Propane in Construction

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This manual has been reviewed and endorsed by the Provincial Labour-Management Health and Safety Committee and is fully a document of accord between labour and management authorities.

In the past, members of the public have used printed information that was outdated by subsequent improvements in knowledge and technology. We therefore make the following statement for their protection in future.

The information presented here was, to the best of our knowledge, current at time of printing and is intended for general application. This publication is not a definitive guide to government regulations or to practices and procedures wholly applicable under every circumstance. The appropriate regulations and statutes should be consulted. Although the Construction Safety Association of Ontario cannot guarantee the accuracy of, nor assume liability for, the information presented here, we are pleased to answer individual requests for counselling and advice.

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Introduction

This manual has been prepared to assist people in the construction industry who work with or near propane. Packaged under pressure, this gas presents three areas of hazard if misused:

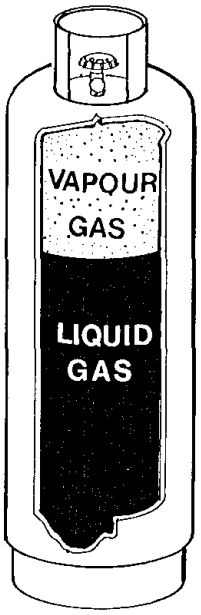
1) high flammability and explosive potential
2) displacement of breathable air in confined spaces (also, being heavier than air, propane will collect in low areas)
3) contact injury from accidental exposure to a substance under high pressure.

We will not cover the use of propane in the roofing industry, but instead refer the reader to the following publications available from the Construction Safety Association of Ontario:

- **DS3 Guidelines for Operating Bitumen Roofing Tankers**
- **DS4 Heating with Propane and Kerosene on Roofing Kettles and Tankers**
- **DS5 Guidelines for Operating Bitumen Roofing Kettles**
- **B19 Safety Guidelines for Roofers.**

Propane - Physical Characteristics

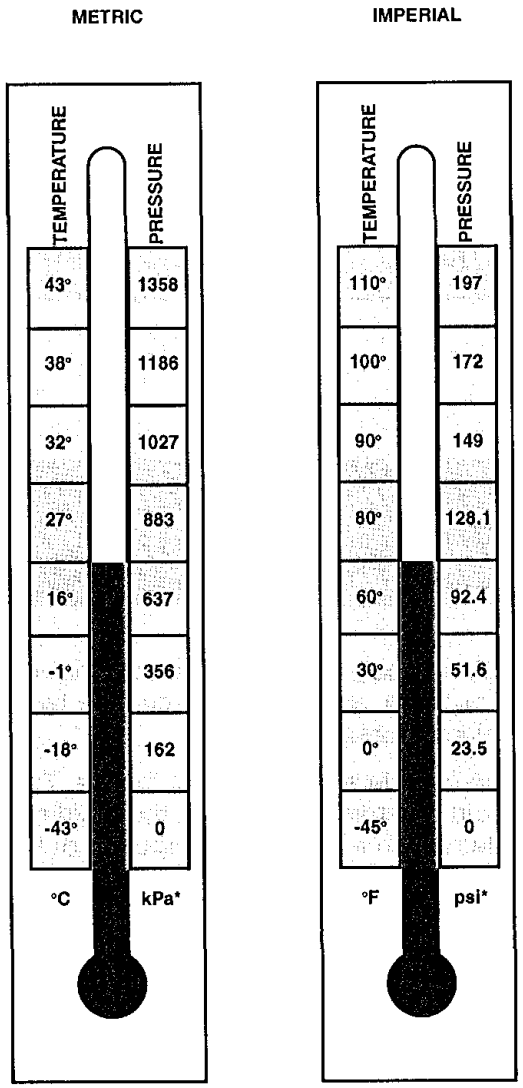
Propane or Liquefied Petroleum Gas (LPG) is a by-product of petroleum or natural gas refining which is packaged under pressure in cylinders. In its stored state it is a liquid but is released from the cylinder or tank in a gaseous form. The boiling point of propane, the point at which the liquid converts to a gas, is −42.2°C (−44°F). If the surrounding air temperature is above this, gas will form in the upper part of the cylinder (Figure 1).



Cutaway View of Vapour Withdrawal Propane Cylinder

Figure 1

The pressure within the container is variable depending on the temperature to which the container is exposed (Table 1). The pressure increases as the temperature rises causing expansion of the liquid. For this reason containers are never fully charged with liquid, but have a vapour space at the top of the tank to allow for normal expansion.



*kilopascals

*pounds per square inch

Temperature/Pressure Variables
(Values taken from CSA Standard B149.2-M80)

Table 1

Should the temperature rise above safe limits a relief valve will open to allow release of the gas in a measured amount. This release is generally over in seconds. The valve reseals and remains closed until the pressure builds up again. Cylinder relief valves are set at 2585.5 kPa (375 lbs. per square inch).

Propane is packaged in a number of cylinder types and sizes to meet a variety of applications:

- 100 lb. cylinders for construction heaters, roofing kettles, and other appliances that consume large amounts of fuel. They are called 100 lb. cylinders because they are charged with 100 lbs. of liquid at the propane plant.
- 20 lb. cylinders for oxypropane welding set-ups. (This is a familiar size that will be used on such appliances as household gas barbecues.)
- 10 and 20 lb. cylinders for soldering work.
- 14 oz. throwaway containers for various hand-held torch applications.

Propane is a clean-burning, easy-to-use fuel very convenient for the contractor. When the liquid converts to a gas its volume is increased 270 times. This explains why so much energy (BTU's) can be contained in a small cylinder.

The high flammability of propane can be seen by comparing its ignition characteristics with those of gasoline (Table 2).

When you consider that the heat from a lighted cigarette ranges between 1000°F and 1600°F, and that a lighted match produces 2000°F, all that is necessary for combustion is a sufficient quantity of propane gas mixed with air. This is why safety procedures must be followed so that a very efficient energy source does not become a hazard to workers.

	Propane	Gasoline
Minimum ignition temperature range	493°– 549°C (920°– 1020°F)	427°– 482°C (800°– 900°F)
Flammability limits in air	2.4 – 9.5%	1.3 – 7.6%
Vapour density (air=1)	1.52	3.50
Minimum flash point	–104° C (–156°F)	–51° C (–60°F)

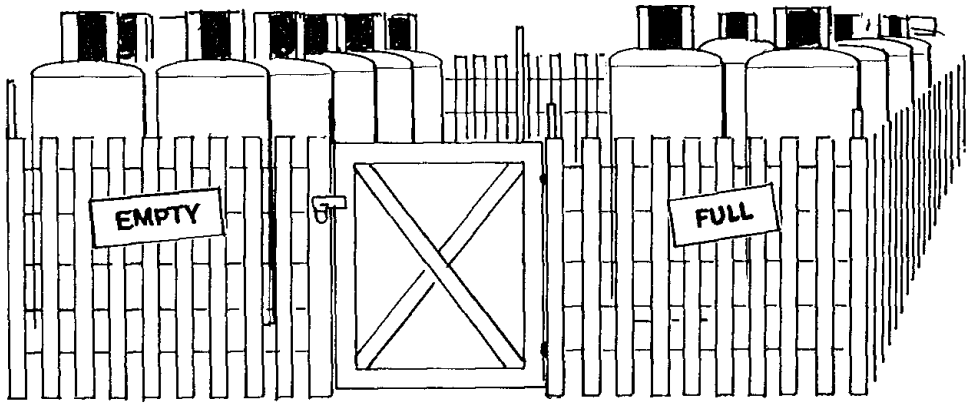
Table 2

Safe Handling of Cylinders

In construction, most propane applications dispense the fuel in a vapour form. For this reason it is essential that portable cylinders be transported, stored and used in an upright position. Propane liquid must never come in contact with the cylinder relief valve. If liquid escapes through the valve large volumes of gas will be released. On a construction heater, for example, this can cause a serious overburn with flames extending many feet past the burner tip.

The simplest way to avoid the problem is to fasten cylinders in an upright position with rope, wire or other means. When transporting by truck take extra care to keep cylinders upright and stationary. Cylinders should not be transported in an automobile trunk or in a closed van. Because propane is heavier than air, escaping gas can collect in a confined space and create an explosive atmosphere, as well as threaten life by displacing breathable air.

Store cylinders safely on the jobsite. They should be stored away from the building, preferably in a separate compound out of traffic areas and where they are in no danger of being struck by falling materials or moving equipment. A simple compound can be constructed using a length of snow fence and a few T-bars (Figure 2). When properly constructed this barrier provides a means of tying up the cylinders as well as controlling stock. Cylinders should not be stored closer than 25 feet to a property line. Empty cylinders should be stored on one side, full on the other. Don't mix the cylinders.



Simple But Secure On-Site Storage

Figure 2

The compound should not be close to an area where flammable liquids such as gasoline and diesel fuel are stored. **Only cylinders that are in use should be inside a building.** ("In use" means hooked up to a construction heater or other appliance.)

Propane must not be stored inside a building unless in a specially constructed explosion-proof room, which meets the propane and fire codes. **Do not locate cylinders in stairwells and hallways.** Leaking gas or the outbreak of fire can block exits and prevent escape.

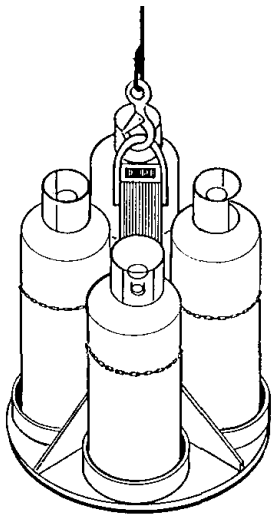
When moving cylinders of gas around the jobsite remember the following precautions.

☐ Keep cylinders upright. Use a hand cart (Figure 3). Never roll cylinders.

Figure 3

- ☐ Use a hoisting cradle to move cylinders from one level to another (Figure 4).
- ☐ Never use a sling. This practice is prohibited by construction regulations under the Occupational Health and Safety Act.
- ☐ Never hook onto the protective collar around the valve.
- ☐ Keep cylinders away from heat sources.

Figure 4



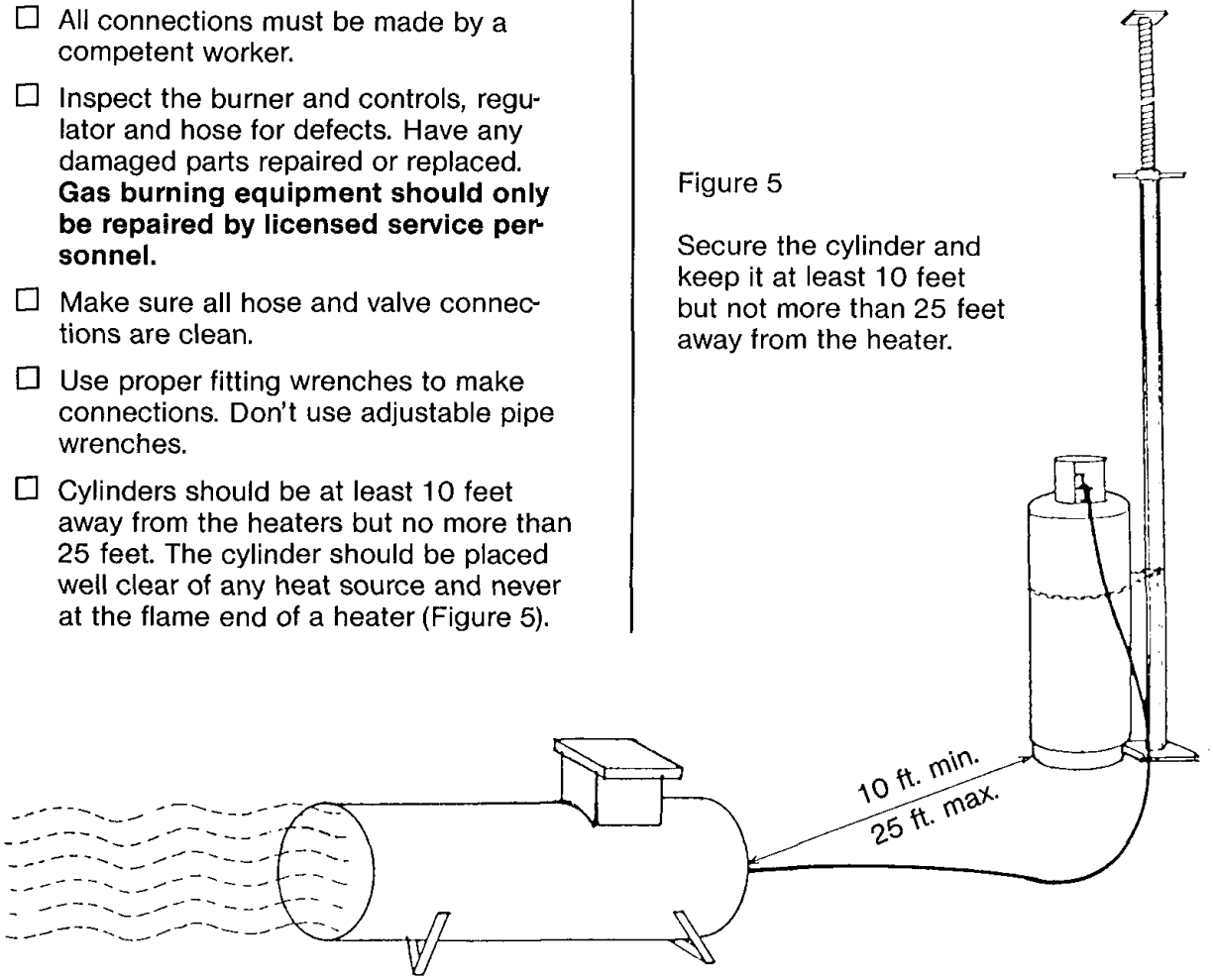
Propane and Construction Heaters

When hooking up and using construction heaters observe the following precautions.

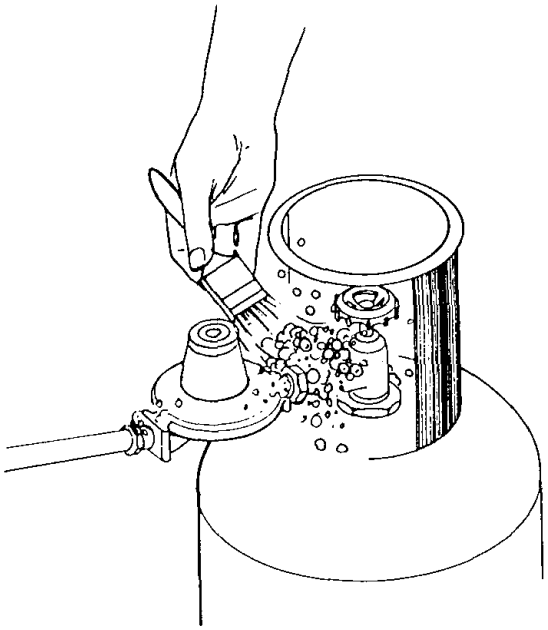
- ☐ All connections must be made by a competent worker.
- ☐ Inspect the burner and controls, regulator and hose for defects. Have any damaged parts repaired or replaced. **Gas burning equipment should only be repaired by licensed service personnel.**
- ☐ Make sure all hose and valve connections are clean.
- ☐ Use proper fitting wrenches to make connections. Don't use adjustable pipe wrenches.
- ☐ Cylinders should be at least 10 feet away from the heaters but no more than 25 feet. The cylinder should be placed well clear of any heat source and never at the flame end of a heater (Figure 5).

Figure 5

Secure the cylinder and keep it at least 10 feet but not more than 25 feet away from the heater.



- ☐ Have a 4A40BC fire extinguisher on hand before lighting the heater.
- ☐ When connections are made, slowly open the cylinder valve and check for leaks when the hose line is full of gas. When in use cylinder valves must be fully opened. Check for leaks with soapy water (Figure 6) or a leak detector.



Soap Test for Leaks

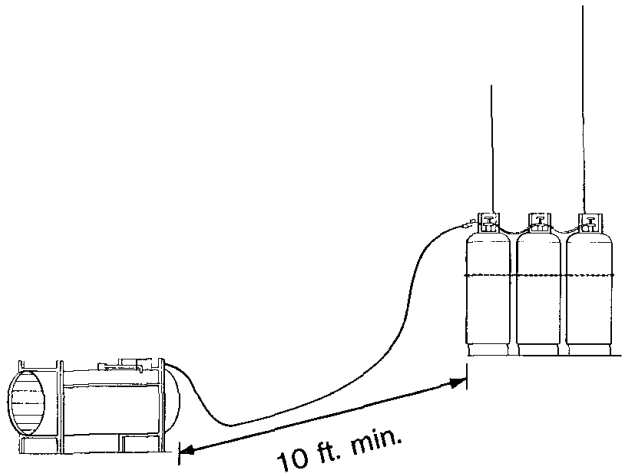
Figure 6

Sometimes you may notice a gas odour or frost appearing on a fitting, but these signs are not always reliable. If a leak is detected shut off the cylinder valve and make corrections. Fully close valves when not in use.

- ☐ If the cylinder valve is opened too quickly it may cause closing (slugging) of the excess flow check valve. The purpose of this valve is to shut off gas flow should the regulator accidentally be broken off.

  To unslug the check valve, shut off the flow at the cylinder, wait a couple of minutes for the check valve to reopen, then proceed. The cylinder valve should be opened slowly to its normal limit, approximately 1½ to 2 turns. Do not force the valve beyond this limit.

- ☐ Secure the cylinder by tying or wiring it to a column or other upright. Keep cylinders out of traffic areas where they may be knocked over.
- ☐ The cylinder and heater must always be in the same room so that the cylinder valve can be shut down quickly if trouble develops.
- ☐ Keep heaters away from flammable materials. The heat from a burner is effective well past the tip.
- ☐ Watch for a drop in pressure or reduced flame efficiency. This indicates that gas is being withdrawn too quickly, and may require additional cylinders to be hooked up in manifold. Never attempt to increase the amount of vapour by applying heat to the cylinder.
- ☐ Where possible, use only single cylinders for heaters. However, if cylinders must be manifolded, use no more than three 100-pound cylinders (Figure 7). If other heaters with manifolded cylinders are to be operated in the same area, they must be at least fifty feet away or be separated by a firewall.



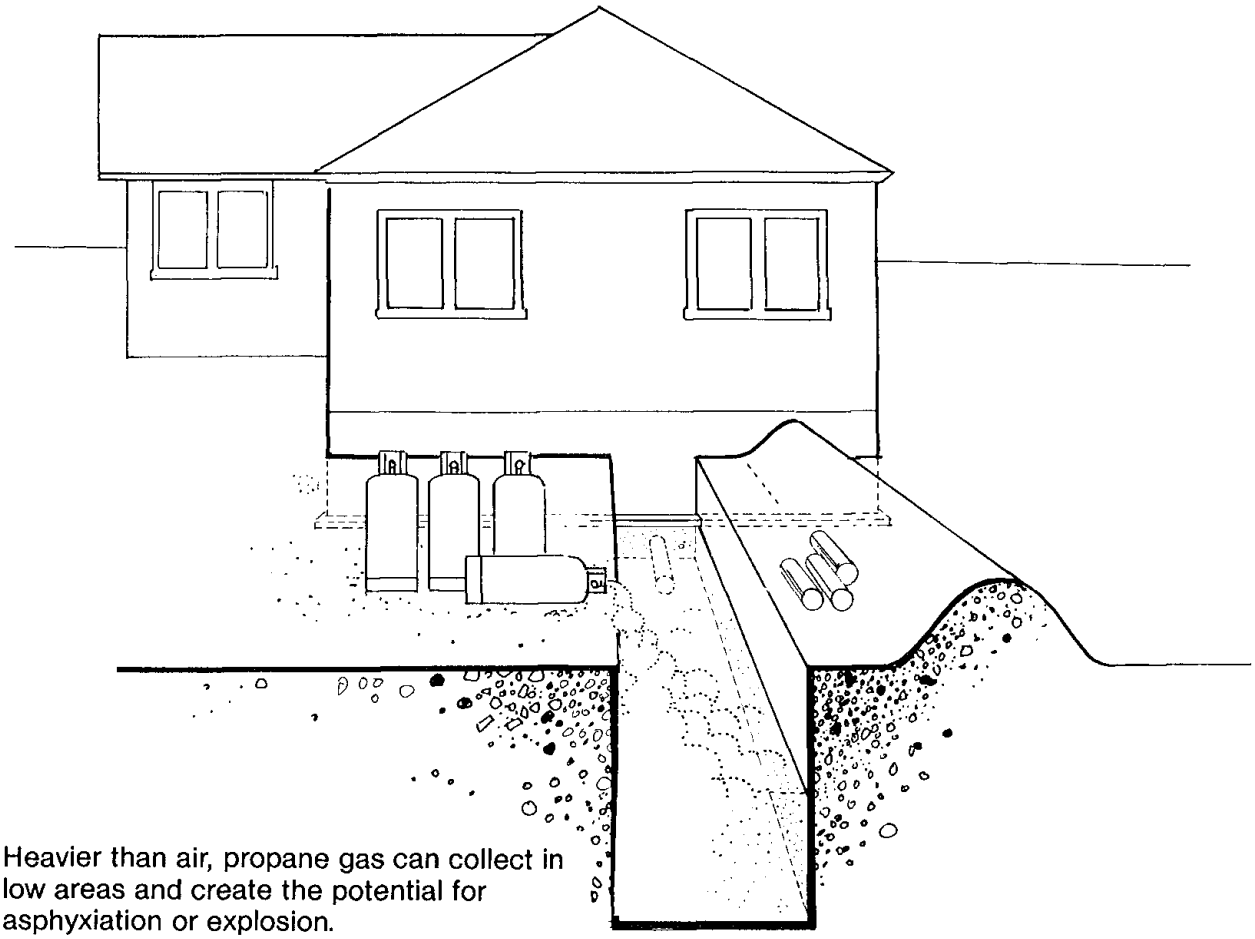
Typical Manifold Set-Up

Figure 7

- ☐ Remember that propane is heavier than air and will collect in low areas such as trenches, pits and basements where it can create a flammable or explosive situation (Figure 8).
- ☐ Never attempt to tie down, defeat or bypass safety devices on a construction heater. If the heater is defective replace it. If the heater is inadequate get extra heaters or replace it with a larger one.
- ☐ If the flame goes out, act with caution. Shut off the gas supply, then determine whether escaped gas is concentrated in the area. Usually, because of its strong odour, you can readily smell propane. However, in a confined space, test with a gas detection device. If escaped gas is detected or even suspected, ventilate and purge the area thoroughly before relighting the unit.

Warning If the heater is in a confined or low-lying area, escaped gas can be hazardous. Never enter the area without assistance standing by. Never attempt to relight until the gas is completely purged from the area.

- ☐ Never expose any part of your skin to liquid propane. Propane under pressure is extremely cold and can cause frostbite. Always wear gloves when handling cylinders.
- ☐ Don't allow propane gas to saturate your clothing. A highly flammable situation can remain for some time after the exposure. Saturated clothing should be removed and aired outside.
- ☐ Never operate heaters without adequate ventilation. Follow manufacturer's recommendations on the plate.



Heavier than air, propane gas can collect in low areas and create the potential for asphyxiation or explosion.

Figure 8

Bulk Tanks

Propane construction heaters that operate from a central bulk storage tank are common on large construction projects. This type of installation takes planning and close consultation between contractor and gas supplier to select a safe, convenient tank storage area that will not interfere with on-site traffic and materials handling, nor infringe on property line clearance requirements. The bulk tank and feed lines are installed by licensed service personnel, but hooking up the heaters is generally left to workers on the site. The feed lines are usually well provided with hook-up points called station valves. They consist of a shut-off and a connection point for a flexible hose. However, the same rules for hooking up to a portable container apply here.

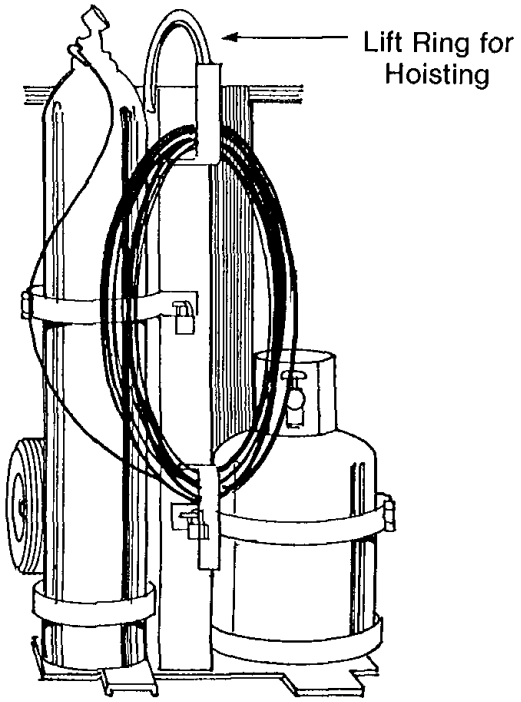
- ☐ Check for leaks at the hook-up point after installing flexible heater line.
- ☐ Make sure the shut-off valve is in the same room as the heater.
- ☐ If heat is required in an area that is not serviced by a valve a qualified serviceman should extend the line, or take off a spur line using approved piping and install a valve at its terminus.
- ☐ Flexible hose lengths should never exceed 25 feet between heater and station valve.

Propane for Welding and Cutting

In recent years, propane has become a popular energy source in open flame welding and cutting. Combined with oxygen in a manner similar to oxyacetylene welding it provides a gas mix that is considered much more stable by many users.

While propane welding cylinders are generally smaller than those used for construction heaters, they should be treated with the same care.

- ☐ Fittings should be clean and free of grease before hooking up.
- ☐ Proper fitting wrenches should be used to avoid damage to fittings.
- ☐ Cylinders should be in an upright position at all times, kept in a suitable cradle when in use, and preferably tied upright to prevent tipping over (Figure 9).



Oxypropane Welding Cart

Figure 9

- ☐ A fire extinguisher (4A40BC minimum) should be kept close when using any torch.
- ☐ Regulators should be removed and stored in a protective case when not in use, along with hoses and torches.
- ☐ Consult manufacturer's handbook for regulator settings. They are very different from oxyacetylene settings.

Summary

The safe use of propane depends on twelve basic rules:

1) Don't store cylinders inside a building.
2) Remove cylinders from the building when not in use or when empty.
3) Keep cylinders away from heat sources, and flammables away from heaters.
4) Always secure cylinders to prevent upset.
5) Never transport cylinders in an enclosed vehicle or auto trunk.
6) Always use proper gear for hoisting or moving cylinders around the worksite.
7) Keep heaters in good condition. Repairs and maintenance should be done only by licensed service personnel.
8) Always have a fire extinguisher handy (4A40BC minimum).
9) Protect stored cylinders or bulk tanks from on-site traffic.
10) Don't tamper with controls or safety devices.
11) Never enter an area where leaking gas is suspected.
12) Don't use or store cylinders of propane in low areas such as trenches, manholes or basements.

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