

Working safely with acetylene



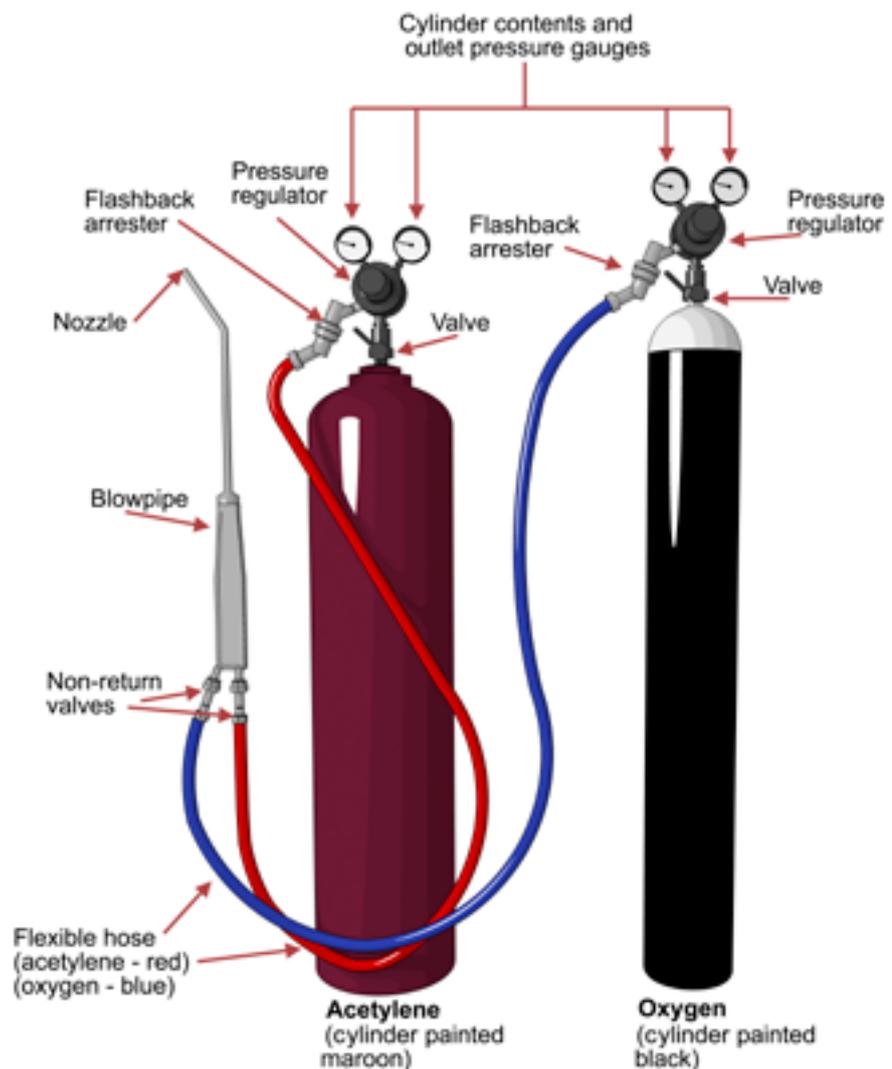
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Introduction

This leaflet provides guidance on the fire and explosion hazards of acetylene. It is for people who use acetylene for welding, cutting and similar processes.

The leaflet does not cover fixed installations where acetylene is used (see www.hse.gov.uk/fireandexplosion/acetylene.htm for more information on these).

Figure 1 Typical equipment used in oxy/acetylene gas welding and similar processes (Note that cylinder valves will be operated either by a 'cylinder key' or a 'handwheel').



What does the law say?

There are specific legal duties relating to acetylene under the Health and Safety at Work etc Act 1974 and the Provision and Use of Work Equipment Regulations 1998 (see www.hse.gov.uk/fireandexplosion/acetylene.htm). This leaflet will help people who use acetylene to comply with their legal duties.

Explosion hazard of acetylene cylinders

An acetylene cylinder has a different design from most other gas cylinders. It consists of a steel shell containing a porous mass. The acetylene gas in the cylinder is dissolved in acetone which is absorbed by the porous mass. Decomposition of the acetylene is triggered by heat, eg when it is:

- involved in a fire;
- scorched by flames from a blowtorch; or
- involved in a flashback.

The porous mass slows down any decomposition of the gas. From the start of decomposition to the cylinder exploding could take several hours. This should provide time for emergency action.

Decomposition can be triggered more easily and proceed more rapidly if:

- the porous mass has been damaged by repeated flashbacks;
- the cylinder has been mishandled or dropped;
- the cylinder valve is leaking; or
- the acetylene in the hoses is above the pressure recommended by the supplier.

There are a number of incidents each year where a flashback into an acetylene cylinder triggers decomposition, leaving the cylinder in a dangerous, unstable condition, which can lead to an explosion.

A flashback occurs if there is a flammable mixture of fuel gas and oxygen in the hoses when the torch is lit. This can ignite the mixture and will travel backwards into the cylinder. A flashback can cause decomposition of the acetylene.

An explosion of the cylinder immediately after a flashback is rare. If decomposition is identified early, there is time to evacuate, call the fire and rescue services and take emergency action.

The fire and rescue services cool cylinders for at least an hour, then monitor them for another hour. They then decide whether it is safe to enter the exclusion zone or move the cylinder.

Other hazards

If acetylene gas is drawn off from cylinders too quickly, acetone can be mixed with the gas. This can cause the equipment to malfunction. Acetylene gas can also condense and drip off the torch, causing a fire risk. To avoid this, the rate of withdrawal of gas should be restricted to the values given in the British Compressed Gases Association (BCGA) Code of Practice *The design and construction of manifolds using acetylene gas from 1.5 bar to a maximum working pressure of 17 bar (246.5/bf/in²)* (see 'Further reading').

The working pressure of acetylene equipment is critical: Acetylene pressure must not exceed 0.62 bar (9psi) unless equipment has been specifically designed for it. See www.bcga.co.uk for details and references.

How to prevent flashback

Only use regulators, flashback arrestors, hoses and blowpipes designed for acetylene and oxygen, respectively, and marked and manufactured to the correct BS EN ISO Standards (see 'Further information').

For most welding and cutting processes, the acetylene pressure should not exceed 0.62 bar (9psi) (see www.hse.gov.uk/fireandexplosion/acetylene.htm).

Before use

Check:

- ✓ the identification on the cylinder;
- ✓ that it looks safe for use;
- ✓ that it is clean with no obvious damage.

After use

- ✓ Check there is no obvious damage.
- ✓ Turn off all valves (at cylinder, blowpipes etc).
- ✓ Vent excess gas from the hoses.

Training

- ✗ Do not use oxy/acetylene equipment unless you have been trained.

Use the correct lighting-up procedures

- ✓ Before lighting the blowpipe, purge the hoses by opening the gas supply to each hose for a few seconds. This will flush out any flammable mixtures of gases in the hose.
- ✓ Purge one hose at a time and close the blowpipe valve after purging.
- ✓ Use a well-ventilated area.
- ✓ Use a spark ignitor to light the gas.
- ✓ Use the correct gas pressures and nozzle sizes for the job.

Handle acetylene cylinders with care

- ✗ Do not drop or jar them.
- ✗ Do not roll them across the floor.
- ✓ Keep them in an upright position, and if returned to an upright position, leave for an hour to settle.

Fit flashback arresters (or equivalent)

- ✓ Fit flashback arresters onto the pressure regulators on both the acetylene cylinder and the oxygen cylinder. These, or equivalent devices, prevent any decomposition travelling back into the cylinder.
- ✓ For long lengths of hose, fit arresters on both the blowpipe and the regulator, and shorten the hose as soon as the long length is no longer required.

Note: The fitting of flashback arresters is **not** a substitute for safe working practices.

Maintain non-return valves

- ✓ Fit non-return valves (often called check valves) on the torch, to prevent back-feeding of gas into the hoses.
- ✓ Inspect regularly and replace damaged non-return valves.

Note: Non-return valves will not stop a flashback once it has occurred.

Keep nozzles in good condition

Poorly maintained nozzles cause turbulent gas flow, which increases the risk of flashback.

- ✓ Inspect nozzles regularly. Make sure they are not blocked by dirt or spatter. Replace damaged nozzles.
- ✓ Do not hold the nozzle too close to the workpiece. The nozzle can overheat and cause a flashback.

What to do if there is a flashback

If a flashback does occur:

- immediately close both the blowpipe/nozzle valves, oxygen first, then acetylene. (Note: this is opposite to the normal closing-down procedures);
- close both cylinder valves;
- if the flame cannot be put out at once, evacuate the area and call the fire and rescue services;
- find the cause of the incident and examine all equipment for damage;
- do not move or vent cylinder, monitor for any heat over the next hour;
- if a hotspot is detected, or the cylinder begins to vibrate, immediately evacuate the area and call the fire and rescue service;
- before using again, make sure all equipment is working effectively, especially anything that might have been affected by heat. If in doubt, consult your supplier.

For more information refer to BCGA leaflet, *Cylinders in fire* (see 'Further reading').

General maintenance

Regulators and other equipment should be maintained in line with the manufacturer's recommendations. If uncertain, refer to your supplier or the BCGA guidance.

Carrying acetylene in vehicles

Acetylene has an unusually wide explosive limit which means that even a small leak in an enclosed space can cause an explosive atmosphere to build up. Acetylene cylinders should therefore be transported in open vehicles where it is reasonably practicable.

If this is not reasonably practicable and acetylene cylinders or an oxy/acetylene set has to be carried in the rear of a closed van, you must ensure that there is ventilation fitted to the load space of the vehicle. In most vans, this can be two low level ventilation grills and rotary roof vents which will increase the air changeover rate in the load space when the vehicle is parked or moving.

Further detail on how load space ventilation can affect the potential build-up of acetylene in closed vans can be found at www.hse.gov.uk/fireandexplosion/acetylene.htm.

Note: A large release, such as when valves are not closed or do not close properly, will cause an explosive atmosphere to develop quickly even with ventilation (although the gas may dissipate once the cylinder is empty). Following industry guidance on removing the hoses from the cylinders reduces the risk of this not being noticed.

Further reading

Cylinders in fire L6 BCGA 2012 www.bcgaco.uk/publications

The design and construction of manifolds using acetylene gas from 1.5 bar to a maximum working pressure of 17 bar (246.5/bf/in²) Code of Practice 5(rev2) BCGA 2012 www.bcgaco.uk/publications

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

See www.hse.gov.uk/fireandexplosion/acetylene.htm for more resources relating to acetylene.

Further information, publications and contact information for BCGA is available at www.bcgaco.uk.

British Standards can be obtained in PDF or hard copy formats from BSI: <http://shop.bsigroup.com> or by contacting BSI Customer Services for hard copies only
Tel: 0845 086 9001 email: cservices@bsigroup.com.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

This leaflet is available at: www.hse.gov.uk/pubns/indg327.htm.

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