

Dispensing Propane Safely



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Table of Contents

1. Introduction to Dispensing Propane Safely	1
2. Properties and Characteristics of Propane	5
3. Dispensing Station Equipment	9
4. DOT Cylinders	13
5. Filling Small Cylinders	25
6. Refueling, Maintaining, and Troubleshooting Forklift Cylinders	33
7. Refueling Motorhomes and Other Vehicle-Mounted ASME Tanks	45
8. Dispensing Propane Safely for Mowers	53
9. Dispensing Propane Autogas	69
 Appendices	
A1: Composite Cylinders	75
A2: Retail Cylinder Exchange Operations	81
A3: Pre-Requisite Module Table	85
A4: DOT Cylinder Code Chart	87
A5: Module Quizzes	89
A6: Module Answer Keys	109



1

Introduction to Dispensing Propane Safely

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, professional landscape companies, campgrounds, rental equipment companies, and gas stations.

Motorhomes, campers, autogas vehicles, lawn mowers, barbecue grills, and forklifts are just a few of the vehicles and equipment served by propane dispensing stations.

In order to ensure your safety and the safety of your customers when dispensing propane, you should know about the fuel, equipment, regulations, and processes that are involved in filling various types of propane containers. This manual 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 vehicles.



Everyone who dispenses propane will need to review the first three modules in addition to the modules specific to their filling applications. These modules will give you basic information on dispensing equipment and the safe handling and transfer of propane. The lone exception is if you only dispense propane autogas. Then, you will need to review the first two modules in addition to the Dispensing Propane Autogas module.



If you fill any type of propane cylinder, such as a mower, forklift, or small cylinder, you will need to review the first four modules in addition to the modules specific to your filling applications. Module 4 contains important information on cylinder components and markings, pre-fill inspection, purging, and the loading and transporting of cylinders.

Your training will not be complete unless you review the appropriate modules. Refer to the table in appendix A1 for further guidance of which modules should be taken as a prerequisite to others.

Propane Dispensers

Propane dispenser operators play a critical role in safely and efficiently dispensing propane into containers and vehicles.

Responsibilities include:

- Understanding the regulations, routine inspections, and operation of the dispensing equipment.
- Inspecting containers and vehicles to ensure that they are compliant and safe for filling.
- Filling containers to their proper levels and preventing them 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 how to safely handle and transport propane containers is important.

Safety tips for your customers may 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.

Your company may choose to distribute safety information to customers when propane containers are filled. One resource to consider, should your company provide safety information, is the pamphlet, "Important Propane Safety Information for Users of Small Cylinders."

Visit propanecouncil.org to download the pamphlet or to order copies.

A decorative graphic on the left side of the page, consisting of a large right-pointing arrow. The arrow is filled with a light gray color and has a darker gray outline. Inside the arrow, the number '2' is written in a bold, blue font.

2

Properties and Characteristics of Propane

Introduction

The safe dispensing of propane involves knowing its properties and characteristics and being aware of safety procedures. A Safety Data Sheet, or SDS, is available from propane suppliers or distributors and must be available and accessible to all employees at the workplace. The SDS provides important information on propane, including physical properties, health effects, first aid, safety precautions, and personal protective equipment.

Propane is stored as both a liquid and a vapor. As propane liquid turns to vapor, it expands 270 times. Because of the large expansion rate, a liquid propane leak can be more hazardous than a propane vapor leak.

Propane containers are usually filled to only 80% of their capacity to allow room for liquid propane to expand with an increase in temperature.



Propane is non-toxic, but its vapor can be dangerous to inhale because it can displace oxygen. Since propane vapor is heavier than air, propane released in a confined space may settle in low-lying areas. However, if there is sufficient air movement, especially outdoors, the vapor will quickly dissipate in the air.

Propane liquid becomes very cold when released to the atmosphere. This means if it comes in contact with your skin, it can cause frostbite or freeze burns. For this reason, appropriate gloves or other personal protective equipment resistant to propane should always be worn when filling containers. Your employer may require other safety equipment, depending on your specific responsibilities, so be sure to check with your supervisor.

Propane is a fuel; it will ignite and burn under the right conditions. Three ingredients are needed to start and sustain combustion: propane, oxygen, and an ignition source. 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

A strong, unpleasant-smelling chemical is added to propane so you can detect it. The chemical added to propane makes it smell like rotten eggs, a skunk's spray, or a dead animal. You should respond immediately to even a faint odor of propane.



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.



What You Should Know Before Dispensing Propane

Sources of Ignition

You should be aware of any potential ignition sources any time you are handling or transferring propane. Some examples include: a person smoking, open flames, internal combustion engines, and static electricity. Make sure you eliminate any potential ignition sources before handling or filling propane cylinders and tanks.

In the right conditions, a source of ignition such as a static discharge or spark may cause the ignition of some fuels, including gasoline and propane.

For more information on controlling static electricity, visit propanecouncil.org.

Uncontrolled Propane Leaks and Fires

An uncontrolled release of propane can be extremely dangerous and potentially cause a fire or an explosion. 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 safe to do so.

2. Evacuate the area immediately.

Everyone in the building, or area affected by the emergency, should evacuate immediately to a safe distance. 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.

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

Introduction

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 discusses equipment that is common to most dispensing stations. This section does not discuss autogas dispensers. Please review module 9 for more information on autogas dispensing station equipment.

Dispenser Components

There are two common types of propane dispensing station setups: vertical tank dispensers and horizontal tank dispensers. Dispensing equipment often varies from facility to facility.

Your system may or may not have all of the following components:

- Valves that control the flow of propane through the piping system.
- A metering system that measures how much propane is being filled into containers.
- An emergency break-away device designed to provide protection in case of a vehicle pull-away, by stopping the flow of propane if a person drives away with the hose attached.



Shutdown Systems

Most dispensers will have a shutdown system to stop the flow of propane in an emergency. Know where the system is located and know how to operate it.

Preparing the Dispenser

1. The first step in preparing the dispenser for operation is to 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:
 - » Close the downstream manual valve.
 - » Wait patiently for the excess flow valve to open; you may hear it click.
 - » 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.

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.

To shut down the dispenser:

- Close all valves at the storage tank.
- If so equipped, place the dust cap or plug in the hose end valve or filling adapter.
- Store the filler hose in the proper location.
- Close and lock the cabinet.

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





4

DOT Cylinders

Introduction

An important part of a dispenser operator’s job is being able to recognize various types of propane cylinders and understand their markings. This will help ensure that the cylinder is suitable for filling.

Most propane cylinders in service today are manufactured according to Department of Transportation (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 typically filled at a facility and delivered to industrial, commercial, or residential customers.



Common Elements of DOT Cylinders

Cylinder bodies are typically made from either aluminum or steel.

Every aluminum or steel cylinder has a foot ring. It is used to protect the bottom of the cylinder body from damage and also functions as a support stand or base.



Openings for valves and fittings are located in the service end of the cylinder. The number of openings depends on how the cylinder will be used.

Portable and exchange cylinders usually have one combination service valve and pressure-relief valve screwed into the top of the cylinder.

Vertical cylinders with 4 to 40 lb propane capacity must be fitted with an overfilling prevention device, or OPD.

OPD cylinder valves are distinctively marked and equipped with a unique handwheel in the shape of a modified triangle.

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 existing cylinders are not required to be fitted with an OPD.

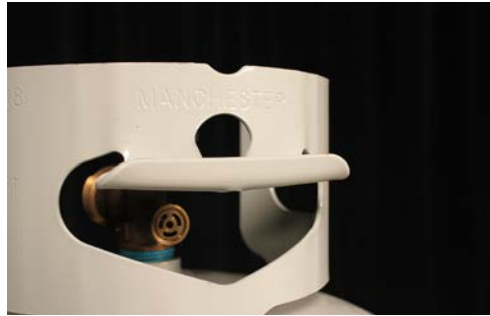
These include:

- Cylinders used in industrial truck service or mower applications
- Cylinders manufactured prior to 1998 and designed for use in the horizontal position
- Cylinders 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.

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



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 the cylinder specification design code, service pressure, cylinder tare weight, water capacity in pounds, manufacturer name, and test or requalification date.



The cylinder must be identified as a propane cylinder before filling it. Refer to appendix 4 for additional information on the entire cylinder marking requirements, as well as a table listing all the specification design codes for propane cylinders.

Cylinder capacity is marked by the pounds of water it can hold.

The tare weight 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 water capacity can have different tare weights, so each cylinder should be treated individually.

All refillable cylinders must be requalified at regular intervals. Requalification is not typically handled at dispenser locations, and should be performed only by trained individuals.

When reading the original date or 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 seven years of the marked date.
- The letter “E” following the date indicates that requalification is required again within five years of the marked date.
- The most recent requalification date must be marked on the cylinder.

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

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.

Pre-Fill Visual Inspection

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 able to spot any problems easily. 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
- Defective inner face seal of an OPD valve
- Defective or leaking pressure-relief device
- Damage to the cylinder valve, valve protection, and cylinder foot rings
- Evidence of physical abuse, fire or heat damage, or excessive rusting or corrosion
- Out-of-date requalification



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.



Cylinders set aside because of defects identified must not be refilled unless the cylinder has been repaired properly or replaced by a trained and qualified service technician. Contact your propane supplier for assistance.

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



Valves and accessories should also be inspected prior to filling. They should be checked regularly for signs of aging and wear.

Never look directly into a relief valve opening to inspect it. Instead, use a mirror to safely inspect the relief valve.

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

Valves may also become damaged through improper cylinder maintenance. For example, service personnel may fail to use proper brushes around cylinder openings when painting them. As a result, gauge faces, “weep” holes in filler valves, and discharge openings of relief valves may be 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. If you encounter this situation, set the cylinder aside in a designated safe area and contact the local fire or police department.



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 propane cylinder, it can slow down the filling operation, create unusually high service pressures, cause regulator freeze-up, or cause fading of the odorant in the cylinder.

Contact your propane supplier to make sure you have the appropriate equipment needed and that all purging is performed in a safe location.

Steps for Purging Cylinders with Propane Vapor

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.

Using propane vapor to force the air out of a cylinder is an effective purging method that is often used 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 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 as 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.

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.



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. Cylinders used in industrial applications must have additional warning information.



In addition, a consumer information or warning label must be on all portable refillable cylinders of 100 lb propane capacity or less.

Be sure to apply an appropriate 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 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 lb propane capacity with no single container having a capacity of more than 45 lb. Verify with 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.



Conducting a cylinder pre-fill inspection, purging a cylinder, labeling a cylinder, and preparing a cylinder for transportation enable you to safely serve both your customers and your company.



5

Filling Small Cylinders

Introduction

Before you begin the process of filling small cylinders, make sure that the dispenser is properly prepared and that the cylinder is safe to fill.

This module gives you the basic information needed to fill small propane cylinders. However, before you begin the filling process, you need to make sure that you review the first four modules of this program.

These four modules will provide you a better understanding of:

- How to safely handle and transfer liquid propane
- Information about dispensing equipment
- Various cylinder components
- Required cylinder markings
- Pre-fill visual inspection
- Requalification requirements
- Purging cylinders
- Labeling, loading, and transporting cylinders

You have not completed the necessary training to fill small propane cylinders unless you have completed modules 1 through 4 first.



Filling Cylinders

Before filling a cylinder, make sure you are aware of the following information regarding safety and handling procedures, and be sure to check with your supervisor for any exceptions.

- Know your facility's fire prevention and emergency evacuation plans, including where and how to operate emergency shutdown and pump controls. Please note that there are different types of emergency shutdown systems. Be sure you know how to operate the emergency shutdown system at your facility.
- Locate the nearest fire extinguishers and make sure they are in proper working condition. Know how to use the fire extinguishers according to your company policies. 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 to stop 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.

Pre-Filling Procedures

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

- Do not allow unauthorized people in the filling area.
- Open the secured filling area and inspect the cylinder filling station equipment.
- 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.
- Open the appropriate liquid outlet and bypass return valves on the storage tank.
- Verify the cylinder you are preparing to fill is a propane cylinder by reviewing the cylinder design code specification markings on the cylinder.
- Verify the cylinder is not out of date by checking the date code on the cylinder.
- Inspect the cylinder to be sure it's not damaged or leaking and is safe to fill.
 - » If the cylinder is new and has not been vacuum-purged or is a cylinder that has been open to the atmosphere, it will need to be purged properly before filling.
 - » If you find any defects that would prevent you from filling a cylinder, mark the cylinder and set aside in a designated safe area. Contact your propane supplier for assistance.

Please remember that a trained operator must be present during the entire filling procedure. Always put on appropriate personal protective equipment before filling cylinders.



Filling Portable Cylinders by Weight

When filling portable cylinders by weight, it's important to note that the steps involved may vary depending on the type of equipment installed at the facility.

The OPD should never be used for determining if a cylinder is full. It will not always stop the flow of propane into the cylinder at the proper fill amount.

Always consult your supervisor or propane supplier for more information.

Before beginning the filling process, make sure the platform scale is clear of all debris and obstructions. In addition, platform scales require periodic maintenance and should be checked for accuracy.

To fill cylinders by weight:

- Make sure all cylinder valves are closed.

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

- Check the water capacity and tare weight stamped on the cylinder or its protective collar.
- Determine propane capacity by using the following formula:
Propane Capacity [lb] = water capacity [lb] X .42
- Add the tare weight and propane capacity together to determine the total filled weight of the cylinder.
- Next, add the hose and fitting weight to the total filled weight of the cylinder. This is the scale set point. Set the platform scale to the set point. Make sure the scale is level and no obstructions interfere with proper operation. Always be present and pay close attention during the entire filling operation.
- Place the cylinder on the scale.
- Select the proper hose end adapter to fit the cylinder valve.
- Remove the protective cap or plug from the valve.
- Connect to the cylinder.



- ♦ Start the pump.
 - » If through a filler valve, slowly open the hose end valve.
 - » If through a service valve, open the hose end valve, then slowly open the cylinder service valve.
- ♦ When target weight is reached, close the hose end valve.
- ♦ Shut off the pump.
- ♦ Make sure the service valve is closed.
- ♦ Loosen the connection and wait for any trapped liquid to bleed off.
- ♦ When trapped liquid is vented, disconnect the hose end fitting.
- ♦ Verify the filled weight, as required by regulations.
- ♦ Use an approved method, such as a non-corrosive leak detector solution, to check for leaks.
- ♦ 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.
- ♦ Apply any required DOT and/or OSHA labels and a cylinder warning label if the manufacturer's label is not legible or you removed a paper or plastic sleeve.



Filling Portable Cylinders by Volume

Before filling cylinders by volume, 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.**

The OPD should never be used for determining if a cylinder is full. It will not always stop the flow of propane into the cylinder at the proper fill amount.

To fill cylinders by volume:

- ♦ Make sure all cylinder valves are closed.
- ♦ Select the proper hose end adapter to fit the filler valve or service valve.
- ♦ Remove the protective cap or plug from the valve.
- ♦ Connect the cylinder.
- ♦ Open the vent valve on the fixed maximum liquid level gauge.
If a white mist appears when the gauge is opened, stop!
The cylinder is already full.
- ♦ Start the pump.
 - » If through a filler valve, slowly open the hose end valve.
 - » If through a service valve, open the hose end valve and then slowly open the cylinder service valve.



- ♦ When a white mist begins to escape from the fixed maximum liquid level gauge, immediately close the hose end valve.
- ♦ Close the vent valve on the fixed maximum liquid level gauge.
 - » Failure to shut off the propane promptly will result in an overfilled cylinder. **Overfilling a cylinder can create a hazardous condition.**
- ♦ Shut off the pump.
- ♦ Make sure the cylinder service valve is closed.
- ♦ Loosen the connection and wait for any trapped liquid to bleed off.
- ♦ When trapped liquid has vented, disconnect the hose end fitting.
- ♦ Use an approved method, such as a non-corrosive leak detector solution to check for leaks.
- ♦ Reinstall appropriate valve caps and plugs.
 - » If the cylinder has a filler valve, reinstall the cap.
 - » If the cylinder has a PDL service valve, reinstall the valve plug.
- ♦ Replace any caps and plugs that are missing.
- ♦ Apply any required DOT and/or OSHA labels and a cylinder warning label if the manufacturer's label is not legible or you removed a paper or plastic sleeve.



Post-Filling Procedures

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

- Close the valves at the storage tank.
- 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. Secure the installation against tampering or unauthorized use.

Prior to returning the cylinder to the customer, be sure it is properly prepared for transportation. Refer to module 4 for additional loading and transportation requirements.





6

Refueling, Maintaining, and Troubleshooting Forklift Cylinders

Introduction

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

This module gives you the basic information needed to fill, maintain, and troubleshoot forklift cylinders. However, before you begin the filling process, you need to make sure that you review the first four modules of this program.

These four modules will provide you a better understanding of:

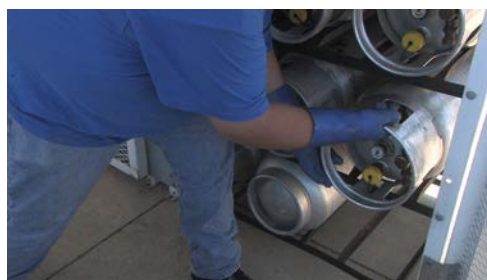
- How to safely handle and transfer liquid propane
- Information about dispensing equipment
- Various cylinder components
- Required cylinder markings
- Pre-fill visual inspection
- Requalification requirements
- Purging cylinders
- Labeling, loading, and transporting cylinders

You have not completed the necessary training to fill, maintain, or troubleshoot forklift cylinders unless you have completed modules 1 through 4 first.



Forklift Cylinder Construction

Forklift cylinders are refueled by refilling from a dispensing tank on site 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 steel. They typically hold 33 lb of propane, but other sizes are also available.

Every DOT cylinder has a foot ring. It is used to protect the bottom of the cylinder from damage and also functions as a support stand or base.

Forklift cylinders also have a protective collar. It 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.

If any of these parts become 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.

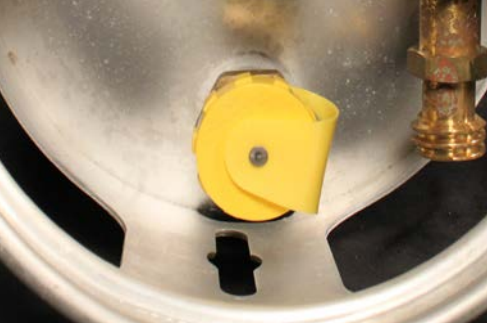


Forklift Cylinder Parts

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, 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 cap 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 shows the approximate fuel level.

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.

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.



Filling Cylinders

Before filling a cylinder, make sure you are aware of the following information regarding safety and handling procedures, and be sure to check with your supervisor for any exceptions.

- Know your facility’s fire prevention and emergency evacuation plans, including where and how to operate emergency shutdown and pump controls. Please note that there are different types of emergency shutdown systems. Be sure you know how to operate the emergency shutdown system at your facility.
- Locate the nearest fire extinguishers and make sure they are in proper working condition. Know how to use the fire extinguishers according to your company policies. 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 to stop 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.

Pre-Filling Procedures

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

- Do not allow unauthorized people in the filling area.
- Open the secured filling area and inspect the cylinder filling station equipment.
- 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.
- Open the appropriate liquid outlet and bypass return valves on the storage tank.
- Verify the cylinder you are preparing to fill is a propane cylinder by reviewing the cylinder design code specification markings on the cylinder.
- Verify the cylinder is not out of date by checking the date code on the cylinder.
- Inspect the cylinder to be sure it's not damaged or leaking and is safe to fill.
- If the cylinder is new and has not been vacuum-purged or is a cylinder that has been open to the atmosphere, it will need to be purged properly before filling.
- If you find any defects that would prevent you from filling a cylinder, mark the cylinder and set it aside in a designated safe area. Contact your propane supplier for assistance.

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.

Always put on appropriate personal protective equipment before filling cylinders. In addition, a trained operator must be present during the entire filling process.

Filling Forklift Cylinders by Weight

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

Before beginning the filling process, make sure the platform scale is clear of all debris and obstructions. In addition, platform scales require periodic maintenance and should be checked for accuracy.

To fill a forklift cylinder by weight:

- Make sure all cylinder valves are closed.

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

- Check the water capacity and tare weight stamped on the cylinder or its protective collar.
- Determine propane capacity by using the following formula:
Propane Capacity [lb] = water capacity [lb] X .42
- Add the tare weight and propane capacity together to determine the total filled weight of the cylinder.
- Next, add the hose and fitting weight to the total filled weight of the cylinder. This is the scale set point. Set the platform scale to the set point. Make sure the scale is level and no obstructions interfere with proper operation. Always be present and pay close attention during the entire filling operation.
- Place the cylinder on the scale.
- Select the proper hose end adapter to fit the cylinder valve.
- Remove the protective cap or plug from the valve.
- Connect to the cylinder.



- Start the pump.
 - » If through a filler valve, slowly open the hose end valve.
 - » If through a service valve, open the hose end valve, then slowly open the cylinder service valve.
- When target weight is reached, close the hose end valve.
- Shut off the pump.
- Make sure the service valve is closed.
- Loosen the connection and wait for any trapped liquid to bleed off.
- When trapped liquid is vented, disconnect the hose end fitting.
- Verify the filled weight, as required by regulations.
- Use an approved method, such as a non-corrosive leak detector solution, to check for leaks.
- Reinstall appropriate valve caps and plugs.
 - » If the cylinder has a filler valve, reinstall the cap.
 - » Replace any caps and plugs that are missing.
- Apply any required DOT and/or OSHA labels and a cylinder warning label if the manufacturer's label is not legible or you removed a paper or plastic sleeve.



Filling Forklift Cylinders by Volume

Before filling cylinders by volume, 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:

- Make sure all cylinder valves are closed.
- Select the proper hose end adapter to fit the filler valve or service valve.
- Remove the protective cap or plug from the valve. Connect the cylinder.
- Open the vent valve on the fixed maximum liquid level gauge. If a white mist appears when the gauge is opened, stop! The cylinder is already full.
- Start the pump.
 - » If through a filler valve, slowly open the hose end valve.
- When a white mist begins to escape from the fixed maximum liquid level gauge, immediately close the hose end valve.
- Close the vent valve on the fixed maximum liquid level gauge. Failure to shut off the propane promptly will result in an overfilled cylinder. Overfilling a cylinder can create a hazardous condition.



- Shut off the pump.
- Loosen the connection and wait for any trapped liquid to bleed off.
- When trapped liquid has vented, disconnect the hose end fitting.
- Reinstall appropriate valve caps and plugs. If the cylinder has a filler valve, reinstall the cap.
- Replace any caps and plugs that are missing.
- Apply any required DOT and/or OSHA labels and a cylinder warning label if the manufacturer’s label is not legible or you removed a paper or plastic sleeve.
- Position the cylinder securely, using the locating pin on the truck and the hole in the cylinder collar. Secure the hold-down straps properly.
- Reconnect the fuel line and check the cylinder and its valves for leaks with a non-corrosive leak detector solution. Inspect the gaskets and “O” rings in the filler valve and service valve connector for defects or leaks.



Post-Filling Procedures

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

- Close the valves at the storage tank.
- 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. Secure the installation against tampering or unauthorized use.

Cylinder Exchange

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 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 an approved method, such as a non-corrosive leak detector solution. If a leak is found, close the valve immediately and notify your supervisor or manager. If no leaks are found, start the engine and proceed with your work.



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7

Refueling Motorhomes and Other Vehicle-Mounted ASME Tanks

Introduction

Propane dispensers are used to refuel motorhome tanks and other vehicle-mounted ASME tanks such as catering truck tanks. This module does not include information on filling motor fuel tanks [see Module 9: Dispensing Propane Autogas].



This module gives you the basic information needed to fill motorhome tanks and other vehicle-mounted ASME tanks. However, before you begin the filling process, you need to make sure that you review the first three modules of this program. These three modules will provide you a better understanding of how to safely handle and transfer liquid propane as well as a review of the dispensing equipment you will use.

You have not completed the necessary training to fill motorhome and other vehicle-mounted ASME tanks unless you have completed modules 1 through 3 first.

Features of Vehicle-Mounted ASME Tanks

There are several variations of vehicle-mounted ASME tanks. All variations are equipped with a(n):

- 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 with a tube inside at the maximum liquid filling line.

Fuel tank float gauges are used to confirm the liquid level before and after filling. They are not used for filling but rather to let you know when you need a refill.

The filler valve assembly may include a stop-fill/auto-stop valve that acts as an overfill protection device similar to those used in portable DOT cylinders.

Motorhome tanks and other vehicle-mounted 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.

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.



Inspecting Tank, Valves, and Hoses

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

- Filler valve threads or gaskets
- Fixed maximum liquid level gauge
- Vapor service hose or valve
- Relief valve or pipe-away hose
- The tank — dents, gouges, or significant corrosion
- Float gauge face — cracks or other damage



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.

Filling Motorhome or Other Vehicle-Mounted ASME Tanks

Before filling a vehicle-mounted ASME tank, make sure no one is inside the vehicle and that the ignition is turned off.

Customers should be restricted from the immediate area around the liquid propane filling operation.

Make sure there are no ignition sources within 25 feet of the fill connection 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 motorhomes and catering trucks 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 before starting the filling process.

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

Always put on appropriate personal protective equipment before starting the filling operation.

- Set the propane meter to zero.
- Connect the fill hose to the tank fill valve.
- Open the vent valve on the 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 the pump and slowly open the valve on the end of the hose.
- 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 hose end valve.
- Close the fixed maximum liquid level gauge.
- Shut off the pump.
- Slowly loosen the filler adapter to vent liquid propane trapped between the filler adapter and the tank filler valve. Wait until propane stops venting before completely disconnecting the adapter.
- Check the valve for leaks and replace the dust cap.



If it is not your company's policy to light customer pilot lights, you should advise the customer to have a professional service company or gas distributor light the pilot lights. 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 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 fuel system and safe filling procedures will ensure your safety as well as that of your customers.



8

Dispensing Propane Safely for Mowers

Introduction

Propane lawn mowers offer many benefits to professional landscape contractors, including reduced costs, lower emissions, and long run times between fills. Refueling propane equipment is an easy and safe process, if you follow the proper procedures.

In order to ensure your safety and the safety of your co-workers when dispensing propane, you should know about the fuel, equipment, regulations, and processes that are involved in refueling propane mowers.

This module gives you the basic information needed to fill propane mower cylinders. However, before you begin the filling process, you need to make sure that you review the first four modules of this program.

These four modules will provide you a better understanding of:

- How to safely handle and transfer liquid propane
- Information about the dispensing equipment
- Various cylinder components
- Required cylinder markings
- Pre-fill visual inspection
- Requalification requirements
- Purging cylinders
- Labeling, loading, and transporting cylinders

You have not completed the necessary training to fill propane mower cylinders unless you complete modules 1 through 4 first.



If you refuel propane mowers, there are several responsibilities that come with the job. They include:

- Understanding the routine inspections, operation, and regulations that apply to the dispensing equipment.
- Making sure that the correct type of cylinder is being used on the mower.
- Inspecting cylinders to ensure that they are safe for filling.
- Filling cylinders to their proper levels and preventing containers from being overfilled.
- Maintaining the security of the propane dispenser and transfer area by confining or restricting ignition sources, and preventing tampering or the release of propane.
- Shutting down and securing the dispenser in the event of an emergency.

Whether you have an on-site propane refueling station or are simply exchanging cylinders, this manual will provide you with the necessary information needed to safely refuel your mower.

Propane Cylinders

There are two types of propane cylinders that are used on mowers. The most common are cylinders that use a left-hand thread and have a vapor service valve, commonly referred to as outdoor power equipment or mower cylinders. These have a colored, usually green, collar and are designed specifically for mower applications.

Some mowers designed to use forklift cylinders have a right-hand thread and a liquid service valve. The different threads prevent users from installing the wrong type of cylinder on the mower. If you are not sure which type of cylinder your mower requires, please consult your equipment manufacturer or dealer.

Do not attempt to modify, convert, or otherwise tamper with the valves on the cylinder or mower, as they are not interchangeable.

Both types of propane cylinders have common valves and gauges. These may include:

- Pressure-relief valve
- Filler valve
- Fixed maximum liquid level gauge
- Fuel gauge
- Liquid or vapor service valve



The pressure-relief valve provides overpressure protection to the cylinder. If the pressure inside the container becomes too high, the relief valve releases vapor and reduces the pressure to a safe level. It should be kept clean, unrestricted, and set to the 12 o'clock position when the cylinder is mounted horizontally, whether on a mower or in a storage rack. A rain cap or dust cap must also be in place.

Most cylinders have a filler valve. The valve has an internal check valve that prevents fuel from leaving the cylinder. The filler valve should be covered with a plastic cap. Some filler valves may contain an overfill prevention device, or OPD.

The fixed maximum liquid level gauge indicates when the maximum permitted filling level has been reached in the cylinder. When the level of liquid propane reaches the tube opening, liquid propane emits out of the vent valve, signaling the operator to stop filling.

Cylinders may also have a fuel gauge that shows the approximate fuel level.

Mower-specific cylinders with a left-hand thread have a vapor service valve. Forklift cylinders with a right-hand thread have a liquid service valve. Each valve has an internal check valve to prevent fuel from leaving the cylinder. When the cylinder is in use, the valve must be opened completely.



Liquid and vapor service valves are equipped with a male quick-disconnect coupling, which acts as an added check valve. A hose that is part of the carburetion system is equipped with the female portion of the coupling. 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.

Both the washer and the “O” ring should be replaced if they show signs of wear, abuse, or leakage.



Filling Mower Cylinders

Before filling a cylinder, make sure you are aware of the following information regarding safety and handling procedures, and be sure to check with your supervisor for any exceptions:

- Know your facility's fire prevention and emergency evacuation plans, including where and how to operate emergency shutdown and pump controls. Please note that there are different types of emergency shutdown systems. Be sure you know how to operate the emergency shutdown system at your facility.
- Locate the nearest fire extinguishers and make sure they are in proper working condition. Know how to use the fire extinguishers according to your company policies. 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 to stop the flow of propane.
- Ensure there are no ignition sources within 25 feet of the filling area, or metal-working operations — including grinding, oxygen fuel gas cutting, brazing, soldering, or welding — within 35 feet.



Pre-Filling Procedures

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

- Do not allow unauthorized people in the filling area.
- Open the secured filling area and inspect the cylinder filling station equipment.
- 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.
- Open the appropriate liquid outlet and bypass return valves on the storage tank.
- Verify the cylinder you are preparing to fill is a propane cylinder by reviewing the cylinder design code specification markings on the cylinder.
- Verify the cylinder is not out of date by checking the date code on the cylinder.
- Inspect the cylinder to be sure it's not damaged or leaking and is safe to fill.
- If the cylinder is new and has not been vacuum-purged or is a cylinder that has been open to the atmosphere, it will need to be purged properly before filling.
- If you find any defects that would prevent you from filling a cylinder, it should be marked and set aside in a designated safe area. Contact your propane supplier for assistance.



Remember that a trained operator must be present during the entire filling procedure.

There are two ways to fill a mower cylinder. They can be filled by weight, using an accurate and approved method, or they can be filled by volume, using the fixed maximum liquid level gauge. All cylinders must be filled outdoors or in an approved filling area.

Whether filling by weight or volume, the following steps should be taken before you fill or exchange your cylinder:

- Park the mower and turn off the engine. Set the parking brake.
- Put on appropriate personal protective equipment.
- Touch a grounded object to control static electricity.
- Close the service valve.
- Unscrew the service line fitting. If you have a left-hand thread, loosen to the right. If it's a right-hand thread, loosen to the left.
- Remove cylinder from the mower and set upright on level ground.
- Inspect cylinder and valves for leaks, wear, and damage.
- Make sure all cylinder valves are closed.



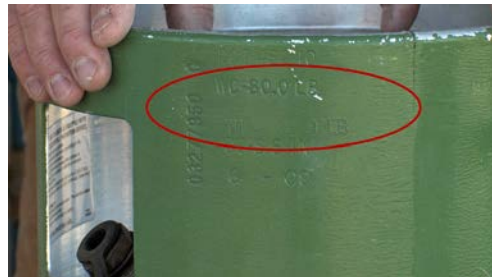
Filling Mower Cylinders by Weight

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

Before beginning the filling process, make sure the platform scale is clear of all debris and obstructions. In addition, platform scales require periodic maintenance and should be checked for accuracy.

To fill cylinders by weight, follow these steps to determine the total filled weight of a cylinder:

- Check the water capacity and tare weight stamped on the cylinder or its protective collar.
- Determine propane capacity by using the following formula:
Propane Capacity [lb] = water capacity [lb] X .42
- Add the tare weight and propane capacity together to determine the total filled weight of the cylinder.
- Next, add the hose and fitting weight to the total filled weight of the cylinder. This is the scale set point. Set the platform scale to the set point. Make sure the scale is level and no obstructions interfere with proper operation. Always be present and pay close attention during the entire filling operation.
- Place the cylinder on the scale.
- Select the proper hose end adapter to fit the cylinder valve.



- Remove the protective cap or plug from the valve.
- Connect the dispensing hose by rotating the filler nozzle clockwise until it is firmly attached to the filler valve.
- Start the pump and slowly open the filler nozzle or hose end valve.
- When target weight is reached, close the filler nozzle or hose end valve.
- Shut off the pump.
- Loosen the connection and wait for any trapped liquid to bleed off.
- When all trapped liquid has been vented, disconnect the filler nozzle or hose end fitting.
- Verify the filled weight.
- Reinstall appropriate valve caps and plugs. Replace any caps and plugs that are missing.
- Apply any required DOT and/or OSHA labels and a cylinder warning label if the manufacturer's label is not legible or you removed a paper or plastic sleeve.



Filling Mower Cylinders by Volume

Before filling cylinders by volume, 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. Remember to always be present and pay close attention during the entire filling operation:

- Select the proper nozzle or hose end adapter to fit the filler valve or service valve.
- Remove the protective cap or plug from the valve.
- Connect the cylinder.
- Open the vent valve on the fixed maximum liquid level gauge. If a white mist appears when the gauge is opened, stop! The cylinder is already full.



- ♦ Start the pump.
 - » If through a filler valve, slowly open the filler nozzle or hose end valve.
 - » If through a service valve, open the filler nozzle or hose end valve and then slowly open the cylinder service valve.
- ♦ When a white mist begins to escape from the fixed maximum liquid level gauge, immediately close the hose end valve.
- ♦ Close the vent valve on the fixed maximum liquid level gauge. Failure to shut off the propane promptly will result in an overfilled cylinder. **Overfilling a cylinder can create a hazardous condition.**
- ♦ Shut off the pump.
- ♦ Make sure the cylinder service valve is closed.
- ♦ Loosen the connection and wait for any trapped liquid to bleed off.
- ♦ When all trapped liquid has been vented, disconnect the filler nozzle or hose end fitting.
- ♦ Reinstall appropriate valve caps and plugs. Replace any caps and plugs that are missing.
- ♦ Apply any required DOT and/or OSHA labels and a cylinder warning label if the manufacturer's label is not legible or you removed a paper or plastic sleeve.



Post-Filling Procedures

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

- Close the valves at the storage tank.
- 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. Secure the installation against tampering or unauthorized use.



Cylinder Exchange

When exchanging a mower cylinder, the following steps should be taken as you bring your mower to the protective storage cage:

- Park the mower and turn off the engine. Set the parking brake.
- Put on appropriate personal protective equipment.
- Touch a grounded object to control static electricity.
- Close the service valve.
- Unscrew the service line fitting. If you have a left-hand thread, loosen to the right. If it's a right-hand thread, loosen to the left.



- Remove cylinder from the mower and store in a designated safe area.
- Select a full cylinder.
- Inspect cylinder and valves for leaks, wear, and damage.
- Make sure all cylinder valves are closed.



Placing Cylinders onto Mowers

If the cylinder is installed horizontally, position the cylinder securely using the alignment pin on the saddle that matches the hole in the collar of the cylinder. Secure the hold-down straps properly. Make sure the pressure-relief valve is set to the 12 o'clock position.

In some instances, alignment pins may be missing or have broken off. If your mower has a missing or broken pin, it should be replaced immediately as it can cause a serious safety problem.



If the cylinder is installed vertically, simply position the cylinder securely in the cradle and secure the hold-down straps properly.

Make sure the service valve is closed before connecting the fuel line.

Reconnect the fuel line and slowly open the service valve. 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. If a leak is found, close the service valve immediately and notify your supervisor.



If no leaks are found, start mower and you are ready to go.

Refueling propane lawn mowers is an efficient and easy process when performed safely. Remember to always properly refuel your mower and do not take shortcuts. Your safety and the safety of your co-workers depend on it.



9

Dispensing Propane Autogas

Introduction

Propane autogas dispensing stations across the U.S. offer a safe, convenient, and quick fueling source for vehicles. In order to ensure your safety and the safety of your co-workers, you should know about the fuel, equipment, processes, and regulations that are involved in fueling these vehicles.

This module gives you the basic information needed to fill propane autogas tanks. However, before you begin the filling process, you need to make sure that you review the first two modules of this program. These two modules will provide you a better understanding of how to safely handle and transfer liquid propane.

You have not completed the necessary training to fill propane autogas tanks unless you have complete modules 1 and 2 first.



Dispensing Station Equipment

Propane autogas dispensing systems are very similar to gasoline or diesel dispensing systems, with a few important differences:

- Propane autogas dispensers are closed, pressurized systems that keep the propane in its liquid state.
- Most dispensers use a gasoline-style, low-emission nozzle that has a closed, threaded connection to maintain pressure while transferring the fuel. Some dispensers use a low-emission nozzle that does not have a threaded connection and is placed directly on the filling connection.



To dispense propane autogas safely, be familiar with the specific equipment you are working with and how to use it. Just like a gasoline station and gasoline pump, each propane autogas fueling site and dispenser will have instructions on the correct use of the equipment. Equipment at fueling sites vary, so always follow instructions at your site.

Refueling a Vehicle: Preparation

Before refueling a vehicle, 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 the emergency shutoff valve. Please note that there are different types of emergency shutdown systems. Be sure you know how to operate the emergency shutdown system at your facility.
- Locate the nearest fire extinguishers and make sure they are in proper working condition. Know how to use the fire extinguishers according to your company policies. Only use fire extinguishers to create an escape route — not to fight a propane autogas fire. The only safe way to extinguish a propane autogas fire is to stop the flow of fuel.
- Ensure there are no ignition sources within 25 feet of the filling area, or metal-working operations — including grinding, oxygen-fuel gas cutting, brazing, soldering, or welding — within 35 feet.

Make sure that a propane decal is in the lower-right of the rear of the vehicle, above the bumper. This is required on propane autogas-fueled vehicles.

Inspect the dispensing equipment. Check for signs of damage or areas that could be leaking. Check the hose and filler nozzle for signs of wear. If you smell propane, or see or hear a propane leak, do not fill the vehicle.



In addition, be sure to follow any instructions for inspection or operation of the vehicle that are provided to you by the manufacturer or your propane autogas supplier.

Refueling a Vehicle: Connecting

Much like with conventional fuels, refueling a vehicle with propane autogas is a simple, efficient, and safe process. Follow these steps:

- Park on level ground near the dispenser to ensure that the tank is filled properly.
- Turn off the vehicle. Make sure that no one is inside the vehicle while you refuel.
- Do not allow unauthorized people in the filling area.
- Remember that an operator must be present during the entire filling procedure.
- Do not smoke strike matches, or light a cigarette lighter.
- Do not use cell phones or other electronic devices.
- Put on appropriate personal protective equipment.
- Touch a grounded object to control static electricity.
- Remove the motor fuel filler valve cap
 - by turning the cap counter-clockwise.
 - Be sure to keep track of the cap for replacement after refueling.



- Inspect the filler valve. Make sure the “O” ring in the filler valve is seated in the groove and is not damaged or missing. Never connect the filler nozzle to the filler valve if the “O” ring is missing or damaged. This could result in a release of propane, with the potential for injury or fire.
- Connect any fill hose end valve adapter, if necessary.
- If you have a threaded nozzle, connect the propane autogas filler nozzle to the motor fuel filler valve, and rotate the filler valve nozzle clockwise until it is firmly attached to the filler valve. Make sure the nozzle is properly threaded; an improperly threaded nozzle could lead to a dangerous leak.
- If you have a nozzle that does not have a threaded connection, push the nozzle securely on the filling connection. The nozzle will automatically lock onto the connector when the trigger is squeezed. As a built-in safety device, if the nozzle is not connected properly, propane will not be dispensed.



Refueling a Vehicle: Dispensing Propane Autogas

- Activate or “turn on” the dispenser.
- Slowly squeeze the nozzle trigger to begin fueling.
- When the OPD stops the flow of fuel into the tank, close the filler nozzle.
- Turn off the dispenser.
- Disconnect the filler nozzle by rotating the nozzle connector counter-clockwise, and return it to the dispenser. If you have a non-threaded nozzle, the nozzle and connection will separate automatically when the trigger is released. Once this occurs, you can return the nozzle to the dispenser.
- Check for leaks near the filler valve. Follow your company’s policy if you observe a leak. Replace the filler valve cap, if applicable.
- You are now ready to go.



Refueling propane autogas vehicles is a safe, efficient, and quick process. Always refuel your vehicle properly and do not take shortcuts. Your safety and the safety of your co-workers depend on it.



A1

Composite Cylinders

Introduction

Composite cylinders are different in many ways from steel and aluminum cylinders. 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 may be translucent, which means that the user can easily see the liquid level in the cylinder and avoid unexpected fuel run-outs.

The service and fill connections on composite cylinders are identical to those connections on valves used in steel or aluminum cylinders. No adapters are necessary to use or fill composite cylinders.



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.
- If a composite cylinder is dropped from a distance of four feet or greater, 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 five years old. If the latest inspection date is more than five years old, the cylinder 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 permanently 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

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.



Filling Composite Cylinders by Weight

Composite cylinders less than 200 lb water-capacity 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 “hazmat 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 DOT special permits for composite cylinders is that a copy of the manufacturer’s DOT special permit for the specific composite cylinder filled must be maintained at each facility where the cylinder is offered or reoffered for transportation.

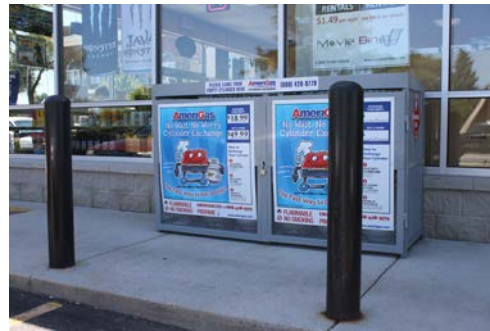




Retail Cylinder Exchange Operations

Introduction

Cylinder exchange cabinets provide a convenient way for recreational and grill cylinder customers to obtain fuel. Retail exchange 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 gas stations, campground grocery stores, and truck stops.



Consult with your local Authority Having Jurisdiction [AHJ] should you have questions regarding the proper location or other code requirements for a retail cylinder exchange cabinet.

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

Cylinders stored at a location open to the public must be protected by a fenced enclosure, a lockable ventilated metal locker, or a 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 warning, and product identification labels. Check with your supervisor or manager 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 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 sources of ignition, 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.



Cylinders, either empty or full, must never be permitted indoors, so make sure customers and fellow employees are aware of this safety precaution.



Safety Requirements

If more than 720 lb 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 lb of dry chemical with a B:C rating and be located no more than 50 feet from the storage location.

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



Pre-Requisite Module Table

Pre-Requisite Module Table

Type of Cylinder or Tank to Fill	Pre-Requisite Module
Small Portable Cylinders [Module 5]	1, 2, 3, 4
Forklift Cylinders [Module 6]	1, 2, 3, 4
Motorhome and Other Vehicle-Mounted ASME Tanks [Module 7]	1, 2, 3
Mower Cylinders [Module 8]	1, 2, 3, 4
Autogas Vehicle Tanks [Module 9]	1, 2



DOT Cylinder Code Chart

DOT Cylinder Code Chart

DOT Cylinder Code Chart			
DOT/ICC Cylinder Codes for Propane Service	Typical Cylinder Material	Cylinder Construction	Service Pressure (PSIG)
3A	Steel	Seamless	240 or 300
3AA	Steel	Seamless	240 or 300
3B	Steel	Seamless	240 or 300
4B240	Steel	2 or 3 pc., Welded, or Brazed	240
4BA240	Alloy Steel (Prescribed)	2 or 3 pc., Welded, or Brazed	240
4BA260	Alloy Steel (Prescribed)	2 or 3 pc., Welded, or Brazed	260
4BA300	Alloy Steel (Prescribed)	2 or 3 pc., Welded, or Brazed	300
4BW240	Steel (Prescribed)	3 pc., Welded	240
4BW300	Steel (Prescribed)	3 pc., Welded	300
4E240	Aluminum	2 pc., Welded	240
4E300	Aluminum	2 pc., Welded	300
39-240/300 (Non-refillable)	Steel	Welded	240
*ICC 26-150	Steel	Welded	150
*ICC 26-300	Steel	Welded	300

*NOTE: Cylinders are no longer manufactured under this code; however, cylinders manufactured under this code are still in use today. Also, the term “service pressure” for these codes had a different meaning at the time the code was written.



Module Quizzes

Modules 1–2 Quiz: Introduction to Dispensing Propane Safely, and Properties and Characteristics of Propane

1. Which is NOT a responsibility of a propane dispenser operator?
 - a. Understanding the regulations and operations of the dispensing equipment
 - b. Repairing defective and damaged cylinders
 - c. Inspecting customer cylinders and containers to ensure they are safe for filling
 - d. Filling containers to their proper levels and preventing them from being overfilled
2. Important safety tips to tell customers before transporting propane cylinders include:
 - a. Always transport and store a cylinder in a secure and upright position so it will not fall, shift, or roll.
 - b. Never keep a filled cylinder inside a hot vehicle.
 - c. Always proceed directly to your destination and immediately remove the cylinder from your vehicle.
 - d. All of the above
3. What is an SDS?
 - a. A detailed procedure for inspecting propane containers
 - b. A detailed procedure for filling propane cylinders
 - c. An information bulletin that alerts you to properties and health hazards of propane
 - d. A consumer safety information packet
4. _____ is added to propane to increase the likelihood that a leak will be detected.
 - a. Moisture
 - b. An identifying color
 - c. Additional vapor
 - d. Odorant
5. In order to allow for liquid expansion, propane containers are typically filled to ____% of their capacity.
 - a. 25
 - b. 40
 - c. 65
 - d. 80

6. Propane liquid released into the air will expand to _____ times its original volume.
- a. 2.15
 - b. 9.6
 - c. 270
 - d. 350
7. The proper mixture of propane vapor, air, and _____ is needed for propane to burn.
- a. nitrogen
 - b. humidity
 - c. odorant
 - d. an ignition source
8. If propane liquid comes in contact with your skin, it can cause _____.
- a. a rash
 - b. frostbite or freeze burns
 - c. redness similar to a sunburn
 - d. a slight irritation
9. Gloves and other PPE are required when filling containers because of the _____ of liquid propane.
- a. refrigerating effect (potential for freeze burns)
 - b. vaporization rate
 - c. expansion properties
 - d. toxicity
10. In the event of an uncontrolled propane leak or fire, what should you do?
- a. Shut down the dispenser, if safe to do so.
 - b. Evacuate the area immediately.
 - c. Call for help.
 - d. All of the above

Module 3 Quiz: Dispensing Station Equipment

1. Most propane dispensers include a(n) _____ that supplies propane to the dispensing equipment.
 - a. metering system
 - b. platform scale
 - c. scale
 - d. ASME storage tank
2. The two common types of propane dispensing set-ups include horizontal tank dispensers and _____.
 - a. underground tank dispensers
 - b. mobile tank dispensers
 - c. vertical tank dispensers
 - d. round tank dispensers
3. _____ control the flow of propane through the piping system of a dispenser.
 - a. Valves
 - b. Plugs
 - c. Gears
 - d. Meters
4. Most dispensers have a(n) _____ to stop the flow of propane in an emergency.
 - a. alarm
 - b. OPD
 - c. shutdown system
 - d. hose-end valve
5. When preparing the dispenser for use, _____ open the liquid outlet valve and the first downstream manual valve.
 - a. slowly
 - b. quickly
 - c. halfway
 - d. None of the above
6. When the operator is not in attendance, the dispenser should be _____.
 - a. maintained and lubricated
 - b. shut down and secured
 - c. calibrated and cleaned
 - d. opened to the public

Module 4 Quiz: DOT Cylinders

1. The _____ is a wide metal band welded or brazed to the bottom of the cylinder and used to protect the cylinder body from corrosion or damage.
 - a. valve opening
 - b. OPD
 - c. pressure-relief valve
 - d. foot ring
2. An OPD serves as a _____.
 - a. primary means of preventing overfilling of cylinders
 - b. secondary means of preventing overfilling of cylinders
 - c. means of protection for the cylinder valves
 - d. handle for lifting the cylinder
3. To protect the valves, portable cylinders use a _____.
 - a. collar
 - b. NTP fitting
 - c. foot ring
 - d. OPD
4. Which of the following indicates the weight of the cylinder when empty?
 - a. Water capacity
 - b. Requalification date
 - c. Design code
 - d. Tare weight
5. Which of the following is typically NOT the responsibility of a propane dispenser operator?
 - a. Pre-fill visual check
 - b. Scale calibration
 - c. Cylinder requalification
 - d. Customer education
6. Cylinders may NOT be filled if they are past their _____ date.
 - a. annual inspection
 - b. requalification
 - c. maintenance test
 - d. DOT fitness

7. Before a cylinder can be filled or refilled, DOT regulations require a _____ to verify it is fit for continued service.
- visual check
 - requalification
 - cylinder stress test
 - purging
8. Prior to inspecting a cylinder, you should _____ to help spot any problems.
- wash the cylinder with soap and water
 - open the service valve
 - remove any plastic or paper sleeves
 - All of the above
9. Problems that prevent filling a cylinder include:
- Cracks or leaks
 - Bulging, denting, or gouging
 - Out-of-date requalification
 - All of the above
10. A blue-green stain on the brass portion of the cylinder valve is evidence that it has been in contact with _____.
- methanol
 - anhydrous ammonia
 - ethyl mercaptan
 - polyethylene
11. Which of the following problems can be caused by cylinders NOT properly purged of air or moisture?
- Fading of the odorant in the cylinder
 - Unusually low service pressures
 - Regulator overheating
 - Inaccurate weight when filling
12. DOT requires that all cylinders be clearly labeled with _____.
- consumer and warning information
 - valve size and propane capacity
 - NFPA 704 information and storage tips
 - shipping name and hazard class

13. Consumer information/warning labels must be on all portable refillable cylinders of _____ pounds propane capacity or less not filled on site.
- a. 20
 - b. 33
 - c. 45
 - d. 100
14. Many jurisdictions limit closed-bodied vehicles such as passenger cars and vans to a maximum of _____ pounds propane capacity, with no single container having a capacity of more than _____ pounds.
- a. 80, 30
 - b. 90, 45
 - c. 100, 50
 - d. 150, 75
15. If a cylinder warning label is NOT legible or if the paper or plastic sleeve is removed during inspection, _____ before releasing the cylinder to the customer.
- a. place a new cylinder warning label on it
 - b. have the customer sign a waiver
 - c. orally deliver safety information
 - d. contact the supervisor
16. New cylinders that have NOT been vacuum-purged by the manufacturer and cylinders that have been opened to the atmosphere must be _____ prior to filling.
- a. reconditioned
 - b. repainted
 - c. purged of air or moisture
 - d. requalified

Module 5 Quiz: Filling Small Cylinders

1. Only use fire extinguishers to create an escape route — NOT to fight a propane fire.
 - a. True
 - b. False
2. Before operating a filling station, ensure there are no ignition sources within _____ feet of the points of transfer.
 - a. 5
 - b. 10
 - c. 25
 - d. 50
3. Before starting the cylinder filling operation, which of the following steps must you always follow?
 - a. Do not allow unauthorized people in the filling area.
 - b. Always put on appropriate personal protective equipment.
 - c. Inspect all cylinder filling equipment before use.
 - d. All of the above
4. Because platform scales have built-in safety features, it is not necessary to make sure the scale is clear of debris or obstructions before use.
 - a. True
 - b. False
5. Always verify the cylinder you are preparing to fill is a propane cylinder by reviewing the design code specification markings on the cylinder.
 - a. True
 - b. False
6. Container water capacity is multiplied by _____% when determining propane capacity.
 - a. 24
 - b. 36
 - c. 42
 - d. 58

7. When filling a cylinder by weight, the scale set point should equal the _____.
- a. tare weight + propane capacity [lb]
 - b. tare weight + propane capacity [lb] + hose and fitting weight
 - c. propane capacity [lb] + hose and fitting weight
 - d. tare weight + propane capacity [lb] - hose weight
8. After filling the cylinder, you need to _____ to complete the job.
- a. check for leaks using an approved method
 - b. reinstall appropriate valve caps and plugs
 - c. apply any required labels if missing or not legible
 - d. All of the above
9. When filling a cylinder by volume using the fixed maximum liquid level gauge, the filling process relies on the _____ to determine when the maximum permitted filling limit for a cylinder is reached.
- a. sensor
 - b. trip lever
 - c. operator
 - d. control valve
10. When filling a cylinder by volume and a white mist begins to escape from the fixed maximum liquid level gauge, you need to immediately _____.
- a. shut off the pump
 - b. check for leaks
 - c. close the hose end valve
 - d. close the service valve

Module 6 Quiz: Refueling, Maintaining, and Troubleshooting Forklift Cylinders

1. Forklift cylinders typically hold _____ pounds of propane.
 - a. 20
 - b. 33
 - c. 45
 - d. 100
2. The purpose of the O-ring inside the forklift connector is to provide _____.
 - a. weather protection
 - b. a gas-tight seal
 - c. protection from debris
 - d. refueling safety
3. Pressure-relief valves should be directed upward at a _____ degree angle when the forklift cylinder is mounted horizontally.
 - a. 30
 - b. 45
 - c. 60
 - d. 90
4. Relief valves on forklift cylinders must be replaced within _____ years of the cylinder's manufacture date and every 10 years thereafter.
 - a. 5
 - b. 7
 - c. 12
 - d. 18
5. Leaks, cracks, or bulging are often discovered during a cylinder _____ inspection.
 - a. pre-fill
 - b. tare weight
 - c. operational
 - d. post-fill
6. Tare weight is required when calculating cylinder filling by _____.
 - a. volume
 - b. weight
 - c. outage gauge
 - d. OPD

7. When filling forklift cylinders by weight, it is important to:
- Close the fixed maximum liquid level gauge.
 - Weigh the cylinder halfway through the filling process.
 - Verify that the cylinder is not overfilled at the conclusion of the filling process.
 - Position the cylinder with the relief valve in the liquid space of the cylinder.
8. When filling cylinders by weight, the _____ is used to determine that the cylinder has reached its maximum permitted filling level.
- float gauge
 - scale
 - locating pin
 - OPD
9. The fixed maximum liquid level gauge is _____ when filling a forklift cylinder by volume.
- opened
 - closed
 - tightened
 - loosened
10. When filling forklift cylinders by volume, once a white mist is emitted from the fixed maximum liquid level gauge, the _____ must be immediately shut off.
- pump
 - gauge
 - hose end valve
 - dispenser
11. When changing out a forklift cylinder, the cylinder service valve should be _____ prior to making the hose connection to the cylinder.
- lubricated
 - closed
 - opened
 - replaced
12. The locating pin on the forklift is used to _____.
- determine whether the cylinder is full
 - determine the age of the cylinder
 - properly position the cylinder on the forklift
 - maintain the pressure in the cylinder

Module 7 Quiz: Refueling Motorhomes and Other Vehicle-Mounted ASME Tanks

1. Permanently mounted tanks used in motorhomes are built to _____ specifications.
 - a. DOT
 - b. ASME
 - c. NFPA
 - d. NPGA
2. All vehicle-mounted ASME tanks are equipped with a(n) _____.
 - a. ASME data plate
 - b. fixed maximum liquid level gauge
 - c. relief valve
 - d. All of the above
3. If the data plate is missing from an ASME tank, it cannot be filled.
 - a. True
 - b. False
4. All ignition sources must be at least _____ feet from the fill connection.
 - a. 10
 - b. 25
 - c. 40
 - d. 55
5. Motorhome and catering truck tanks are used to supply propane appliances; therefore, appliance pilots and electronic ignition systems must be _____ before beginning the filling operation.
 - a. inspected
 - b. turned off
 - c. turned on
 - d. leak checked

6. While filling ASME tanks, and a white mist appears from the fixed maximum liquid level gauge, immediately close the _____.
- a. fixed maximum liquid level gauge
 - b. service valve
 - c. hose end valve
 - d. pump
7. The _____ is used to determine when the tank has been adequately filled.
- a. float gauge
 - b. fixed maximum liquid level gauge
 - c. rotary gauge
 - d. relief valve
8. Which of the following should be completed immediately after the filling process?
- a. Check for leaks with a non-corrosive leak detector solution.
 - b. Relight the customer's pilot lights.
 - c. Verify that appliance pilots have been extinguished.
 - d. Inspect the tank data plate.

Module 8 Quiz: Dispensing Propane Safely for Mowers

1. Responsibilities of an operator who refuels propane mowers include _____.
 - a. understanding the inspections, operation, and regulations that apply to the dispensing equipment
 - b. making sure that the correct type of cylinder is being used on the mower
 - c. filling cylinders to their proper levels and preventing them from being overfilled
 - d. All of the above
2. Which of the following is not commonly found on a propane mower cylinder?
 - a. Pressure-relief valve
 - b. Air intake valve
 - c. Fixed maximum liquid level gauge
 - d. Liquid or vapor service valve
3. Which of the following statements is false?
 - a. Mower-specific cylinders have a left-hand thread and a vapor service valve.
 - b. Mowers that use forklift cylinders have a right-hand thread and a liquid service valve.
 - c. The service valve should be approximately 80% open when the cylinder is in use.
 - d. Service valves have an internal check valve to prevent fuel from leaving the cylinder.
4. Before filling a cylinder, verify that it is a propane cylinder by _____.
 - a. checking to see if it has a service valve
 - b. reviewing the cylinder design code specification markings on the cylinder
 - c. inspecting the warning labels on the cylinder
 - d. checking the bottom of the cylinder for an "approved for propane use" stamp
5. The two methods to fill a cylinder are by _____.
 - a. weight and volume
 - b. weight and temperature
 - c. temperature and volume
 - d. None of the above
6. All cylinders must be filled outdoors or in an approved filling area.
 - a. True
 - b. False
7. Appropriate personal protective equipment (PPE) should be put on before filling or exchanging a cylinder.
 - a. True
 - b. False

8. Which of the following is NOT a step to determine the total filled weight of a cylinder?
- Check the water capacity and tare weight stamped on the cylinder or its protective collar.
 - Determine the propane capacity using the formula:
propane capacity [lb] = water capacity [lb] X .42
 - Multiply the propane capacity by .8 to determine the total filled weight.
 - Add the tare weight and propane capacity together to determine the total filled weight of a cylinder.
9. If filling a cylinder by volume, the cylinder will be full when _____.
- white mist begins to escape from the fixed maximum liquid level gauge
 - the dispenser pump automatically turns off
 - liquid propane begins to escape from the service valve
 - All of the above
10. For a cylinder that is installed horizontally on a mower, the pressure-relief valve should be set at the _____ position.
- 3 o'clock
 - 6 o'clock
 - 9 o'clock
 - 12 o'clock

Module 9 Quiz: Dispensing Propane Autogas

1. Propane autogas dispensing systems typically use a _____ to fuel the vehicle.
 - a. gasoline-style, low-emission nozzle
 - b. gasoline-style, high-emission nozzle
 - c. welding-style nozzle
 - d. fire hose-style nozzle
2. Make sure there are no ignition sources within _____ feet of the filling area.
 - a. 5
 - b. 25
 - c. 80
 - d. 1000
3. You should know your facility's fire prevention and emergency evacuation plans, including where and how to operate the emergency shutdown system.
 - a. True
 - b. False
4. Propane autogas-fueled vehicles are required to have a propane decal located _____.
 - a. on the passenger-side window
 - b. on the left side of the front bumper
 - c. on the lower-right rear of the vehicle, above the bumper
 - d. on the lower-right rear of the vehicle, attached to the bumper
5. Before beginning the refueling process, what should you do?
 - a. Turn off the vehicle.
 - b. Do not smoke, strike matches, or light a cigarette lighter.
 - c. Touch a grounded object to control static electricity.
 - d. All of the above
6. The dispenser operator does NOT need to be present during the entire filling procedure.
 - a. True
 - b. False

7. If a nozzle with a threaded connection is being used, it must be firmly attached and properly threaded before beginning the filling process.
- a. True
 - b. False
8. What safety device automatically stops the flow of fuel into the tank when it is filled?
- a. O-ring on the filler valve
 - b. Filler valve flap
 - c. Overfill prevention device [OPD]
 - d. Filler nozzle ball valve

Module A1 Quiz: Composite Cylinders

1. Composite cylinders are made from a combination of _____.
 - a. fiberglass or carbon fibers and a plastic resin
 - b. steel and aluminum
 - c. aluminum and plastic
 - d. titanium and aluminum
2. _____ on composite cylinders are identical to those used on steel or aluminum cylinders.
 - a. Foot rings
 - b. Collars
 - c. Service and fill connections
 - d. Cylinder markings
3. Do NOT expose composite cylinders to temperatures higher than ____ degrees (F).
 - a. 98
 - b. 120
 - c. 149
 - d. 212
4. _____ are required to be present at the dispensing facility before a composite cylinder can be filled.
 - a. Special filling equipment and nozzles
 - b. DOT special permits
 - c. Special hoses
 - d. Special fire extinguishers

Module A2 Quiz: Retail Cylinder Exchange Operations

1. Full or empty cylinders can _____ be stored or permitted indoors.
 - a. always
 - b. sometimes
 - c. only under special conditions
 - d. never
2. Areas where more than _____ pounds of propane are stored in one location must be provided with an approved portable fire extinguisher.
 - a. 500
 - b. 670
 - c. 720
 - d. 840
3. Fire extinguishers are used primarily on _____ fires.
 - a. electrical
 - b. oil
 - c. propane
 - d. combustible
4. Cylinders awaiting resale must be stored in a(n) _____ position.
 - a. vertical and upright
 - b. horizontal
 - c. secured
 - d. upside-down
5. Cylinders must be stored with the relief valve in the _____ space of the container.
 - a. liquid
 - b. odorized
 - c. vapor
 - d. vertical
6. Stored cylinders must be at least _____ feet away from gas station fuel dispensers.
 - a. 5
 - b. 10
 - c. 15
 - d. 20

7. Cabinets must be placed at least _____ feet from doorways of public buildings.

- a. 5
- b. 10
- c. 15
- d. 20

8. Empty exchange cylinders should be handled in the same manner as _____ cylinders.

- a. defective
- b. operating
- c. open
- d. full



Module Quizzes Answer Keys

Modules 1–2 Answer Key: Introduction to Dispensing Propane Safely, and Properties and Characteristics of Propane

1. Which is NOT a responsibility of a propane dispenser operator?
 - a. Understanding the regulations and operations of the dispensing equipment
 - b. Repairing defective and damaged cylinders**
 - c. Inspecting customer cylinders and containers to ensure they are safe for filling
 - d. Filling containers to their proper levels and preventing them from being overfilled

2. Important safety tips to tell customers before transporting propane cylinders include:
 - a. Always transport and store a cylinder in a secure and upright position so it will not fall, shift, or roll.
 - b. Never keep a filled cylinder inside a hot vehicle.
 - c. Always proceed directly to your destination and immediately remove the cylinder from your vehicle.
 - d. All of the above**

3. What is an SDS?
 - a. A detailed procedure for inspecting propane containers
 - b. A detailed procedure for filling propane cylinders
 - c. An information bulletin that alerts you to properties and health hazards of propane**
 - d. A consumer safety information packet

4. _____ is added to propane to increase the likelihood that a leak will be detected.
 - a. Moisture
 - b. An identifying color
 - c. Additional vapor
 - d. Odorant**

5. In order to allow for liquid expansion, propane containers are typically filled to _____% of their capacity.
 - a. 25
 - b. 40
 - c. 65
 - d. 80**

6. Propane liquid released into the air will expand to _____ times its original volume.
- a. 2.15
 - b. 9.6
 - c. 270**
 - d. 350
7. The proper mixture of propane vapor, air, and _____ is needed for propane to burn.
- a. nitrogen
 - b. humidity
 - c. odorant
 - d. an ignition source**
8. If propane liquid comes in contact with your skin, it can cause _____.
- a. a rash
 - b. frostbite or freeze burns**
 - c. redness similar to a sunburn
 - d. a slight irritation
9. Gloves and other PPE are required when filling containers because of the _____ of liquid propane.
- a. refrigerating effect (potential for freeze burns)**
 - b. vaporization rate
 - c. expansion properties
 - d. toxicity
10. In the event of an uncontrolled propane leak or fire, what should you do?
- a. Shut down the dispenser if safe to do so.
 - b. Evacuate the area immediately.
 - c. Call for help.
 - d. All of the above**

Module 3 Answer Key: Dispensing Station Equipment

1. Most propane dispensers include a(n) _____ that supplies propane to the dispensing equipment.
 - a. metering system
 - b. platform scale
 - c. scale
 - d. ASME storage tank**
2. The two common types of propane dispensing set-ups include horizontal tank dispensers and _____.
 - a. underground tank dispensers
 - b. mobile tank dispensers
 - c. vertical tank dispensers**
 - d. round tank dispensers
3. _____ control the flow of propane through the piping system of a dispenser.
 - a. Valves**
 - b. Plugs
 - c. Gears
 - d. Meters
4. Most dispensers have a(n) _____ to stop the flow of propane in an emergency.
 - a. alarm
 - b. OPD
 - c. shutdown system**
 - d. hose-end valve
5. When preparing the dispenser for use, _____ open the liquid outlet valve and the first downstream manual valve.
 - a. slowly**
 - b. quickly
 - c. halfway
 - d. None of the above
6. When the operator is not in attendance, the dispenser should be _____.
 - a. maintained and lubricated
 - b. shut down and secured**
 - c. calibrated and cleaned
 - d. opened to the public

Module 4 Answer Key: DOT Cylinders

1. The _____ is a wide metal band welded or brazed to the bottom of the cylinder and used to protect the cylinder body from corrosion or damage.
 - a. valve opening
 - b. OPD
 - c. pressure-relief valve
 - d. foot ring**
2. An OPD serves as a _____.
 - a. primary means of preventing overfilling of cylinders
 - b. secondary means of preventing overfilling of cylinders**
 - c. means of protection for the cylinder valves
 - d. handle for lifting the cylinder
3. To protect the valves, portable cylinders use a _____.
 - a. collar**
 - b. NTP fitting
 - c. foot ring
 - d. OPD
4. Which of the following indicates the weight of the cylinder when empty?
 - a. Water capacity
 - b. Requalification date
 - c. Design code
 - d. Tare weight**
5. Which of the following is typically NOT the responsibility of a propane dispenser operator?
 - a. Pre-fill visual check
 - b. Scale calibration
 - c. Cylinder requalification**
 - d. Customer education
6. Cylinders may NOT be filled if they are past their _____ date.
 - a. annual inspection
 - b. requalification**
 - c. maintenance test
 - d. DOT fitness

7. Before a cylinder can be filled or refilled, DOT regulations require a _____ to verify it is fit for continued service.
- a. visual check**
 - b. requalification
 - c. cylinder stress test
 - d. purging
8. Prior to inspecting a cylinder, you should _____ to help spot any problems.
- a. wash the cylinder with soap and water
 - b. open the service valve
 - c. remove any plastic or paper sleeves**
 - d. All of the above
9. Problems that prevent filling a cylinder include:
- a. Cracks or leaks
 - b. Bulging, denting, or gouging
 - c. Out-of-date requalification
 - d. All of the above**
10. A blue-green stain on the brass portion of the cylinder valve is evidence that it has been in contact with _____.
- a. methanol
 - b. anhydrous ammonia**
 - c. ethyl mercaptan
 - d. polyethylene
11. Which of the following problems can be caused by cylinders NOT properly purged of air or moisture?
- a. Fading of the odorant in the cylinder**
 - b. Unusually low service pressures
 - c. Regulator overheating
 - d. Inaccurate weight when filling
12. DOT requires that all cylinders be clearly labeled with _____.
- a. consumer and warning information
 - b. valve size and propane capacity
 - c. NFPA 704 information and storage tips
 - d. shipping name and hazard class**

13. Consumer information/warning labels must be on all portable refillable cylinders of ____ pounds propane capacity or less not filled on site.
- a. 20
 - b. 33
 - c. 45
 - d. 100**
14. Many jurisdictions limit closed-bodied vehicles such as passenger cars and vans to a maximum of ____ pounds propane capacity, with no single container having a capacity of more than ____ pounds.
- a. 80, 30
 - b. 90, 45**
 - c. 100, 50
 - d. 150, 75
15. If a cylinder warning label is NOT legible or if the paper or plastic sleeve is removed during inspection, _____ before releasing the cylinder to the customer.
- a. place a new cylinder warning label on it**
 - b. have the customer sign a waiver
 - c. orally deliver safety information
 - d. contact the supervisor
16. New cylinders that have NOT been vacuum-purged by the manufacturer and cylinders that have been opened to the atmosphere must be _____ prior to filling.
- a. reconditioned
 - b. repainted
 - c. purged of air or moisture**
 - d. requalified

Module 5 Answer Key: Filling Small Cylinders

1. Only use fire extinguishers to create an escape route — NOT to fight a propane fire.
a. True
b. False
2. Before operating a filling station, ensure there are no ignition sources within _____ feet of the points of transfer.
a. 5
b. 10
c. 25
d. 50
3. Before starting the cylinder filling operation, which of the following steps must you always follow?
a. Do not allow unauthorized people in the filling area.
b. Always put on appropriate personal protective equipment.
c. Inspect all cylinder filling equipment before use.
d. All of the above
4. Because platform scales have built-in safety features, it is not necessary to make sure the scale is clear of debris or obstructions before use.
a. True
b. False
5. Always verify the cylinder you are preparing to fill is a propane cylinder by reviewing the design code specification markings on the cylinder.
a. True
b. False
6. Container water capacity is multiplied by _____% when determining propane capacity.
a. 24
b. 36
c. 42
d. 58

7. When filling a cylinder by weight, the scale set point should equal the _____.
- a. tare weight + propane capacity [lb]
 - b. tare weight + propane capacity [lb] + hose and fitting weight**
 - c. propane capacity [lb] + hose and fitting weight
 - d. tare weight + propane capacity [lb] - hose weight
8. After filling the cylinder, you need to _____ to complete the job.
- a. check for leaks using an approved method
 - b. reinstall appropriate valve caps and plugs
 - c. apply any required labels if missing or not legible
 - d. All of the above**
9. When filling a cylinder by volume using the fixed maximum liquid level gauge, the filling process relies on the _____ to determine when the maximum permitted filling limit for a cylinder is reached.
- a. sensor
 - b. trip lever
 - c. operator**
 - d. control valve
10. When filling a cylinder by volume and a white mist begins to escape from the fixed maximum liquid level gauge, you need to immediately _____.
- a. shut off the pump
 - b. check for leaks
 - c. close the hose end valve**
 - d. close the service valve

Module 6 Answer Key: Refueling, Maintaining, and Troubleshooting Forklift Cylinders

1. Forklift cylinders typically hold _____ pounds of propane.
 - a. 20
 - b. 33**
 - c. 45
 - d. 100
2. The purpose of the O-ring inside the forklift connector is to provide _____.
 - a. weather protection
 - b. a gas-tight seal**
 - c. protection from debris
 - d. refueling safety
3. Pressure-relief valves should be directed upward at a _____ degree angle when the forklift cylinder is mounted horizontally.
 - a. 30
 - b. 45**
 - c. 60
 - d. 90
4. Relief valves on forklift cylinders must be replaced within _____ years of the cylinder's manufacture date and every 10 years thereafter.
 - a. 5
 - b. 7
 - c. 12**
 - d. 18
5. Leaks, cracks, or bulging are often discovered during a cylinder _____ inspection.
 - a. pre-fill**
 - b. tare weight
 - c. operational
 - d. post-fill
6. Tare weight is required when calculating cylinder filling by _____.
 - a. volume
 - b. weight**
 - c. outage gauge
 - d. OPD

7. When filling forklift cylinders by weight, it is important to:
- a. Close the fixed maximum liquid level gauge.
 - b. Weigh the cylinder halfway through the filling process.
 - c. Verify that the cylinder is not overfilled at the conclusion of the filling process.**
 - d. Position the cylinder with the relief valve in the liquid space of the cylinder.
8. When filling cylinders by weight, the _____ is used to determine that the cylinder has reached its maximum permitted filling level.
- a. float gauge
 - b. scale**
 - c. locating pin
 - d. OPD
9. The fixed maximum liquid level gauge is _____ when filling a forklift cylinder by volume.
- a. opened**
 - b. closed
 - c. tightened
 - d. loosened
10. When filling forklift cylinders by volume, once a white mist is emitted from the fixed maximum liquid level gauge, the _____ must be immediately shut off.
- a. pump
 - b. gauge
 - c. hose end valve**
 - d. dispenser
11. When changing out a forklift cylinder, the cylinder service valve should be _____ prior to making the hose connection to the cylinder.
- a. lubricated
 - b. closed**
 - c. opened
 - d. replaced
12. The locating pin on the forklift is used to _____.
- a. determine whether the cylinder is full
 - b. determine the age of the cylinder
 - c. properly position the cylinder on the forklift**
 - d. maintain the pressure in the cylinder

Module 7 Answer Key: Refueling Motorhomes and Other Vehicle-Mounted ASME Tanks

1. Permanently mounted tanks used in motorhomes are built to _____ specifications.
 - a. DOT
 - b. ASME**
 - c. NFPA
 - d. NPGA

2. All vehicle-mounted ASME tanks are equipped with a(n) _____.
 - a. ASME data plate
 - b. fixed maximum liquid level gauge
 - c. relief valve
 - d. All of the above**

3. If the data plate is missing from an ASME tank, it cannot be filled.
 - a. True**
 - b. False

4. All ignition sources must be at least _____ feet from the fill connection.
 - a. 10
 - b. 25**
 - c. 40
 - d. 55

5. Motorhome and catering truck tanks are used to supply propane appliances; therefore, appliance pilots and electronic ignition systems must be _____ before beginning the filling operation.
 - a. inspected
 - b. turned off**
 - c. turned on
 - d. leak checked

6. While filling ASME tanks, and a white mist appears from the fixed maximum liquid level gauge, immediately close the _____.
- a. fixed maximum liquid level gauge
 - b. service valve
 - c. hose end valve**
 - d. pump
7. The _____ is used to determine when the tank has been adequately filled.
- a. float gauge
 - b. fixed maximum liquid level gauge**
 - c. rotary gauge
 - d. relief valve
8. Which of the following should be completed immediately after the filling process?
- a. Check for leaks with a non-corrosive leak detector solution.**
 - b. Relight the customer's pilot lights.
 - c. Verify that appliance pilots have been extinguished.
 - d. Inspect the tank data plate.

Module 8 Answer Key: Dispensing Propane Safely for Mowers

- Responsibilities of an operator who refuels propane mowers include _____.
 - understanding the inspections, operation, and regulations that apply to the dispensing equipment
 - making sure that the correct type of cylinder is being used on the mower
 - filling cylinders to their proper levels and preventing them from being overfilled
 - All of the above**
- Which of the following is not commonly found on a propane mower cylinder?
 - Pressure-relief valve
 - Air intake valve**
 - Fixed maximum liquid level gauge
 - Liquid or vapor service valve
- Which of the following statements is false?
 - Mower-specific cylinders have a left-hand thread and a vapor service valve.
 - Mowers that use forklift cylinders have a right-hand thread and a liquid service valve.
 - The service valve should be approximately 80% open when the cylinder is in use.**
 - Service valves have an internal check valve to prevent fuel from leaving the cylinder.
- Before filling a cylinder, verify that it is a propane cylinder by _____.
 - checking to see if it has a service valve
 - reviewing the cylinder design code specification markings on the cylinder**
 - inspecting the warning labels on the cylinder
 - checking the bottom of the cylinder for an “approved for propane use” stamp
- The two methods to fill a cylinder are by _____.
 - weight and volume**
 - weight and temperature
 - temperature and volume
 - None of the above
- All cylinders must be filled outdoors or in an approved filling area.
 - True**
 - False
- Appropriate personal protective equipment (PPE) should be put on before filling or exchanging a cylinder.
 - True**
 - False

8. Which of the following is NOT a step to determine the total filled weight of a cylinder?
- a. Check the water capacity and tare weight stamped on the cylinder or its protective collar.
 - b. Determine the propane capacity using the formula:
propane capacity [lb] = water capacity [lb] X .42
 - c. Multiply the propane capacity by .8 to determine the total filled weight.**
 - d. Add the tare weight and propane capacity together to determine the total filled weight of a cylinder.
9. If filling a cylinder by volume, the cylinder will be full when _____.
- a. white mist begins to escape from the fixed maximum liquid level gauge**
 - b. the dispenser pump automatically turns off
 - c. liquid propane begins to escape from the service valve
 - d. All of the above
10. For a cylinder that is installed horizontally on a mower, the pressure-relief valve should be set at the _____ position.
- a. 3 o'clock
 - b. 6 o'clock
 - c. 9 o'clock
 - d. 12 o'clock**

Module 9 Answer Key: Dispensing Propane Autogas

1. Propane autogas dispensing systems typically use a _____ to fuel the vehicle.
a. gasoline-style, low-emission nozzle
b. gasoline-style, high-emission nozzle
c. welding-style nozzle
d. fire hose-style nozzle
2. Make sure there are no ignition sources within _____ feet of the filling area.
a. 5
b. 25
c. 80
d. 1000
3. You should know your facility's fire prevention and emergency evacuation plans, including where and how to operate the emergency shutdown system.
a. True
b. False
4. Propane autogas-fueled vehicles are required to have a propane decal located _____.
a. on the passenger-side window
b. on the left side of the front bumper
c. on the lower-right rear of the vehicle, above the bumper
d. on the lower-right rear of the vehicle, attached to the bumper
5. Before beginning the refueling process, what should you do?
a. Turn off the vehicle.
b. Do not smoke, strike matches, or light a cigarette lighter.
c. Touch a grounded object to control static electricity.
d. All of the above
6. The dispenser operator does NOT need to be present during the entire filling procedure.
a. True
b. False

7. If a nozzle with a threaded connection is being used, it must be firmly attached and properly threaded before beginning the filling process.

a. True

b. False

8. What safety device automatically stops the flow of fuel into the tank when it is filled?

a. O-ring on the filler valve

b. Filler valve flap

c. Overfill prevention device (OPD)

d. Filler nozzle ball valve

Module A1 Answer Key: Composite Cylinders

1. Composite cylinders are made from a combination of _____.
a. fiberglass or carbon fibers and a plastic resin
b. steel and aluminum
c. aluminum and plastic
d. titanium and aluminum
2. _____ on composite cylinders are identical to those used on steel or aluminum cylinders.
a. Foot rings
b. Collars
c. Service and fill connections
d. Cylinder markings
3. Do NOT expose composite cylinders to temperatures higher than ____ degrees (F).
a. 98
b. 120
c. 149
d. 212
4. _____ are required to be present at the dispensing facility before a composite cylinder can be filled.
a. Special filling equipment and nozzles
b. DOT special permits
c. Special hoses
d. Special fire extinguishers

Module A2 Answer Key: Retail Cylinder Exchange Operations

1. Full or empty cylinders can _____ be stored or permitted indoors.
 - a. always
 - b. sometimes
 - c. only under special conditions
 - d. **never**
2. Areas where more than _____ pounds of propane are stored in one location must be provided with an approved portable fire extinguisher.
 - a. 500
 - b. 670
 - c. **720**
 - d. 840
3. Fire extinguishers are used primarily on _____ fires.
 - a. electrical
 - b. oil
 - c. propane
 - d. **combustible**
4. Cylinders awaiting resale must be stored in a(n) _____ position.
 - a. **vertical and upright**
 - b. horizontal
 - c. secured
 - d. upside-down
5. Cylinders must be stored with the relief valve in the _____ space of the container.
 - a. liquid
 - b. odorized
 - c. **vapor**
 - d. vertical
6. Stored cylinders must be at least _____ feet away from gas station fuel dispensers.
 - a. 5
 - b. 10
 - c. 15
 - d. **20**

7. Cabinets must be placed at least _____ feet from doorways of public buildings.

- a. 5**
- b. 10
- c. 15
- d. 20

8. Empty exchange cylinders should be handled in the same manner as _____ cylinders.

- a. defective
- b. operating
- c. open
- d. full**

