



Guidance on Gas Cylinder Storage



INTRODUCTION CO₂

Carbon dioxide gas (CO₂) is used in bars and catering areas to pressurise consumable liquids, such as beer, etc. The associated CO₂ cylinders are commonly stored in cellars or similar enclosed/confined spaces. Carbon dioxide is an odourless gas that is 1.5 times heavier than air. If a leak should occur then carbon dioxide could build up in these enclosed spaces in hazardous concentrations and cause asphyxiation unless adequate ventilation is provided.

GENERAL ASPECTS

Although many bar storage areas would not be classed as enclosed spaces, the following general safety precautions should nevertheless be adhered to:

- all cylinder handlers should undergo training
- each operator should be provided with or have access to the written advice from the supplier, i.e. BOC, CCSB, etc, on safety data and storage and handling information; and
- all bars and catering outlets that use cylinder gasses must hold the suppliers safety data sheets.

It is important to remember that:

- the maintenance department is responsible for routine maintenance of the buildings but not the gas systems themselves;
- the supplier must carry out preliminary safety checks prior to installation, appropriateness of piping, etc - they should be requested as part of the contract;
- only food grade cylinders and gas should be used for dispensing beer and soft drinks.

STORAGE

CO₂ cylinders are black and should have a label attached – the label should be checked upon receipt to ensure that the contents are correct. Where possible cylinders should be stored outside in metal cages, or in a secure location that is free from fire risk and ignition sources. Cylinders stored in the open should be protected from rusting and extremes of temperature and weather. Ideally cylinders should be stored in the vertical position and properly secured using restraining chains. If stored in the horizontal position, cylinders should be chocked and placed so that the valve cannot be damaged. When cylinders have been horizontally stored they must be stored upright for 1 hour before use. A cylinder warning notice should be displayed on storage area, and access only permitted to authorised persons (signs are available from the Safety Office).

HANDLING AND USE

Any damaged cylinders must be reported to the supplier and not used. Cylinders should not be transported unnecessarily. Manual handling aspects are important - use trolleys to move cylinders, wear appropriate personal protective equipment, such as, gloves and safety shoes/boots, and ensure that the personnel involved have been trained in manual handling techniques. Cylinder pressure regulators should be checked annually.

Empty bottles must be treated as Full Bottles.

When CO₂ cylinders are brought inside buildings the room must be adequately naturally or artificially ventilated, and cylinders should be:

- checked for leakage after delivery, before storage, and before use;
- checked for leakage, weekly, when connected to the system;
- kept away from ignition sources; and
- stored at temperatures below 45°C with valve guards in place and the cylinder valve closed when not in use.



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In exceptional circumstances cylinders may need to be stored in unventilated rooms. Such rooms would be classed as confined spaces and specific risk assessments would be required. This arrangement should be avoided if possible. Carbon dioxide monitoring (using a carbon dioxide detector and alarm system) would be required in poorly ventilated areas - advice should be sought from the CO₂ supplier. Regular checks would need to be made to ensure the system is working. Risk assessments should include, safe working procedures, action to be taken in an emergency, first aid, etc.

EMERGENCY ACTION

In the event of a leak, the area should be evacuated and well ventilated. If the cylinder has a bursting disc, which may give a sudden release of gas, then the area must be cleared and ventilated. Remember:

- do not enter a confined space unless the oxygen and carbon dioxide levels are satisfactory; and
- then - and only then - check that the cylinder valve is closed.

In the event of fire:

- vacate area, and carry out Company Fire Procedures as recorded in the Company's Health and Safety Policy.
- inform emergency services of the presence of cylinders and the possibility of bursting discs; and

In either instance notify the supplier to collect the cylinders for examination and testing.

FIRST AID

Inhalation-asphyxiation

Staff should be aware of the effects of inhalation. The normal level of carbon dioxide in air is 0.03%, and increased levels of carbon dioxide (2%) will cause increased breathing rates, headaches, and lack of concentration. Concentrations of 8-15% cause headaches, nausea and vomiting, and concentrations of 12-15% will cause unconsciousness and rapid death. If a medical emergency arises, the casualty should be removed to an uncontaminated area. The casualty should be kept warm and rested, and an ambulance summoned. Artificial respiration should be applied if breathing has stopped. Breathing apparatus will be required in the affected area.

Skin contact - cold burns

Treat as thermal burn, i.e. irrigate affected area with tepid water and seek medical advice.

INTRODUCTION LPG

The most widely used forms of LPG are propane and butane. LPG forms a flammable mixture in air between 2-10% by volume. It is colourless and heavier than air. The main hazards associated with LPG are fire, explosion and physical effects such as frost burns, asphyxiation and injuries from the manual handling of cylinders.

The guidance on the storage of LPG is extremely complex. This guidance aims to give a general indication of the requirements. If you are storing LPG you are strongly advised to seek guidance from the Gas Supplier, the Health and Safety department, or the LPG association

The LP Gas Association, Code of practice 7, 'Storage of Full and Empty LPG Cylinders and Cartridges' gives recommendations for various situations where LPG could be stored. These include open-air storage, storage against walls or between 2 or 3 walls, and indoor storage (separate buildings, within parts of buildings or in cabinets/cupboards). The most common storage situations are summarised below. If you intend to store in any other way please contact the Health and Safety Department.



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STORAGE IN THE OPEN AIR FOR LESS THAN 400KG

Storage in a yard is good practice. In brief, the following should be adhered to:

- If the whole yard is accessible to the public then the LPG must be stored in a cage.
- This should be constructed of weld mesh 12 gauge 50 x 50mm or similar standard. Any walk-in cage should be at least 1.8 metres high.
- It should have two outward opening exits which are lockable, but which permit immediate escape from inside without the use of a key. One exit is acceptable if the maximum travel distance is less than 12 metres within the cage.
- The stack must be at least 1 metre from the boundary, 2 metres from a cellar opening, drain, gully, door or window and 3 metres from any combustibles unless they are behind a 30-minute fire resisting structure.
- Storage of LPG may be directly against a wall greater than 2 metres high on a boundary if it is of 30 minutes fire resistance.
- No smoking or naked lights allowed within 1 metre of the stack or any vehicles except those which are specifically delivering or collecting the LPG.
- Only electrical apparatus suitable for use in a “Zone 2” area (see BS EN 60079/10) are allowed in the storage area or in the separation distance. The separation distance for this quantity is 1.5 metres above the tallest cylinder and within 1 metre horizontally. You are advised to consult on any other quantity or circumstance.
- The area must be kept weed and litter free, but do not use sodium chlorate weed killer.
- Floors must be concreted. Any slope should be away from the building or the stored materials.
- Notices such as, ‘LPG Area’, ‘Flammable’, ‘No Smoking/ No Naked Lights’ and ‘Fire Procedure’ should be prominently displayed. The signage provided must comply with the Safety Sign Regulations.
- Flammable, combustible, corrosive, oxidising or toxic chemicals must not be kept in the separation distance.
- Procedures should be in place for checking, removing, storing (in open air) any damaged or leaking cylinders.
- Every container must be stored upright and kept closed and the protective caps in place on the valves.
- No stack should be higher than 2.5 metres nor contain
 - more than 30kg worth of containers less than 6kg in size
 - 45kg worth of 6 to 15kg containers nor
 - more than 50kg of containers between 15 and 20kg in size.



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- A non-combustible roof is acceptable provided at least 0.3 metres high clear ventilation space exists all round.

MORE THAN 400KG OUTDOOR STORAGE (AND ANY STORAGE OF 47KG CONTAINERS)

The following standards are set for storage of more than 400kg of LPG or for any containers over 20kg. Unless compensating factors exist then the following standards are required:

- Good through ventilation.
- Best if entirely open mesh sides.
- Walls on two adjacent sides may create a stagnant corner, so keep LPG away from that area if possible.

The following table gives general separation distances for specified stacks of LPG.

Total quantity of LPG storage in cylinders (tonnes)		Largest stack (tonnes)	Separation distance to boundary if no firewall (m)	With Firewall	
From	To			Firewall to boundary (m)	Stack to firewall (m)
0.015	0.4	0.4	1	0	1
0.4	1	1	3	1	1.5
1	4	1	4	1	1.5
4	6	3	5	1.5	1.5

See LP Gas Association Code of Practice 7 for larger quantities.

The signage must prominently be provided and indicate:

- that it is an LPG storage area
- that the contents are flammable;
- that smoking and other ignition sources are prohibited;
- the procedures to be followed in case of fire.

Any electrical fittings within the area must be suitable for Zone 2 use (i.e. explosive vapour-air mixture not likely to occur in normal operation). Of course Zone 1 (mixture likely) or Zone 0 (mixture continuously present) equipment would also be suitable.

Training: Relevant staff must be fully trained to cope with their tasks and emergencies.

FIRE FIGHTING/EMERGENCY PROCEDURES

Fire fighting equipment must be provided. Dry powder type extinguishers should be used; one 9kg dry powder is suitable for a store of up to 400kg of LPG.

Instruction and training should be provided for all appropriate employees to include actions in the event of a leakage and in case of fire.

Full advice should be sought from the Fire Officer as hoses for cooling cylinders and extinguishing other combustibles may also be required



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LPG AT FIXED INSTALLATIONS (i.e. Bulk Storage)

General guidance to safe practice in storing and handling LPG at fixed storage installations where tanks are filled on site is given in Code of Practice 1 - Bulk LPG Storage at Fixed Installations.

Part 1: Design, Installation and Operation of Vessels Located above Ground. Matters covered include storage tank location and safety distances; the storage tanks themselves; their piping, valves and fittings; pumps; compressors and meters; vaporisers; electrical considerations; fire protection; operations. If you require any further information contact Gas suppliers, or the LPG Association at the following address LP Gas Association, Pavilion 16, Headlands Business Park, Salisbury Road, Ringwood, Hants BH24 3PB.

STORAGE IN WORKSHOPS.

All cylinder gasses used in workshop maintenance such as Acetylene etc must be stored outside in a steel cage, which restricts unauthorized access. Only cylinders in use may be left in the workshop but the following points must be adhered to;

- All cylinders must be stored in a secure upright position;
- Valves and regulators must be switched off when not in use;
- Cylinders must be stored away from any naked flame or heat source, fire exit points and all access/egress routes;

When storing gases in a workshop that are used for maintenance purposes such as welding, the suppliers data sheet must be located near to the cylinder storage area and all safety precautions followed.

Internally, acetylene cylinders are not designed like other kinds of compressed gas cylinders. Acetylene cylinders are never hollow. These cylinders contain a porous, calcium silicate filler and a suitable solvent usually acetone, because, under pressure, acetylene by itself is unstable.

Acetone is used because it has the ability to absorb over 400 times its own volume of acetylene at 70° F.

When using or handling cylinders and containers, it is important to know about:

- Cylinder approval and marking
- Storage of cylinders
- Operating procedures.

Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or trade name of the gas. Such marking shall be by means of stencilling, stamping, or labelling, and shall not be readily removable. Whenever practical, the marking shall be located on the shoulder of the cylinder.

Appropriate marking not only enables proper use, but also assists in proper storage. The following information generally applies to all cylinders:

- Cylinders shall be kept away from radiators and other sources of heat
- Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 feet (6.1 m) from highly combustible materials. Cylinders should be stored in assigned places away from elevators, stairs, or gangways, or other areas where they might be knocked over or damaged by passing or falling objects, or subject to tampering
- Empty cylinders shall have their valves closed



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- Valve protection caps, where the cylinder is designed to accept a cap, shall always be in place, hand-tight, except when cylinders are in use or connected for use. The valve protection cap is designed to take the blow in case the cylinder falls.

Oxygen-Fuel Gas Welding and Cutting - Cylinders

The potential dangers related to cylinders containing compressed gases require that cylinders be stored and operated properly. Operation must emphasize the absence of oily or greasy substances. Follow these rules of operation:

- Cylinders, cylinder valves, couplings, regulators, hose, and apparatus shall be kept free from oily or greasy substances
- Oxygen cylinders or apparatus shall not be handled with oily hands or gloves
- A jet of oxygen must never be permitted to strike an oily surface, greasy clothes, or enter a fuel oil or other storage tank

The valve outlet and regulator are two critical components of compressed gas cylinders that must be used properly.

Valve protection caps protect the valve from damage and oil and grease. The valve-protection cap shall not be used for lifting cylinders from one vertical position to another. The cap may accidentally and suddenly come loose.

Should a cylinder without a cap fall or be knocked over, the valve may be damaged or sheared off, causing a sudden release of pressure.

If the valve outlet of a cylinder becomes clogged with ice, thaw with warm – not boiling – water.

Like the valve outlet, the regulator must be carefully protected.

Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved.

Cylinders not having fixed hand wheels shall have keys, handles, or non-adjustable wrenches on valve stems while these cylinders are in service.

Unless connected to a manifold, always attach a regulator to the compressed gas cylinder before use. Make certain that the regulator is compatible for the particular gas and service pressure.

Make sure the regulator is clean and has a clean filter installed in the inlet nipple.

Before attaching the regulator, remove the protective cap from the cylinder. Stand to one side of the cylinder. Open the cylinder valve slightly for an instant, and then close it. This "cracking" of the cylinder valve will clean the valve of dust or dirt, which may have accumulated during storage. Dirt can damage critical parts of a regulator, and may cause a fire or explosion.

Before a regulator is removed from a cylinder valve, the valve shall be closed and the gas released from the regulator.

An acetylene cylinder valve shall not be opened more than one and one-half turns of the spindle. This permits adequate flow of acetylene and allows ready closing of the valve in an emergency situation.