Manual shutdown dispenser



Automatic shutdown dispenser



Internal excess flow valve



Remote shutdown station



Ball valve in the open position



Ball valve in the closed position



Globe valve



Hose end valve

## Measuring Components

Platform balance beam scales determine when the proper filling weight for cylinders is reached and when to stop the flow of propane into the cylinder.

Platform scales can be single beam, double beam, or digital. All require periodic maintenance and should be checked for accuracy based on the manufacturer's instructions.

In many states and jurisdictions, scales must have **certification decals** from weights and measures officials, and be inspected periodically and calibrated for accuracy.

**Scales must be leveled and protected from weather**, especially accumulation of water, debris, snow, or ice.



Certification decals on scale



Scale protected from weather

## PREPARING THE DISPENSER

When preparing the dispenser follow these steps:

1. Unlock the cabinet or other locking devices and open any or all entry gates. If the dispenser is equipped with a cabinet, unlock the cabinet and verify that the hose end valves are closed.

2. Slowly open the liquid outlet valve and the first downstream manual valve. If you hear a snapping noise, this means the valves have been opened too quickly and the excess flow valve may have closed.

If the excess flow valve closes or “slugs,” proceed as follows:

1. Close the downstream manual valve.
2. Wait patiently for the excess flow valve to open.  
You may hear it click.
3. Open the valve slowly to avoid a sudden increase in flow.



3. Inspect all valves, piping, transfer hose, and fittings for proper operation.



4. Inspect the threads of all connection adapters, especially brass, for excess wear. Make sure the gaskets and O-rings, if equipped, are in place and in good working condition.



5. Inspect for leaks. If you suspect a leak, shut down the system, immediately leave the area, and contact your supervisor.



## DISPENSER SHUTDOWN

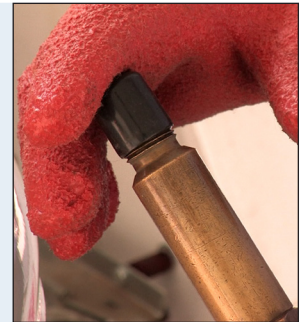
When the dispenser is not in use or when a qualified operator is not present, the dispenser should be shut down and secured.

Follow these steps to shut down the dispenser:

1. Close all valves at the storage tank.



2. If so equipped, place the dust cap or plug in the hose end valve or filling adapter.



3. Store the filler hose in the proper location.

4. Close and lock the cabinet, fence gates, and other locking devices.



Becoming familiar with the dispensing equipment and how it works will help you to fill cylinders safely and protect your customers, your workplace, and yourself.

## 4. DOT CYLINDERS

Most propane cylinders in service today are manufactured according to DOT specifications and are commonly referred to as “DOT cylinders.”

Small, portable cylinders are filled at various locations and are used with hand torches, plumbers’ pots, gas lanterns, camp stoves, barbecue grills, and on many recreational vehicles.

Larger cylinders are filled typically at a propane facility or plant and delivered to industrial, commercial, or residential customers.

### Common Elements

**Cylinder bodies** are most commonly made from either aluminum or some type of alloy steel, and consist of either two or three pieces. A third type is made from composite material and is discussed in Module 8, which highlights emerging technologies.

Every aluminum or steel cylinder has a **foot ring**—a wide metal band that is welded or brazed to the bottom or non-service end of the cylinder. It is used to protect the bottom of the cylinder body from corrosion or other damage and also functions as a support stand or base.

Openings for valves and fittings are located in the **service end of the cylinder**, with threaded fittings welded to the opening. The number of openings depends on how the cylinder will be used.

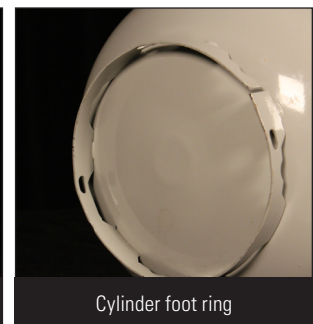
Portable and exchange cylinders rarely have more than one fitting that is threaded to a 3/4" female National Pipe Thread (NPT) fitting and raised above the surface. As a result, the fitting is often called the neck of the cylinder. A combination service valve and pressure-relief valve is installed in the fitting.

Vertical cylinders with 4- to 40-lbs. propane capacity used in vapor service must be fitted with an **overfilling prevention device (OPD)**.

OPD cylinder valves are distinctively marked and equipped with a unique handwheel in the shape of a modified triangle. The **OPD marking is molded into the handwheel and the valve body** to ease identification.



Cylinder body



Cylinder foot ring



Service end of cylinder



Overfilling prevention device



OPD cylinder valve handwheel

OPDs should not be treated as the primary means of preventing overfilling. It is still the dispenser operator's responsibility to close the hose end valve when the proper filling level has been reached.

Some cylinders are not required to be fitted with an OPD. These include cylinders:

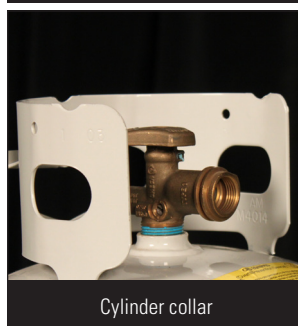
- Used in industrial truck service.
- Manufactured prior to 1998 and designed for use in the horizontal position.
- Used for industrial welding and cutting gases.

To protect the cylinder valves, a wide metal band called a "**collar**" is welded to the cylinder body and partially surrounds the neck of the service end. Larger cylinders may have a cap or a collar.

Collars often incorporate **handles for lifting** and moving. Cylinder valves should never be used to lift or move a cylinder.



Operator closing hose end valve



Cylinder collar



Handle for lifting

## Cylinder Markings

Markings are required by DOT and are the ID card for the cylinder. Markings must be legible and clearly and permanently marked on the collar or cylinder body.

The markings include information for selecting cylinder valves, the **specification design code**, cylinder **tare weight (TW)**, **water capacity (WC)** in pounds, and the manufacturer name and test or requalification date.

Cylinder specification markings consist of two basic parts: the design code and the service pressure. DOT-4BA240 is one of several specifications for cylinders. The term "4BA" indicates that the cylinder is a welded (series 4) alloy steel (series BA) cylinder. The number "240" indicates the service pressure is 240 pounds per square inch gauge (psig).

Cylinder size is marked by the amount of water it can hold in pounds. Propane capacity is 42% WC. Portable cylinders usually range from 1 pound to 100 pounds propane capacity.

TW is the weight of the cylinder when empty and includes the weight of the cylinder valves, but not the filling hose and nozzle. Cylinders with the same WC can have different TWs, so each cylinder should be treated individually.



Specification design code



Tare weight



Water capacity

## Requalification

All refillable cylinders must be requalified at regular intervals. Requalification is not normally handled at dispenser locations, and should be performed only by trained individuals whose facility is registered with the DOT.

When reading requalification markings:

- A date without a letter indicates the next requalification must be within 12 years.
- The letter “S” following the date indicates the cylinder must be requalified 7 seven years of the marked date.
- The letter “E” following the date indicates that requalification is required again within 5 years of the marked date.
- The most recent requalification date is marked on the cylinder. Cylinders that are out of qualification must NOT be refilled; rather, they should be marked and set aside in a designated safe area.

Knowing about cylinder construction, components, and markings will assist you in safely refilling your customers’ cylinders.

CYLINDER REQUALIFICATION METHODS	
EXTERNAL HYDROSTATIC EXPANSION	
LETTER STAMP	NEXT REQUALIFICATION
NONE	12 YRS
DATE 10/05	DATE 10/17
INTERNAL HYDROSTATIC	
LETTER STAMP	NEXT REQUALIFICATION
S	7 YRS
DATE 10/05 S	DATE 10/12 S
EXTERNAL VISUAL INSPECTION	
LETTER STAMP	NEXT REQUALIFICATION
E	5 YRS
DATE 10/05 E	DATE 10/10 E



## 5. INSPECTING, FILLING, AND LABELING SMALL CYLINDERS

Note: Before you begin the process of inspecting and filling small cylinders, make sure that the dispenser is properly prepared. Module 3 gives you step-by-step instructions on how to properly get the dispenser ready to fill cylinders and containers. Please review this module if you have not already done so.

### Pre-fill Visual Check

Customers are often unaware of the many safety procedures that must be performed before having their cylinders filled, such as inspection, requalification, purging, and filling requirements. And you may have no idea what happened to the cylinder prior to its arrival for refilling. However, the safety of yourself, your customers, and the public is the highest priority, so use great care in handling and assessing a small cylinder before filling.

DOT regulations require a visual check before a small cylinder can be filled or refilled to verify that it is fit for continued service. Prior to inspecting a cylinder, remove any plastic or paper sleeve so you are easily able to spot any problems. After inspection, if any of the following are found, the cylinder must not be refilled and should be marked and set aside in a designated safe area.

Problems that prevent refilling a cylinder include:

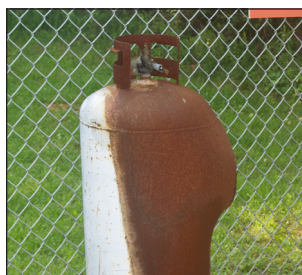
- Cracks or leaks.
- Bulging, serious denting, or gouging.
- Defective valves unless properly repaired or replaced.
- Defective or leaking pressure-relief device, unless properly repaired or replaced.
- Damage to the cylinder valve, valve protection, and cylinder foot rings.
- Out-of-date requalification.
- Evidence of physical abuse, fire or heat damage, or excessive rusting or corrosion.



Fire damage, cracks and bulging



Excessive rusting



Fire damage



Condemned cylinders



Damaged valve



Anhydrous ammonia stain



Paint-covered valves and gauges

Steel cylinders subjected to fire must be requalified, reconditioned, or repaired by the original manufacturer or a DOT-authorized repair facility before being placed back in service. Aluminum cylinders subjected to fire must be removed from service permanently.

If you encounter a cylinder with XXXs over the DOT specification number or marked with "CONDEMNED" on the shoulder, head, or collar, do not refill. Instead, mark and set aside in a designated safe area.

Valves and accessories should also be inspected prior to filling. Many cylinder valves are made with non-metallic or soft parts such as nylon, rubber, and Teflon®. When these materials become damaged or worn out, propane liquid or vapor can leak out of the valve and create a potentially hazardous situation. They should be checked regularly for signs of aging and wear.

Valve accessories may become broken or lost, allowing dirt or moisture to enter the valve. Inspect and replace any faulty or missing dust caps.

Valves may also be damaged through improper cylinder maintenance. For example, service personnel may fail to use proper brushes or applicators around cylinder openings when painting them. As a result, gauge faces, "weep" holes in filler valves, and discharge openings of relief valves may become covered or blocked with paint.

If you find a blue-green stain on the brass portion of the cylinder valve, the cylinder may have come in contact with anhydrous ammonia, which is often used to manufacture illegal drugs. In this instance, place the cylinder in an outdoor area where hazards from ejection of the valve and product loss would be minimized, and contact your supervisor.

\*Teflon is a registered trademark of E.I. du Pont de Nemours and Company.

## Requalification

All refillable cylinders must be requalified at regular intervals. Requalification is not normally handled at dispensing locations, and should be performed only by trained individuals whose facility is registered with the DOT.

When reading requalification markings:

- A date without a letter indicates the next requalification must be within 12 years.
- The letter “S” following the date indicates the cylinder must be requalified within 7 years of the marked date.
- The letter “E” following the date indicates that requalification is required again within 5 years of the marked date.

Cylinders that are out of qualification should not be refilled. Instead, they should be marked and set aside in a designated safe outdoor area.

CYLINDER REQUALIFICATION METHODS	
EXTERNAL HYDROSTATIC EXPANSION	
LETTER STAMP	NEXT REQUALIFICATION
NONE	12 YRS
DATE 10/05	DATE 10/17
INTERNAL HYDROSTATIC	
LETTER STAMP	NEXT REQUALIFICATION
S	7 YRS
DATE 10/05 S	DATE 10/12 S
EXTERNAL VISUAL INSPECTION	
LETTER STAMP	NEXT REQUALIFICATION
E	5 YRS
DATE 10/05 E	DATE 10/10 E

## Purging

In order for equipment to operate properly and to keep customers safe, both new cylinders that have not been vacuum purged by the manufacturer and those that have been opened to the atmosphere must be purged of air or moisture before filling. If air or moisture enters a cylinder, it can slow down the filling process, create unusually high service pressures, cause regulator freeze-up, or cause fading of the odorant in the cylinder.

Never purge with liquid propane. This may cause the liquid to flash into vapor, chilling the cylinder and condensing any moisture vapor on the walls. In addition, only a small percentage of the air will be removed.

When purging cylinders with propane vapor, it's important to note that the steps involved may vary depending on your company policy and the type of equipment installed at the facility. Always consult your supervisor for more information.





# PURGING CYLINDERS WITH PROPANE VAPOR

Using propane vapor to force the air out of the cylinder is an effective purging method that is used often at refilling stations. Cylinders should always be purged in an approved area where there are no ignition sources.

Follow these steps to purge cylinders:

## 1. Connect the vapor hose to the cylinder.

Ensure that you have the correct fittings installed when connecting the vapor hose to the cylinder service valve. If the service valve on the cylinder does not have a female Prest-O-Lite (POL) opening, attach a cylinder service valve adapter to the POL adapter that is installed in the vapor line hose end valve. Securely tighten the vapor hose assembly to the cylinder service valve.



## 2. Pressurize the cylinder with propane vapor to 15 psig.

With the service valve closed on the cylinder being purged, open the service valve on the purging cylinder. Gradually position the ball valve on the vapor hose to allow propane vapor to vent into the cylinder being purged. If no leakage is detected, open the service valve on the cylinder being purged. Observe the gauge on the purging manifold until the pressure reaches 15 psig.



## 3. Bleed off the pressure in the cylinder.

Gradually position the ball valve on the vapor hose to vent a small volume of propane vapor and air until the pressure gauge reaches 0 psig. During this bleed-off process, be very cautious since a small amount of propane vapor and air will be released. To prevent ignition, venting should be done at least 25 feet from any open flame, smoking area, portable electrical tools, and extension lights, and at least 35 feet from any metal cutting, grinding, oxygen-fuel gas cutting, brazing, soldering, or welding.

## 4. Repeat the purging process.

To be sure that roughly 97% of the air has been purged from the cylinder, continue to pressurize and bleed off the pressure in the cylinder at least four more times. Leave the vapor return hose connected until the final purging has been completed, then re-pressurize the cylinder to 15 psig. Close the service valve on both the purging cylinder and the cylinder being purged and check the cylinder for leakage.

## Filling Cylinders

Before filling a cylinder, make sure you are aware of the following information regarding safety and handling procedures:

- Know your facility's fire prevention and emergency evacuation plans, including where and how to operate **emergency shutdown** and pump controls.
- Locate the nearest **fire extinguishers** and make sure they are in proper working condition. Only use fire extinguishers to create an escape route—not to fight a propane fire. The only safe way to extinguish a propane fire is by stopping the flow of propane.
- Before operating a filling station, ensure there are no ignition sources within 25 feet of the points of transfer, or metal-working operations including grinding, oxygen-fuel gas cutting, brazing, soldering, or welding within 35 feet.
- Be sure that valves are protected properly with a valve cap or protective collar, and always use proper cylinder handling techniques.
- The OPD should never be used for determining if a cylinder is full. The OPD will not always stop the flow of propane into the cylinder at the proper fill amount.



Emergency shut-off valve



Fire extinguisher



## PRE-FILLING PROCEDURES

Before starting the cylinder filling operation, follow these steps to ensure the safety of you, your customers, and your fellow employees:

1. Always put on appropriate PPE before filling cylinders.



2. Do not allow unauthorized people in the filling area.



3. Open the secured filling area, and inspect the cylinder filling station equipment.



4. Remove the hose from its secure storage location. If the location isn't weather-protected, remove the dust cap or plug from the hose filling adapter.

5. Open the appropriate liquid outlet and bypass return valves on the storage tank.



6. Please remember that an operator must be present during the entire filling procedure.

# FILLING CYLINDERS BY WEIGHT

Cylinders less than 200 lb. WC and subject to DOT jurisdiction must be filled by weight. Be sure to check with your supervisor for any exceptions.

When filling portable cylinders by weight, it's important to note that the steps involved may vary depending on your company policy and the type of equipment installed at the facility. Always consult your supervisor for more information.

To determine the total filled weight of a cylinder:

1. Check the WC and TW stamped on the cylinder or its protective collar.
2. Determine propane capacity by using the following formula:  
 $WC \text{ (lb)} \times .42 = \text{propane capacity (lb)}$ .
3. Add the TW and propane capacity together to determine the total filled weight of the cylinder.

Follow these steps when filling cylinders by weight:

## Prepare and Connect

1. Make sure all cylinder valves are closed.
2. Set the platform scale to the cylinder's total filled weight, plus the weight of the hose and fitting.
3. Place the cylinder on the scale.
4. Select the proper hose end adapter to fit the cylinder valve.
5. Remove the protective cap or plug from the valve.
6. Connect to the cylinder.



## Start Filling

7. Start the pump.
8. If filling through a filler valve, slowly open the hose end valve. If filling through a service valve, open the hose end valve and slowly open the cylinder service valve.



## End Filling

9. When target weight is reached, close the hose end valve.



## Disconnect from Cylinder

10. Shut off the pump if no other cylinders are filling.
11. Make sure the service valve is closed.
12. Loosen the connection and wait for any trapped liquid to bleed off.
13. When trapped liquid is vented, disconnect the hose end fitting.



## Final Inspection

14. Verify the filled weight, as required by regulations.
15. Use an approved method to check for leaks.
16. Reinstall appropriate valve caps and plugs.
  - If the cylinder has a filler valve, reinstall the cap.
  - If the cylinder has a POL service valve, reinstall the valve plug.
  - Replace any caps and plugs that are missing.
17. Apply DOT labels and a cylinder warning label if the manufacturer's label is not legible or you removed a paper or plastic sleeve.





## Automatic and Manual Shutdown Systems

The steps to fill a cylinder by weight using an **automatic shutdown system** are generally the same as those performed with a manual system with the exception of the stop filling trigger. In an automatic system, when the balance beam rises, it triggers the automatic shutdown device and stops the flow of liquid propane. In contrast, a manual shutdown system requires the operator to physically shut a valve to stop the flow of propane when the beam rises.

Regardless of whether the dispensing equipment is manual or automatic, the operator must set the platform scale for the proper filling weight and be in attendance during the entire filling process.



## Filling Cylinders by Volume

Before filling cylinders by volume, first confirm that the cylinder is appropriate for filling by volume. Then, open and close the vent valve on the fixed maximum liquid level gauge to be sure vapor vents. If no vapor escapes, the valve may be blocked and must be reopened before the gauge will operate properly. Do not attempt to fill a cylinder by volume if the fixed maximum liquid level gauge is damaged or inoperable.

Follow these steps when filling cylinders by volume:

### Prepare and Connect

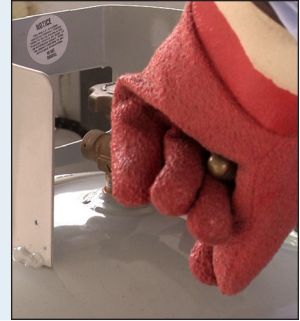
1. Make sure all cylinder valves are closed.
2. Select the proper hose end adapter to fit the filler valve or service valve.
3. Remove the protective cap or plug from the valve.
4. Connect to the cylinder.
5. Open the vent valve on the fixed maximum liquid level gauge. If mist appears when the gauge is open, stop! The cylinder is already full.





## Start Filling

6. Start the pump.
7. If filling through a filler valve, slowly open the hose end valve. If filling through a service valve, open the hose end valve and then slowly open the cylinder service valve.



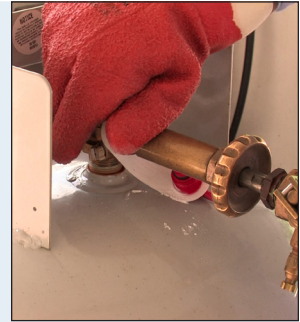
## End Filling

8. When a white mist begins to escape from the fixed maximum liquid level gauge, immediately close the hose end valve.
9. Close the vent valve on the fixed maximum liquid level gauge. Failure to shut off the propane promptly will result in an overfilled cylinder. An overfilled cylinder may discharge propane if the temperature rises, posing a risk of fire or personal injury to anyone nearby.



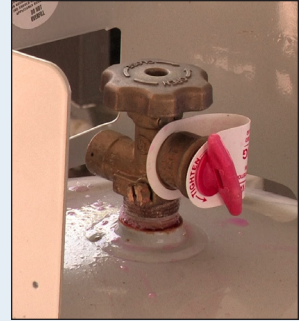
## Disconnect from Cylinder

10. Shut off the pump if no other cylinders are filling.
11. Make sure the cylinder service valve is closed.
12. Loosen the connection and wait for any trapped liquid to bleed off.
13. When trapped liquid is vented, disconnect the hose end fitting.



## Final Inspection

14. Use an approved method to check for leaks.
15. Reinstall appropriate valve caps and plugs.
  - a. If the cylinder has a filler valve, reinstall the cap.
  - b. If the cylinder has a POL service valve, reinstall the valve plug.
  - c. Replace any caps and plugs that are missing.



## Post-filling Procedures

After the cylinder filling operation is completed or any time the filling station is unattended:

16. Close valves at the storage tank.
17. Store the hose on a rack inside a fence-protected area, inside the dispenser cabinet, or secured to a supporting structure inside the filling room. If the location isn't weather-protected, install a dust cap or plug into the hose filling adapter.
18. Secure the installation against tampering or unauthorized use.

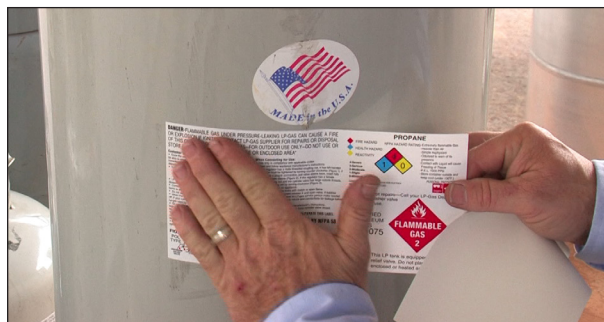


## Cylinder Labeling

DOT and OSHA require specific labeling for all cylinders. Cylinders used to transport propane must be clearly and durably marked with the proper shipping name and hazard class.

In addition, a consumer warning label must be on all portable refillable cylinders of 100-lb. propane capacity or less not filled on site. The label must include information on the potential hazards of propane. Cylinders used in industrial applications must have additional warning information.

Be sure to apply a new warning label if the original manufacturer's label is not present or clearly legible.



## Cylinder Loading and Transporting

Prior to returning the cylinder to the customer, be sure the cylinder valves and fittings are protected against damage while being transported. Cylinders greater than 4.2 lbs. propane capacity must be positioned so that each cylinder's pressure-relief valve is in communication with the vapor space at all times. Cylinders must also be fastened securely in a position to minimize the possibility of movement, tipping, or physical damage while in transit.

It is important to recognize the difference between horizontal and vertical cylinders. They are typically marked to indicate which position they are to be stored and used in. In the event that the relief valve needs to vent while having liquid in the valve and the cylinder is not positioned properly, the situation can become hazardous.

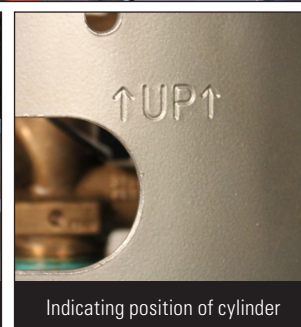
Closed-bodied vehicles, such as passenger cars and vans, are limited to a maximum of 90-lbs. propane capacity with no single container having a capacity of more than 45 lbs. Verify this with your state and local codes, as they may be different.

In addition, check with your supervisor to determine if it is your company's practice to distribute safety information to customers when cylinders are filled.

Properly inspecting, filling, and marking cylinders will enable you to safely serve both your customers and your company.



Horizontal cylinder



Indicating position of cylinder

## 6. REFUELING, MAINTAINING, AND TROUBLE-SHOOTING FORKLIFT CYLINDERS

Propane-fueled forklifts offer numerous advantages over other types of industrial trucks, including greater safety through the use of a closed fuel system, fewer emissions and healthier working conditions, and less wear and tear on carburetors and other engine components.

### Forklift Cylinder Construction

Forklift cylinders are refueled either by refilling on site from a dispensing tank or by exchanging an empty cylinder for a full one. Regardless of the method, before you refuel forklift cylinders, you should understand their construction and how they work.

### Properties of Forklift Cylinders

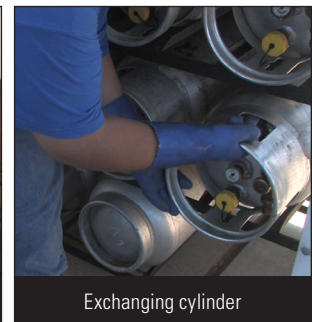
**Forklift cylinders** are manufactured to DOT specifications and, like smaller cylinders, can be made from either aluminum or some type of alloy steel. They typically hold 33 lbs. of propane, but other sizes are also available.

Every DOT cylinder has a **foot ring**—a wide metal band that protects the bottom of the cylinder from corrosion or other damage and also functions as the cylinder's support stand or base.

Forklift cylinders also have a protective collar—a wide metal band that is welded to the cylinder and partially surrounds the valves in the **service end**. The collar often incorporates a handle for lifting and moving the cylinder.

Openings for valves and fittings are located in the service end of the cylinder. Many valves are made with non-metallic or soft parts, such as nylon, rubber, and Teflon®. These materials are also used in O-rings, packing seals, valve discs, and gaskets to ensure that valves provide a gas-tight seal.

If any of these parts are worn out, propane liquid or vapor can leak out of the valve and create a potentially hazardous situation, so valves should be examined at each filling or exchange of the cylinder.





## Forklift Cylinder Parts

One of the many parts of a forklift cylinder is the **pressure-relief valve**, which provides overpressure protection to the cylinder. It should be kept clean, unrestricted, and set to the 12-o'clock position and directed upward at a 45-degree angle when the cylinder is mounted horizontally.

Relief valves on forklift cylinders must be replaced within 12 years of the cylinder's manufacture date, and every 10 years thereafter. A rain or dust cap must also be in place.

**Filler valves** have an internal check valve to limit fuel loss in the event of an accident. This valve should be covered with a plastic cap.

The **fixed maximum liquid level gauge** is an integral part of the filling operation when filling cylinders by the volume method.

DOT cylinders may have a **fuel gauge** that uses a magnetic liquid level float dial inside of the cylinder.

The **liquid hose** is the part of the carburetion system that is equipped with the female portion of the connector.

The **liquid service valve** is equipped with the male portion of a forklift connector, which acts as an added check valve. Both the male and female halves are equipped with 100% shutoffs. When coupled together, they open and allow gas to flow.

If the liquid service valve is turned on without being connected to the female portion, no gas can escape because the coupler has two seals: an O-ring and a flat washer.

The O-ring prevents leakage from the shaft on the other coupling, and the flat washer bottoms out and seals when the coupler is fully connected. Both the washer and the O-ring should be replaced if they show signs of wear, abuse, or leakage.

The service valve can be turned off for service or emergencies and is equipped with an internal excess-flow check valve designed to close automatically if a line is severed. When the propane cylinder is in use, the valve must be open completely.



Pressure-relief valve



Filler valve



Fixed maximum liquid level gauge



Fuel gauge



Liquid hose



Liquid service valve



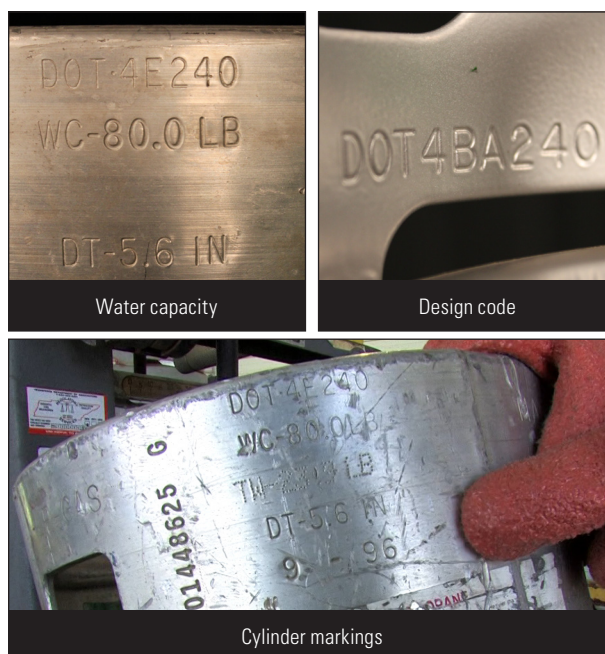
## Cylinder Markings

**Cylinder markings** are required by DOT and include information such as the specification design code, cylinder TW, **WC in pounds**, manufacturer name, and test date. The information must be legible and clearly and permanently marked on the cylinder collar or body.

The **design code** is specified by a number and one or more letters, and the service pressure is designated in psig. For example, DOT-4BA240 may be one marking found on a cylinder. The term "4BA" indicates that the cylinder is a welded (series 4) alloy steel (series BA) cylinder. The number "240" indicates that the service pressure is 240 psig.

The TW is the weight of the cylinder when empty and includes the weight of the cylinder valves. The TW is used when a cylinder is filled by weight and should always be checked before filling. Cylinders with the same WC can have different TWs, so each cylinder should be treated individually.

If you come across a cylinder with XXXs over the DOT specification number or marked with "CONDEMNED" on the shoulder, head, or collar, set the cylinder aside and notify your supervisor. These cylinders must not be refilled or put back in service.



## Requalification

All refillable cylinders, including forklift cylinders, must be requalified at regular intervals. Requalification is not normally handled at forklift customer locations and should be performed only by qualified individuals whose facility is registered with the DOT.

The most recent requalification date is marked on the cylinder:

- A date without a letter indicates the next requalification must be within 12 years.
- The letter "S" following the date indicates the cylinder must be requalified within 7 years of the marked date.
- The letter "E" following the date indicates that requalification is required again within 5 years of the marked date.

Cylinders that are out of qualification must not be refilled. Instead, they should be marked and set aside in a designated safe outdoor area.

CYLINDER REQUALIFICATION METHODS	
EXTERNAL HYDROSTATIC EXPANSION	
LETTER STAMP	NEXT REQUALIFICATION
NONE	12 YRS
DATE 10/05	DATE 10/17
INTERNAL HYDROSTATIC	
LETTER STAMP	NEXT REQUALIFICATION
S	7 YRS
DATE 10/05 S	DATE 10/12 S
EXTERNAL VISUAL INSPECTION	
LETTER STAMP	NEXT REQUALIFICATION
E	5 YRS
DATE 10/05 E	DATE 10/10 E

## Purging

If air or moisture enters a propane cylinder, it can slow down the filling process, create unusually high service pressures, cause improper truck operation, and cause fading of the odorant in the cylinder.

In order for equipment to operate safely, both new cylinders that have not been vacuum purged by the manufacturer and those that have been opened to the atmosphere must be purged of air or moisture before filling.

If you come in contact with a cylinder that has been opened to the atmosphere, do not refill it or remount it on the forklift. Place it in an area for return to your propane supplier.

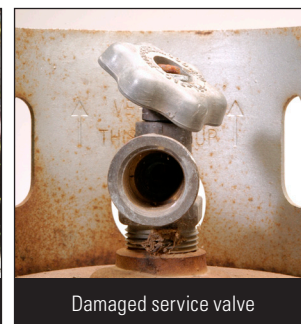
## Pre-fill Visual Check

Before a forklift cylinder can be filled, refilled, or exchanged, DOT regulations require a visual check to verify that it is fit for continued use. If any of the following problems are found during the inspection, the cylinder must not be filled, and it should be marked and set aside in a designated safe outdoor area.

Problems that may prevent refilling a cylinder include:

- Cracks or leaks.
- Bulging, serious denting, or gouging.
- Defective valves, unless properly repaired or replaced.
- Defective or leaking pressure-relief device, unless properly repaired or replaced.
- Damage to the cylinder valve, valve protection, and cylinder foot rings.
- Out-of-date requalification.
- Evidence of physical abuse, fire or heat damage, or excessive rusting or corrosion.

Steel cylinders subjected to fire must be requalified, reconditioned, or repaired by the original manufacturer or a DOT-authorized repair facility. However, aluminum cylinders damaged by fire must be removed from service permanently.



During your visual inspection, also check all valves, springs, valve seats, and gaskets. If they are worn or show any signs of aging, they need to be repaired or replaced.

In addition, valve accessories such as relief valve adapters and protective caps may become broken or lost. As a result, dirt, trash, moisture, and other impurities can enter the valve. However, frequent inspections and replacements can extend the life of cylinder valves.

Valves may also be damaged through improper cylinder maintenance. For example, service personnel may fail to use proper brushes or applicators around cylinder openings when painting them. As a result, gauge faces, “weep” holes in filler valves, and discharge openings of relief valves may become blocked or covered with paint.

In addition to inspecting the cylinder prior to filling or exchanging, it should be checked again after connecting, since leaks or equipment malfunctions may not be identified easily on empty containers that are not pressurized.

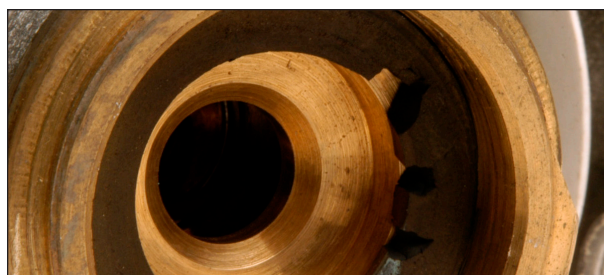
And remember: whether inspecting, refilling, or exchanging forklift cylinders, be sure you are wearing the appropriate PPE required by your company policy.

## Filling Forklift Cylinders

Removable DOT cylinders may be filled either **by weight**, using an accurate and approved scale, or **by volume**, using the fixed maximum liquid level gauge. Cylinders should never be filled by solely using the magnetic float gauge.

Forklift cylinders must also be filled outdoors or in an approved filling area. The lift truck ignition should be off and the hand brake set.

**Filling cylinders on a truck** requires certain safety measures. Not all jurisdictions allow filling on the truck. Check with your supervisor. If it is permitted, pull-away protection is required. In addition, a trained operator must be present during the entire filling process.



Damaged valve



Paint covered valves



Appropriate PPE



Filling by weight



Filling by volume



Filling on a truck

# FILLING FORKLIFT CYLINDERS BY WEIGHT

When filling forklift cylinders by weight, it's important to note that the steps involved may vary depending on your company policy and the type of equipment installed at the facility. Always consult your supervisor for more information.

Follow these steps to determine the total filled weight of a cylinder:

1. Check the WC and TW stamped on the cylinder or its protective collar.
2. Determine propane capacity by using the following formula:  
 $WC \text{ (lb)} \times .42 = \text{propane capacity (lb)}$ .
3. Add the TW and propane capacity together to determine the total filled weight of the cylinder.

Follow these steps when filling a cylinder by weight:

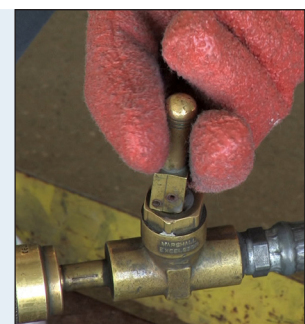
## Prepare and Connect

1. Make sure all cylinder valves are closed.
2. Set the platform scale to the cylinder's total filled weight, plus the weight of the hose and fitting.
3. Place the cylinder on the scale.
4. Select the proper hose end adapter to fit the cylinder valve.
5. Remove the protective cap from the valve.
6. Connect to the cylinder.



## Start Filling

7. Start the pump.
8. If filling through a service valve, open the hose end valve and then slowly open the cylinder service valve.





## End Filling

9. When target weight is reached, close the hose end valve.



## Disconnect from Cylinder

10. Shut off the pump if no other cylinders are filling.
11. Make sure the service valve is closed.
12. Loosen the connection and wait for any trapped liquid to bleed off.
13. When trapped liquid is vented, disconnect the hose end fitting.



## Final Inspection

14. Verify the filled weight, as required by regulations.
15. Use an approved method to check for leaks.
16. Reinstall appropriate valve caps and plugs.
  - If the cylinder has a filler valve, reinstall the cap.
  - Replace any caps and plugs that are missing.





# FILLING FORKLIFT CYLINDERS BY VOLUME

Before filling cylinders by volume, first confirm that the cylinder is appropriate for filling by volume. Then, open and close the vent valve on the fixed maximum liquid level gauge to be sure vapor vents. If no vapor escapes, the valve may be blocked and must be reopened before the gauge will operate properly. Do not attempt to fill a cylinder by volume if the fixed maximum liquid level gauge is damaged or inoperable.

Filling by volume follows a similar procedure, with a few adjustments:

## Prepare and Connect

1. Make sure all cylinder valves are closed.
2. Select the proper hose end adapter to fit the filler valve or service valve.
3. Remove the protective cap from the valve.
4. Connect to the cylinder.
5. Open the vent valve on the fixed maximum liquid level gauge. If mist appears when the gauge is opened, stop! The cylinder is already full.



## Start Filling

6. Start the pump.
7. Open the fixed maximum liquid level gauge.
8. If filling through a filler valve, slowly open the hose end valve.



## End Filling

9. When a white mist begins to escape from the fixed maximum liquid level gauge, immediately close the hose end valve.
10. Close the vent valve on the fixed maximum liquid level gauge. Failure to shut off the propane promptly will result in an overfilled cylinder. An overfilled cylinder may discharge propane if the temperature rises, posing a risk of fire or personal injury to anyone nearby.



## Disconnect from Cylinder

11. Shut off the pump if no other cylinders are filling.
12. Loosen the connection and wait for any trapped liquid to bleed off.
13. When trapped liquid is vented, disconnect the hose end fitting.



## Final Inspection

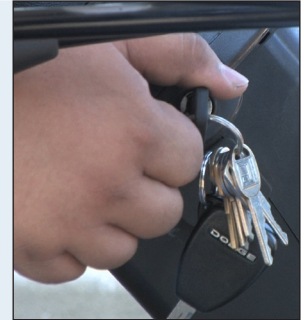
14. Reinstall appropriate valve caps and plugs.
  - If the cylinder has a filler valve, reinstall the cap.
  - Replace any caps and plugs that are missing.
15. Position the cylinder securely, using the locating pin on the truck and the hole in the cylinder collar. Secure the hold-down straps properly.
16. Reconnect the fuel line and check the cylinder and its valves for leaks with a non-corrosive leak detector solution, inspecting the gaskets and O-rings in the filler valve, and service valve connector for defects or leaks.
17. After the cylinder is filled, or at any time the dispensing station is unattended, shut off the pump, close valves at the storage tank and disconnect and store the hose to secure the dispenser against tampering.



# Cylinder Exchange

Follow these steps to exchange a forklift cylinder:

1. Park the truck in a designated safe area and stop the engine.

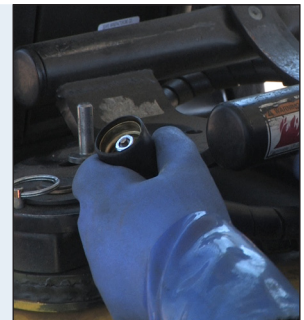


2. Close the cylinder valve and remove the quick-disconnect coupling from the cylinder.

3. Remove the empty cylinder from the cradle holding device and store it in a designated safe area.



4. Select a filled cylinder and check it for damage or leaks. Also be sure to inspect the fuel lines and forklift connector couplings, especially the washers and O-rings, for damage or signs of aging.



5. Be sure the cylinder valve is closed prior to connecting.

6. Carefully install the filled cylinder in the cradle on the truck so the cylinder locator pin enters the locating hole in the cylinder collar.

7. Reconnect the fuel line to the cylinder liquid service valve and open the valve slowly.

8. Securely mount the cylinder in its brackets and within the outline of the vehicle. In some instances, locating pins may be missing or broken off, allowing the cylinder to be mounted in any position. When this happens, the liquid withdrawal tube is exposed to the vapor space, which may give a false indication that the cylinder is empty. The pressure-relief valve may also be immersed in liquid fuel, which would cause the cylinder to vent liquid in the event that it was activated. In the event that the locating pins for a cylinder are broken, take the forklift out of service.



9. Check for leaks using a non-corrosive leak detector solution. If a leak is found, close the valve immediately and notify your supervisor. If no leaks are found, start the engine and proceed with your work.

## Cylinder Labeling

DOT and OSHA require specific labeling for all cylinders. Cylinders used to transport propane must be clearly and durably marked with the proper shipping name and its hazard class. If the original manufacturer's label is not present or clearly legible, apply a new warning label to the cylinder.



## 7. REFUELING ASME MOTOR FUEL AND RV TANKS

Propane autogas refueling stations and dispensers are used to refuel automobiles, fleet vehicles, forklifts, and RV tanks.

Motor fuel tanks are built to American Society of Mechanical Engineers (ASME) standards. In order to fill ASME motor fuel tanks and RV fuel tanks safely, tanks must be inspected to ensure they have all the correct markings and components and are in good condition.

Before filling a vehicle-mounted ASME tank, you must visually inspect the system to answer all of the following questions:

- Are any of the valves or hoses damaged?
- Does the shell show signs of damage or deterioration that might make it unsafe to use?
- Is the tank missing any required labels or markings?
- If the answer to any of these questions is "yes," then DO NOT FILL the tank until the flaw has been corrected.





## Features of Vehicle-Mounted ASME Tanks

There are several variations of vehicle-mounted ASME tanks. All variations are equipped with:

- **ASME data plate.**
- **Fixed maximum liquid level gauge.**
- Relief valve.
- **1 3/4" ACME filler valve.**
- **Float gauge** that displays approximate liquid level.

A fixed maximum liquid level gauge is installed in the ASME tank at the maximum liquid filling line.

Motor fuel tank float gauges are used to confirm the liquid level before and after filling and to alert the driver to the approximate liquid fuel level. They are not used for filling. A separate heavy metal guard or ring protects float gauges.

The filler valve assembly may include a stop-fill/ auto-stop valve that acts as an OPD similar to those used in portable DOT cylinders. These will be flange-mounted to the tank instead of threaded.

Motor fuel tanks provide liquid service to fuel the vehicle's engine. They have a liquid service valve that includes an internal excess flow valve.

RV tanks provide vapor service to appliances within a vehicle, such as a gas range. A vapor service valve assembly may include a relief valve. A pressure regulator is connected to the vapor service valve.

Some tanks are equipped with two service valves to provide both liquid and vapor from the same tank.

If the tank is enclosed within the body of the vehicle, hoses called **pipe-aways** may be connected to the relief valve, the filler valve, and the fixed maximum liquid level gauge to carry any discharged propane to the outside and to provide ready access for filling.



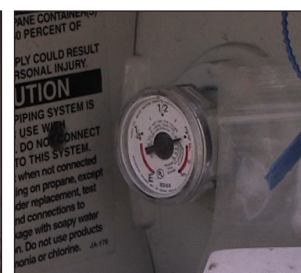
ASME data plate



Fixed maximum liquid level gauge



1 3/4" ACME filler valve



Float gauge



Pipe-away

## Inspecting Tanks, Valves, and Hoses

When inspecting the tank, valves, and hoses, look for the following signs of damage. Any damage could cause a propane leak, which could result in a fire:

- Damage to filler valve threads or gaskets.
- Damage to the fixed maximum liquid level gauge.
- Damage to a liquid or vapor service hose or valve.
- Damage to the relief valve or pipe-away hose.
- Damage to the shell of the tank—dents, gouges, or significant corrosion.
- A cracked float gauge face.

If any damage is present, do not fill the tank.



## Verify Markings and Labels

The following markings and labels must be present and visible:

An ASME data plate lists the working pressure and other tank information. If the data plate is missing or illegible or shows a working pressure other than 250 or 312 psi, the tank must not be filled.

A **propane decal** is required to be displayed on vehicles equipped with motor fuel tanks. This decal alerts emergency response personnel that propane containers are present.

- On vehicles with motor fuel tanks, the decal must be on the lower right rear of the vehicle near the bumper.

Once the motor fuel tank has been inspected and passed inspection, it can be refilled safely.



# FILLING MOTOR FUEL TANKS

Before filling an ASME or autogas fuel tank, it must be inspected. First, be sure that no one is inside the vehicle and the ignition is turned off.

Make sure there are no ignition sources within 25 feet of the point(s) of transfer, or metal-working operations including grinding, oxygen-fuel gas cutting, brazing, soldering, or welding, within 35 feet.

Always put on appropriate PPE before starting the filling operation.

Motor fuel tanks fabricated before January 1, 1984, and not outfitted with an OPD must have a fixed maximum liquid level gauge and are required to be opened on ASME motor fuel tanks. If your vehicle is not outfitted with an OPD, follow these steps when filling:

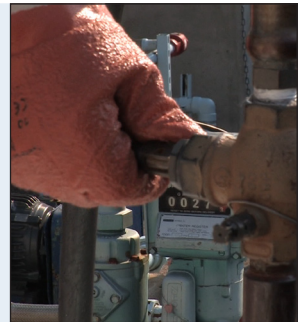
## Prepare and Connect

1. Set the propane meter to zero.
2. Connect the motor fuel hose to the tank fill valve.
3. Open the vent valve on the brass fixed maximum liquid level gauge and check for flow. If vapor appears, continue the filling process. If liquid appears, stop the filling process because the tank is full.



## Start Filling

4. Start the pump.
5. Slowly open the valve on the end of the hose.



## Stop Filling

6. When a steady white mist or fog is first emitted from the fixed maximum liquid level gauge, close the valve on the end of the hose.
7. Close the fixed maximum liquid level gauge.
8. Shut off the pump.



### Disconnect from Tank

9. Slowly loosen the filler adapter and wait until propane stops venting before completely disconnecting the adapter.



### Final Inspection

10. Check the valve for leaks and replace the dust cap.



If your vehicle's tank was fabricated after January 1, 1984, and is outfitted with an OPD, follow these steps when filling:

### Prepare and Connect

1. Set the propane meter to zero.
2. Connect the motor fuel hose to the tank fill valve.



### Start Filling

3. Start the pump.
4. Slowly open the valve on the end of the hose.



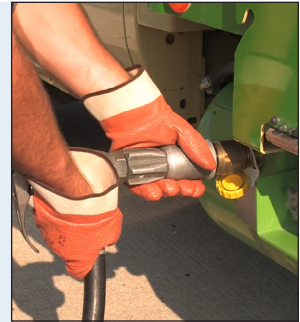
## Stop Filling

5. When the OPD stops the flow, immediately close the valve on the end of the hose.
6. Shut off the pump.



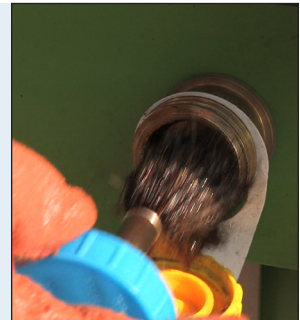
## Disconnect from Tank

7. Slowly loosen the filler adapter and wait until propane stops venting before completely disconnecting the adapter.



## Final Inspection

8. Check the valve for leaks and replace the dust cap.





# FILLING RV TANKS

Before filling a vehicle-mounted ASME tank, it should be inspected. First, be sure that no one is inside the vehicle and the ignition is turned off. Customers are restricted from the immediate area around the liquid propane transfer operation. Make sure there are no ignition sources within 25 feet of the point(s) of transfer, or metal-working operations including grinding, oxygen-fuel gas cutting, brazing, soldering, or welding, within 35 feet.

Filling procedures for vehicle-mounted ASME tanks used for RVs or catering trucks, or in roofing applications, are similar to those for motor fuel tanks with one important addition. RV tanks are used to supply propane appliances that are possible ignition sources.

Therefore, it is critically important that appliance pilots and electronic ignition systems are turned off.

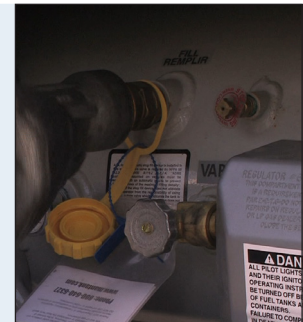
Notify the vehicle operator that you are turning the propane fuel supply off at the service valve. Be sure that pilots and ignition systems are off.

Always put on appropriate PPE before starting the filling operation.

Follow these steps to fill an RV tank:

## Prepare and Connect

1. Set the propane meter to zero.
2. Connect the motor fuel hose to the tank fill valve.
3. Open the vent valve on the brass fixed maximum liquid level gauge and check for flow. If vapor appears, continue the filling process. If liquid appears, stop the filling process because the tank is full.



## Start Filling

4. Start the pump.
5. Slowly open the valve on the end of the hose.



## Stop Filling

6. When a steady white mist or fog is first emitted from the fixed maximum liquid level gauge, or the OPD stops the flow, immediately close the valve on the end of the hose.
7. Close the fixed maximum liquid level gauge if applicable.



## Disconnect from Tank

8. Shut off the pump.
9. Slowly loosen the filler adapter and wait until propane stops venting before completely disconnecting the adapter.



## Final Inspection

10. Check the valve for leaks and replace the dust cap.



## Post-filling Procedures

If it is not your company's policy to light customer pilot lights, you should advise the customer to have a licensed service company or gas distributor light the pilot lights, and that if the customer does this without professional help, the appliance manufacturer's instructions must be followed carefully.

When the dispenser is not in use, or at any time that a qualified dispenser operator is not in attendance, it should be shut down and secured in keeping with company operating procedures.

The shutdown procedure should ensure that:

- Dispenser operating valves are closed.
- Transfer hoses are secured in storage cabinets or their designated locations.
- The dispenser cabinet or fence gates are closed and locked.



Becoming familiar with both the motor fuel system and safe filling procedures is important for your safety as well as that of your customers.

## 8. EMERGING TECHNOLOGIES

Several emerging technologies have been introduced that provide customers with more opportunities to take advantage of the many benefits of propane as an energy source.

### Composite Cylinders

Composite cylinders are different from steel and aluminum cylinders in many ways. Propane composite cylinders are high-strength containers made from a mixture of fiberglass or carbon fibers and a plastic resin, typically epoxy.

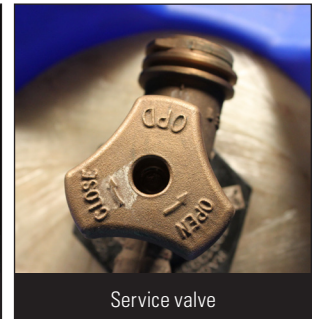
The main body of the composite cylinder is translucent, which means that the user can easily see the liquid level in the cylinder and avoid unexpected fuel run-outs. The main body is protected by a hard plastic outer shell.

However, the service and fill connections on composite cylinders are identical to those connections on valves used in steel or aluminum cylinders, and the end user and propane filler can use the standard connections for their applications. No adapters are necessary to use or fill composite cylinders.

Composite cylinders being manufactured for sale in the U.S. are used for outdoor applications such as barbecue grills and patio heaters, as well as industrial applications such as forklifts. Composite cylinders sold in the U.S. are constructed in accordance with DOT special permits and can be found in two basic designs: one-piece and two-piece construction. Both types of cylinders include the same type of valves and pressure-relief devices as aluminum and steel propane cylinders and may have the same OPDs.



Composite cylinder



Service valve



Cylinder markings

## Special Care of Composite Cylinders

The proper care and handling procedures for composite cylinders are different from those of steel and aluminum cylinders. When handling composite cylinders:

- Do not expose composite cylinders to temperatures higher than 149°F (65°C).
- If a composite cylinder is dropped from a distance of four feet or higher, a complete inspection should be performed by qualified personnel.
- Wash composite cylinders with soap and water and be sure to completely rinse the soap away after washing.
- Water-jet and chemical cleaning methods can be used to remove other materials from the cylinder surface, such as tar oil, labels, and other foreign particles.

## Inspecting a Composite Cylinder before Filling

Before a composite cylinder can be filled, a visual inspection must be performed to ensure the cylinder is still in proper condition and can be filled safely. Follow the manufacturer's recommendations for pre-fill inspections.

1. Inspect the cylinder to ensure that the required permanent markings are on the cylinder.
2. Check the markings for completeness, and make sure that the latest test or inspection date is no more than 5 years old. If the latest cylinder inspection date is more than 5 years old, it cannot be filled and must be removed from service for requalification. Additionally, any cylinder that is more than 15 years beyond its original inspection must be removed from service, and cannot be requalified for continued service.
3. If any damage is observed that meets or exceeds the rejection limits, the cylinder must be permanently removed from service by personnel who are authorized, in writing, by the manufacturer.

Once a pre-fill inspection of the composite cylinder has been completed and no damage has been observed that requires removal or repair of the cylinder, it can be filled with propane.





## Filling a Composite Cylinder

The process of filling composite cylinders must be consistent with the shipping requirements in the hazardous materials regulations for DOT. This means that the same local, state, and federal filling regulations and procedures that are used for steel or aluminum cylinders should be used for filling composite cylinders.

Since composite cylinders are made of resins that have the ability to generate and store static electricity, additional safe handling procedures are recommended. Composite cylinders should be neutralized with a water spray or antistatic solution before refurbishing, purging, or filling. It is very important when handling composite cylinders to wear static-safe footwear or use other means to reduce any potential hazards associated with static electricity.

### Filling Composite Cylinders by Weight

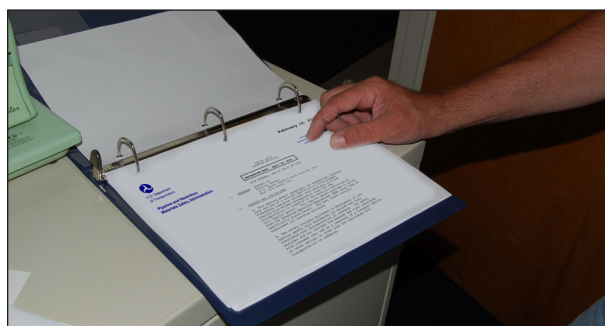
Composite cylinders less than 200 lbs. WC are required by the DOT to be filled by weight if they are being transported in commerce. Otherwise, they can be filled by volume.

Since filling by weight may be different depending on the cylinder type, contact the manufacturer for complete fill-by-weight instructions.

### Additional Training for Filling Composite Cylinders

DOT special permits require that each employee who performs a function mentioned in the permits, such as filling or refilling cylinders, must receive training on the requirements and conditions of the permits in addition to the training required by DOT regulations.

One of the special provisions included in all three DOT special permits is that a copy of the manufacturer's DOT special permit for the specific composite cylinder filled must be on file at the facility where the fill or refill occurs.



## One-Pound (1-lb.) Refillable Cylinders

Another emerging technology is a small, 1-lb. steel refillable cylinder that can be used to fuel lanterns and heaters, as well as outdoor power, camping, and cooking equipment. In addition, the small cylinder can be used in fueling commercial landscaping and plumbing equipment.

One-pound cylinders must be filled only by persons trained in the safe transfer of propane using only equipment that is approved by the manufacturer.

### Equipment and Practices

The following filling equipment and practices are unique to refillable cylinders:

- One-pound cylinders are refilled using a gravity fill method as opposed to being filled by a pump.
- A special attachment for the dispensing equipment—the manufacturer-approved **“safety fill adapter”**—is required in order to refill the cylinder.
- To fill the cylinder, a manufacturer-approved, snap-acting **“dead man” valve** must be manually held open by the filler. This valve is designed to prevent accidental overfills by requiring the filler to be present and actively engaged in the fill process at all times.
- Never use or modify these devices to fill disposable cylinders. The use of unapproved filling devices and/or methods may result in property damage, severe personal injury, or even death.

### Weighing

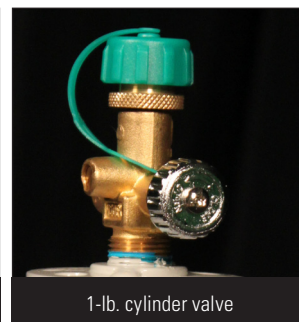
Since 1-lb. cylinders are filled manually, small-capacity scales are required to accurately weigh these small cylinders to within .01 lbs.

Electronic, **digital platform scales**, and hanging-type scales are effective and are available from numerous sources at minimal cost compared to high-capacity beam scales used to weigh larger cylinders. Both types must be calibrated correctly, and since they use batteries, ignition sources should be kept a reasonable distance away from transfer points.

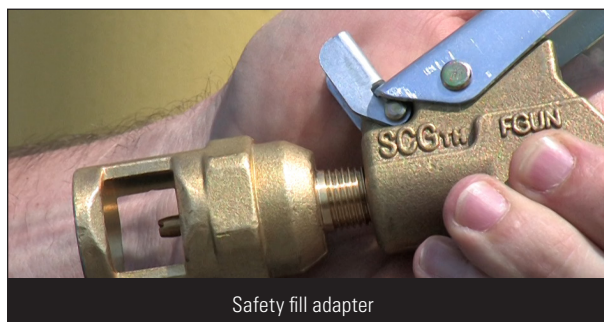
Precise, **analog spring scales**, such as those used in produce departments, are also available in various office supply locations, but tend to be more expensive. However, they use no electricity and are not usually a source of ignition.



1-lb. steel refillable cylinder



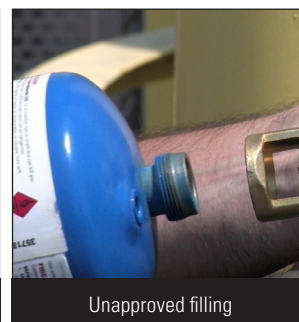
1-lb. cylinder valve



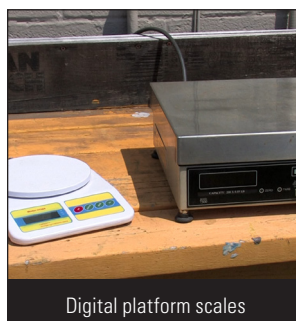
Safety fill adapter



“Dead man” valve



Unapproved filling



Digital platform scales



Analog spring scale

## PREPARING TO FILL A 1-LB. CYLINDER

Before starting the cylinder filling operation, follow these steps to ensure the safety of you, your customers, and your fellow employees:

1. Ensure there are no ignition sources within 25 feet of the point(s) of transfer, or metal-working operations including grinding, oxygen-fuel gas cutting, brazing, soldering, or welding, within 35 feet.

2. Thoroughly inspect each cylinder to be filled using all local, state, and federal guidelines. Check the cylinder valve for aging or damage to springs, seals, or other parts. **DO NOT FILL** a cylinder if there is any question about its condition.



3. Place the cylinder to be filled in a vertical, upright position and keep the cylinder stable and level throughout the filling process.

# FILLING A 1-LB. CYLINDER

Currently, there are two different filling dispensers for the 1-lb. refillable cylinders: 33.5-lb. capacity (forklift cylinder type fillers) and 420-lb. capacity (cylinder type fillers).

Follow these steps when filling a 1-lb cylinder:

## Prepare and Connect

1. New cylinders must be purged of air before being filled for the first time.
2. When connecting the fill nozzle to the cylinder valve, confirm that the threads are not damaged and that a leak-free connection is made. Damaged threads on connections can cause leaks and damage other fittings to which they are connected. Do not attempt to connect a damaged valve or fill nozzle until it is properly repaired or replaced.
3. Once a leak-free connection has been established, open the fixed maximum liquid level gauge and confirm that it is operating. If there is no discharge from its orifice, cease filling operations immediately. **DO NOT FILL** a cylinder with an improperly operating fixed maximum liquid level gauge until it is properly repaired or replaced.



## Start Filling

4. Open the cylinder handwheel and depress the fill gun lever to allow the transfer of propane gas. Continue filling until a white mist is observed discharging from the fixed maximum liquid level gauge.



## Stop Filling

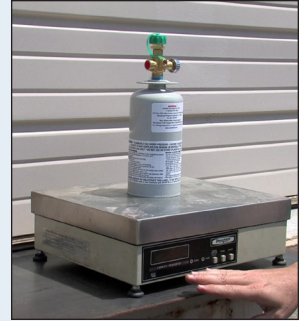
5. When the white mist appears, immediately stop the filling process by releasing the fill gun lever and closing the cylinder handwheel. Unlike some larger propane cylinders, 1-lb. refillable cylinders are not required to have OPD valves, so it is very important that you watch for overfill and stop the dispensing process as soon as you detect the white mist.
6. Close the fixed maximum liquid level gauge only when there is no longer a white mist being discharged from the gauge. This will help to ensure that the cylinder is not overfilled.





## Disconnect from Cylinder

7. Disconnect the cylinder valve from the fill nozzle.
8. Verify that the cylinder is properly filled by weighing the cylinder using an approved scale. The weight of the filled cylinder must not exceed maximum allowable fill, which is determined by multiplying the WC of the cylinder by .42 and adding the TW of the cylinder.
9. The WC and TW of the cylinder are marked on the cylinder collar. If the weight of the cylinder exceeds the maximum allowable weight, release the excess propane through the fixed maximum liquid level gauge until the total weight is equal to or less than the calculated maximum weight.



## Final Inspection

10. When the filling process is complete, check the cylinder for any leaks. If no leaks are found and the protective cap has been put in place, it is now ready for service or storage. However, if a leak is detected, DO NOT release the filled cylinder for use until the leak is repaired. In addition, DO NOT release an overfilled cylinder until it has been returned to the proper fill capacity.





## 9. RETAIL CYLINDER EXCHANGE OPERATIONS

Retail cylinder exchange cabinets provide a convenient way for recreational and grill cylinder customers to obtain fuel. These cabinets are used to store small cylinders awaiting resale or exchange and can be found at home improvement, convenience, hardware, and equipment rental stores, as well as at gas stations, campground grocery stores, and truck stops.

Exchange cabinets can be used to store either full cylinders or empty cylinders that have been returned by customers. Whether full or empty, all cylinders should be handled in the same manner.

Following proper procedures will ensure that cylinders are stored and handled safely. Check with your supervisor if you are not sure of all cylinder exchange cabinet procedures or requirements.

### Setting up Cylinder Cabinets and Cylinder Storage

Cylinders stored at a location open to the public must be protected by a fenced enclosure or a lockable ventilated metal locker or rack that prevents tampering and theft of cylinders. They should always be locked when unattended.

Cabinets should be set on a firm, non-combustible base in a well-ventilated area that is free of combustibles and flammable materials. Many public buildings also require protection for the cages from vehicular damage.

In addition, cabinets are required to have various markings affixed to them. These may include “Flammable Gas,” “No Smoking,” OSHA warnings, and product identification labels. Check with your supervisor for other requirements.

DOT regulations require cylinders also be labeled to indicate contents and be stored with the relief valve in the vapor space of the container. For exchange grill cylinders, this is in the vertical, upright position. Cylinders, either empty or full, must never be stored or permitted indoors, so make sure customers and fellow employees are aware of this safety precaution.

Cylinders stored in an exchange cabinet should have a quick-closing valve outlet and have a protective cap or collar, or be plugged, unless it has an OPD. An OPD is a special cylinder service valve that stops the flow of gas liquid into the cylinder when the cylinder is about 80% filled. These are found on all vertical 4-lb. through 40-lb. cylinders.



## Location Requirements

Cylinder storage cabinets must be at least 20 feet away from any gas station fuel dispenser to prevent combustion. In some states, cabinets are required to be at least 5 feet from ignition sources including soft drink and ice machines, cigarette urns, air conditioners, and some telephones. Consult your local authorities for more information.

Cabinets must also be placed at least 5 feet from any doorway or opening in a public building. For buildings with only one exit, cylinder racks must be located at least 10 feet from that exit.



## Fire Extinguisher Requirements

If more than 720 lbs. of propane—the equivalent of 36 or more 20-lb. grill cylinders—are stored in one location, the area must be provided with at least one approved portable fire extinguisher. Fire extinguishers should have a minimum capacity of 18 lbs. of dry chemical with a B:C rating and be located no more than 50 feet from the storage location.

Fire extinguishers are intended for small fires, such as those involving combustible materials, and should not be used to put out large propane fires.



## 10. RESOURCES AND GLOSSARY

### American Society of Mechanical Engineers (ASME)

The American Society of Mechanical Engineers (ASME) is an organization comprised of professional engineers from many different fields and industries.

One of ASME's missions is to coordinate and develop manufacturing standards for tanks and pressure-relief valves used in the propane industry.

When tanks and pressure-relief valves are built according to ASME standards, they are usually marked with a special ASME stamp.

### Department of Labor (DOL)

The Department of Labor (DOL) enforces all safety and health regulations contained in the Occupational Safety and Health Act. This act ensures that safe practices and procedures are followed when handling propane in the work environment.

With the Occupational Safety and Health Act, Congress created the Occupational Safety and Health Administration (OSHA) to set and enforce standards and provide training, outreach, education and assistance. OSHA is part of the United States Department of Labor.

OSHA also provides specific guidelines about:

- Accident prevention and reporting.
- First aid and medical attention for on-the-job injuries.
- On-the-job safety training.
- Fire protection.
- Proper lighting of work areas.
- Sanitation and general housekeeping at work.

### Department of Transportation (DOT)

The Department of Transportation (DOT) is a department of the United States federal government. Among other things, DOT establishes regulations governing the commercial transportation of hazardous materials, such as propane and other products. DOT regulations are covered by 49 CFR.

### Fire Extinguisher Use and Ratings

Fire extinguishers at propane dispensing facilities are critical. They can keep a small incident from becoming a major accident with extensive property damage and personal injury. OSHA requires employees to be trained to use fire extinguishers when they are first hired and each year thereafter.

A propane fire should not be extinguished until the leak is controlled. Fire extinguishers are not intended to put out a propane fire and have a limited application area. They are effective only for small fires, such as those involving combustible materials. They're also valuable for creating an escape route for people in the area.

As an employee, it is your responsibility to understand the location, rating, maintenance, and appropriate use of fire extinguishers.

You can find a fire extinguisher's rating stamped on its metal data plate. A rating includes numbers indicating the maximum area of fire the extinguisher can put out, and letters showing the type or class of fire the extinguisher can put out.

Most extinguishers are rated for more than one class of fire. For example, a B:C fire extinguisher is designed to fight both class B (flammable liquids and propane) and class C (electrical) fires. Always check the rating of an extinguisher before using it. Check with your supervisor if you have any questions.

## National Fire Protection Association (NFPA)

The National Fire Protection Association (NFPA) is a non-profit, voluntary association devoted to fire prevention and safety.

Since 1896, NFPA has provided information and programs on fire prevention, fire-fighting procedures, and fire protection. NFPA also coordinates fire safety code development for the propane industry.

## NFPA 58: Liquefied Petroleum Gas Code

NFPA publishes *NFPA 58: Liquefied Petroleum Gas Code*. Sometimes this is referred to as the LP-Gas Code. This code covers the proper storage and handling of propane and other LP-gases. You may want to refer to NFPA 58 when filling ASME tanks or cylinders, or transporting propane.

States and jurisdictions have differing policies relative to the adoption of various editions of NFPA 58; some may add or delete provisions to the code. Check with your supervisor to determine which edition of NFPA 58 your jurisdiction has adopted and whether any provisions have been modified.

## Personal Protective Equipment (PPE)

Personal protective equipment (PPE) and procedures for training employees on its proper use are critical steps toward workforce safety.

The proper use of PPE, such as gloves, hard hats, safety shoes, eye protection, shields, respirators, etc., is important in reducing and eliminating on-the-job injuries, the costs associated with those injuries, and ensuring compliance with rules established by the Occupational Safety & Health Administration (OSHA).

OSHA regulations require the use of PPE during operations that present the risk of injuries to employees that cannot be controlled by engineering or process procedures. OSHA requires the employer to:

- Determine the use and selection of PPE.
- Train employees on the proper use and care of PPE.
- Document employee training and use of PPE.

In return, employees are required to properly utilize and care for the PPE that has been assigned. Consult your supervisor for more information.

## Tare Weight (TW) of a Cylinder

The tare weight (TW) is the weight of the cylinder when empty and includes the weight of the cylinder valves. The TW is used when a cylinder is filled by weight and should always be checked before it is filled.

## Water Capacity (WC) of a Cylinder

Water capacity (WC) is the weight of water needed to completely fill a cylinder. The WC for cylinders is calculated in pounds.

The propane capacity is not marked on a cylinder. Instead, the WC is used to establish the cylinder capacity. Never confuse the WC of the cylinder with the propane capacity.

The maximum propane capacity is 42% of the WC. When cylinders are filled by weight, they must NEVER be filled beyond the maximum propane capacity.



# BULK PLANT DISPENSING EQUIPMENT AND PURGING

## Bulk Plant Dispenser Components

In order to dispense propane safely, you should be familiar with the equipment you are working with and how to use it.

Dispensing equipment often varies by facility. Your bulk plant may or may not have all of the following components:

- An **ASME storage tank** that supplies propane to the dispensing equipment.
- **Valves to control the flow of propane** through the piping system.
- **Extra-heavy piping** and forged-steel pipe fittings.
- A propane pump, driven by an explosion-proof **electric motor**.
- A **platform scale** for weighing cylinders during and after filling.
- **Automatic pump bypass return valve(s)**, to protect the pump, piping, and hoses against excessively high pressures when the hose end valves are closed and the pump is running.



ASME storage tank



Valves controlling flow of propane



Extra-heavy piping



Electric motor



Platform scale



Bypass return valve



- **Electrical wiring**, fixtures, and switches to control the propane pump motor and provide for emergency shutdown.
- A **metering system** for measuring liquid propane transferred into containers.
- Propane **transfer hose assemblies** for cylinder filling and ASME tank filling.
- **Hose end adapters** to accommodate the different valves used on DOT cylinders and ASME tanks.
- An **emergency break-away device** for vehicle-mounted containers that is designed to provide protection in case of a pull-away by stopping the flow of gas if a customer drives away with the hose attached.
- A fenced enclosure, a lockable cabinet to secure the dispenser, or devices to secure the valves should be used to prevent unauthorized operation of equipment when not in use. Depending on the site and enclosure, **traffic barricades** may also be required.



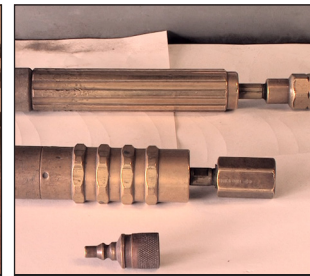
Electrical wiring



Metering system



Transfer hose assemblies



Hose end adapters



Emergency break-away device



Traffic barricades

## Shutdown Components

There are two types of shutdown systems:

**Manual shutdown dispensers** stop the flow of liquid into cylinders by manually closing one or more valves. They rely on the operator to determine when the maximum permitted filling limit for a cylinder is reached.

**Automatic shutdown systems** are used primarily where several cylinders are being filled simultaneously, such as at a cylinder dock, to reduce the possibility of overfilling cylinders. They normally consist of a sensor or trip lever mounted on the balance beam of a scale and a master control valve that stops the flow of liquid propane to the dispensing hose.

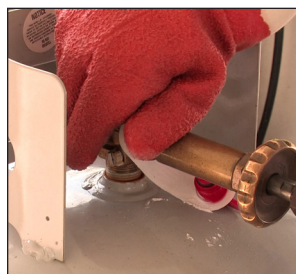
The dispenser tank in your facility may be equipped with an **internal excess flow valve** in combination with a positive shutoff valve. Internal valves that incorporate excess flow protection are also common, and may include thermal and remote shutoff capabilities.

**Remote shutdown stations** may also be installed to provide a greater level of emergency support away from the pump and transfer location.

**Ball valves** control the flow of propane from the supply tank through the piping. A ball valve is open when the valve handle is parallel with the piping. It is closed when the handle is perpendicular to the piping.

**Globe valves** are similar to water faucets and are operated by turning the handwheel counter-clockwise to open and clockwise to close. They must be either fully open or fully closed.

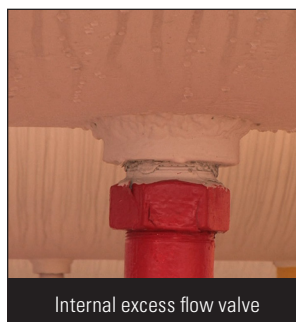
**Hose end valves** stop the flow of propane as part of the container filling operation. As another safeguard against overfilling, hose end valves are quick-closing or snap-acting. Many also have a safety latch to prevent accidental opening when the valve is not connected for filling.



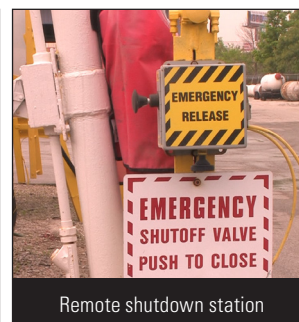
Manual shutdown dispenser



Automatic shutdown system



Internal excess flow valve



Remote shutdown station



Ball valve in the open position



Ball valve in the closed position



Globe valve



Hose end valve

## Measuring Components

Platform balance beam scales determine when the proper filling weight for cylinders is reached and when to stop the flow of propane into the cylinder.

Platform scales can be single beam, double beam, or digital. All require periodic maintenance and should be checked for accuracy based on the manufacturer's instructions.

In many states and jurisdictions, scales must have **certification decals** from weights and measures officials, and be inspected periodically and calibrated for accuracy.

**Scales must be leveled and protected from weather**, especially accumulation of water, debris, snow, or ice.

## Purging

In order for equipment to operate properly and to keep customers safe, both new cylinders that have not been vacuum purged by the manufacturer and those that have been opened to the atmosphere must be purged of air or moisture before filling. If air or moisture enters a cylinder, it can slow down the filling process, create unusually high service pressures, cause regulator freeze-up, or cause fading of the odorant in the cylinder.



Certification decals on scale



Scale protected from weather

# PURGING CYLINDERS WITH PROPANE VAPOR

Using propane vapor to force the air out of the cylinder is an effective purging method that is used often at refilling stations. Cylinders should always be purged in an approved area where there are no ignition sources.

Follow these steps to purge cylinders:

## 1. Connect the vapor hose to the cylinder.

Ensure that you have the correct fittings installed when connecting the vapor hose to the cylinder service valve. If the service valve on the cylinder does not have a female Prest-O-Lite (POL) opening, attach a cylinder service valve adapter to the POL adapter that is installed in the vapor line hose end valve. Securely tighten the vapor hose assembly to the cylinder service valve.



## 2. Pressurize the cylinder with propane vapor to 15 psig.

With the service valve closed on the cylinder being purged, open the service valve on the purging cylinder. Gradually position the ball valve on the vapor hose to allow propane vapor to vent into the cylinder being purged. If no leakage is detected, open the service valve on the cylinder being purged. Observe the gauge on the purging manifold until the pressure reaches 15 psig.



## 3. Bleed off the pressure in the cylinder.

Gradually position the ball valve on the vapor hose to vent a small volume of propane vapor and air until the pressure gauge reaches 0 psig. During this bleed-off process, be very cautious since a small amount of propane vapor and air will be released. To prevent ignition, venting should be done at least 25 feet from any open flame, smoking area, portable electrical tools, and extension lights, and at least 35 feet from any metal cutting, grinding, oxygen-fuel gas cutting, brazing, soldering, or welding.

## 4. Repeat the purging process.

To be sure that roughly 97% of the air has been purged from the cylinder, continue to pressurize and bleed off the pressure in the cylinder at least four more times. Leave the vapor return hose connected until the final purging has been completed, then re-pressurize the cylinder to 15 psig. Close the service valve on both the purging cylinder and the cylinder being purged and check the cylinder for leakage.



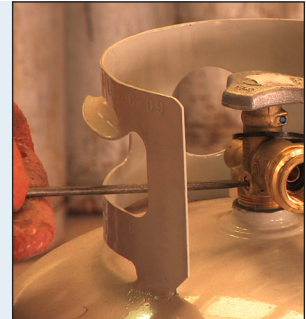
# STEPS FOR PURGING CYLINDERS WITH A VACUUM PUMP

Another method for purging air from cylinders is by using a vacuum pump to force the air out. Always follow manufacturer instructions when using this method of purging, and never attach the pump to any cylinder containing propane since the equipment is designed to purge air only.

Follow these steps to properly purge air from a cylinder using a vacuum pump:

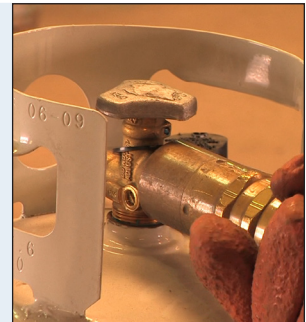
## 1. Vent any pressure.

Vent any pressure through a fixed maximum liquid level gauge before connecting the pump inlet hose. Retighten the gauge after the pressure has been vented.



## 2. Connect the hose.

Connect the pump inlet hose to the cylinder valve and tighten securely by hand.



## 3. Turn the pump on.

Open the cylinder valve and turn the pump on. Allow the pump to pull down to 2 psig.

## 4. Turn the pump off.

Close the cylinder valve, turn the pump off, and disconnect the hose from the cylinder valve. The cylinder is now ready to be filled.



