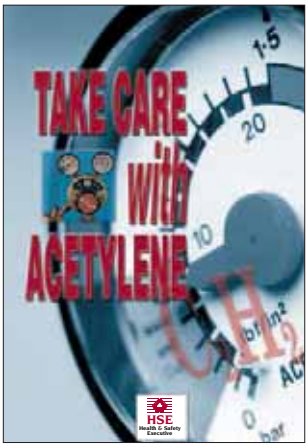
Take care with acetylene



This is a web-friendly version of leaflet INDG327, reprinted 01/01

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

Acetylene cylinder explosion

An operator was lighting an oxy/acetylene cutting torch. There was a flashback to the acetylene cylinder, which started to vibrate. Three minutes later the cylinder exploded. The cylinder split into two parts. The largest part shot through a window and travelled 23 metres before embedding itself in an embankment at the factory boundary.

The workshop was badly damaged. The windows were blown out and the roof collapsed. The explosion also lifted the roof of the main factory building, which had to be replaced. The cost of the damage was over £1 million.

Fortunately, no-one was injured, because the operator realised that the cylinder was in a dangerous condition. He raised the alarm and the factory was immediately evacuated.

What went wrong?

Acetylene is an extremely flammable gas. It is different from other flammable gases because it is also unstable. Under certain conditions, it can decompose explosively into its constituent elements, carbon and hydrogen.

The operator did not fully appreciate the hazards of acetylene. He did not follow the recommended procedures or take adequate precautions. In particular:

- The correct lighting up procedure was not followed. The gas hoses were not purged.
- The acetylene gas was not at the correct pressure.
- The gas cylinders were not protected with flashback arresters.

A flashback can occur…if there is a flammable mixture of fuel gas and oxygen in the hoses when the torch is lit. If it is not stopped, the flame will ignite the mixture and will travel backwards from the torch, along the hoses, through the regulator and into the cylinder. A flashback can trigger decomposition of the acetylene in the fuel hose, in the regulator and in the cylinder itself.

Hazards of acetylene cylinders

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. An explosion of the cylinder only three minutes after a flashback is extremely rare. In most cases, if the decomposition is identified at an early stage, there is time for the building to be evacuated, the fire brigade to be called and for emergency action to be taken.

To make an unstable cylinder safe, the fire brigade may have to apply cooling water for many hours. It could be several days before the cylinder can be moved, because moving the cylinder could restart or accelerate the decomposition.

These incidents put at risk anyone in the vicinity of the cylinder and anyone who tries to make the cylinder safe, such as the emergency services.

Acetylene cylinders can be used safely

An acetylene cylinder has a different design from most other gas cylinders. It consists of a steel shell containing a porous mass. The porous mass is a cellular structure which completely fills the cylinder. The acetylene gas in the cylinder is dissolved in acetone which is absorbed by the porous mass. Decomposition of the acetylene is usually triggered by heat. For example, if the cylinder is:

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

The porous mass is designed to slow down or stifle any decomposition of the gas. From the start of decomposition to the cylinder exploding should take several hours. This will usually (but not always) provide time for emergency action.

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

- the porous mass has been damaged by repeated flashbacks or by mishandling or dropping the cylinder;
- the cylinder valve is leaking gas (an open or leaking valve increases the rate of decomposition within the cylinder); or
- the acetylene in the hoses is above the pressure recommended by the supplier. For most welding and cutting processes, the acetylene pressure should not exceed 0.62 bar (9psi). (See note under References.)

What can you do to prevent flashback?

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.

Fit flashback arresters

✔ Fit flashback arresters onto the pressure regulators on both the acetylene cylinder and the oxygen cylinder.

✔ For long lengths of hose, fit arresters on both the blowpipe and the regulator.

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 backfeeding 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.

If a flashback does occur:

✔ Immediately close the cylinder valves, both acetylene and oxygen, if it is safe to do so. The flame should go out when the fuel gas (acetylene) is shut off. If the flame cannot be put out at once, evacuate the area and call the emergency fire services and the gas supplier.

✔ Check any acetylene cylinder which has been involved in a flashback or which may have been affected by fire or flames. If it becomes warm or starts to vibrate, evacuate the building immediately and call the emergency fire services. Also call the gas supplier.

✔ Do not attempt to move an unstable cylinder. Direct water spray at the cylinder body, if it is safe to do so.

✔ Before using again, check flashback arresters and other components which may have been damaged by the flashback. Replace if necessary. If in doubt, consult the supplier.

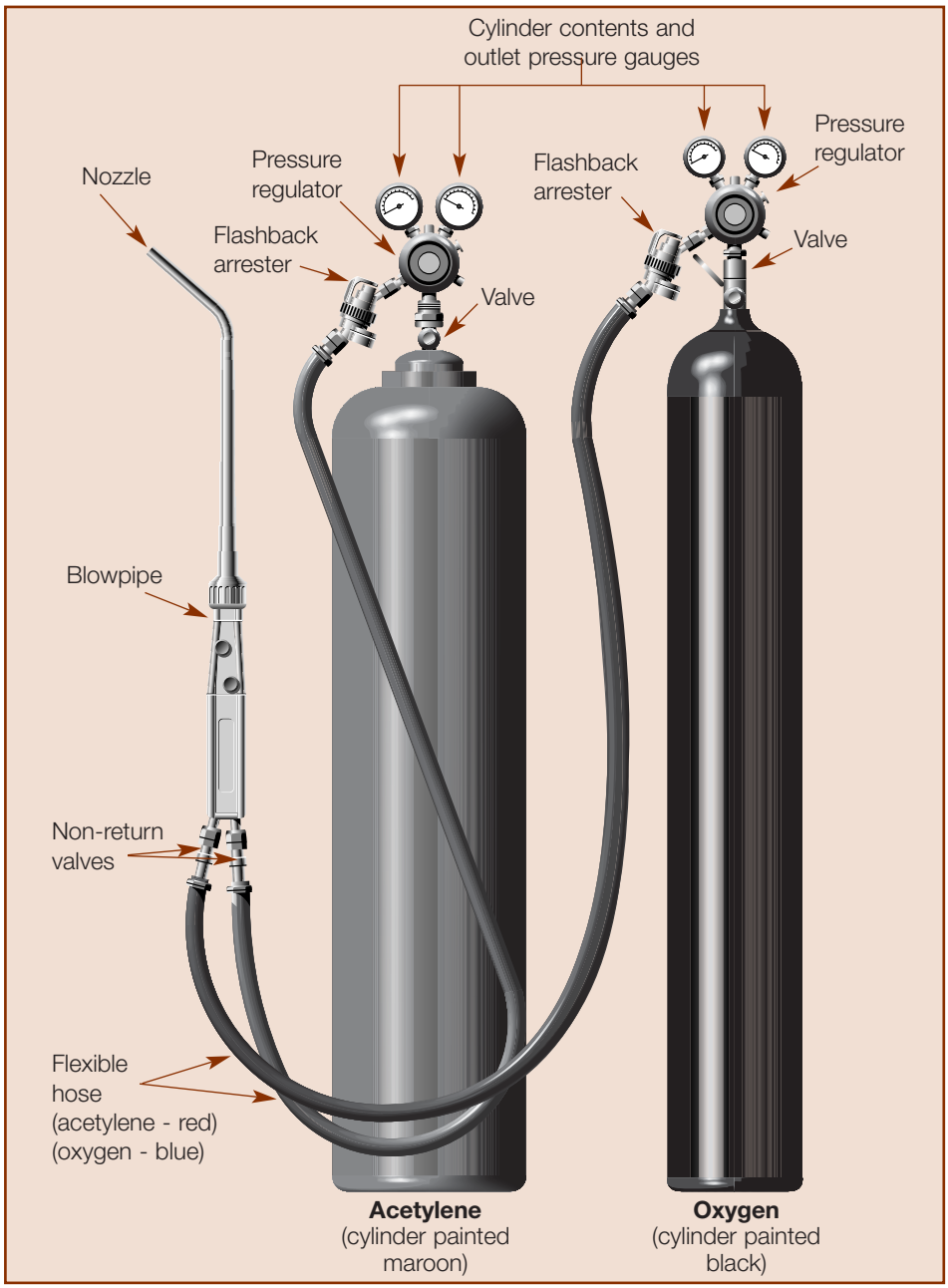


Figure 1 Typical equipment used in oxy/acetylene gas welding and similar processes

References

More detailed advice may be found in the following publications:

The safe use of compressed gases in welding, flame cutting and allied processes HSG139 HSE Books 1997

British Compressed Gases Association Code of Practice CP7 *The safe use of oxy-fuel gas equipment (Individual portable or mobile cylinder supply)*. Revision 2: 1996

BS EN 730 *Gas welding equipment - Equipment used in gas welding, cutting and allied processes, safety devices for fuel gases and oxygen or compressed air. General specifications, requirements and test.*

Hot work on small tanks and drums INDG314 HSE Books 2000

Safety in gas welding cutting and similar processes INDG297 HSE Books 1999

Take care with oxygen: Fire and explosion hazards in the use of oxygen HSE8(rev2) HSE Books 1999

*Acetylene pressure must not exceed 0.62 bar (9psi) unless equipment has been designed to meet HSE Exemption Certificate No 2 of 1989 issued by the Explosives Inspectorate, St Anne's House, Stanley Precinct, Bootle, Merseyside, L20 3RA Tel: 0151 951 4025 and British Compressed Gases Association Code of Practice CP6 *The safe distribution of acetylene in the pressure range 0-1.5 bar (0-22 lbf/in2).* Revision 1:1998

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

Further information

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This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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