

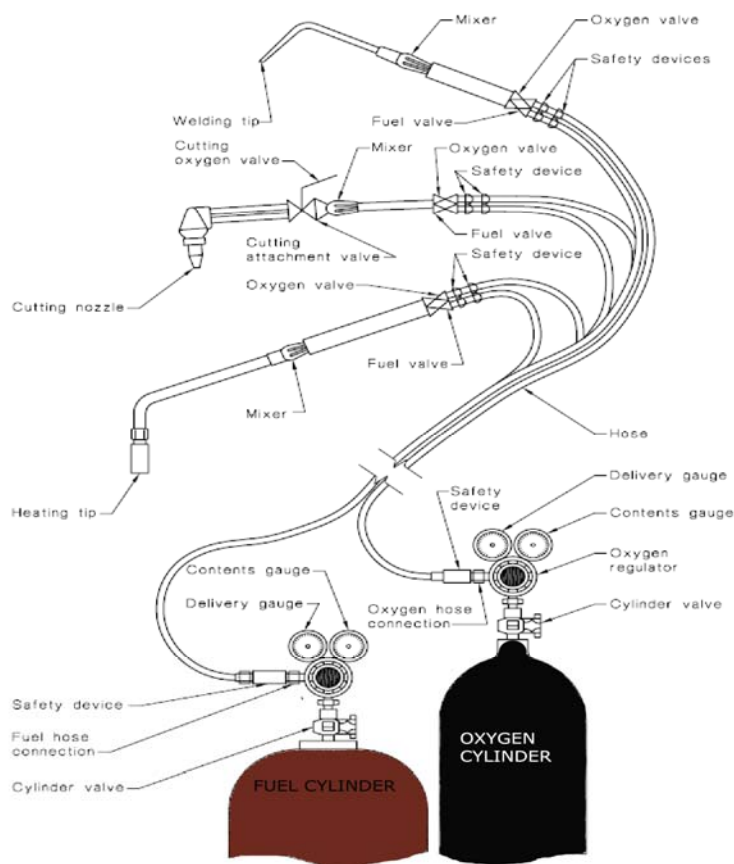
Portable Oxy-Fuel Gas Equipment

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This document has been compiled from the most common asked questions to WorkSafe on portable oxy-fuel gas cutting and welding equipment. It has been published to assist industry by clarifying and explaining WorkSafe’s position on these common questions.

Oxy-fuel gases, include oxygen, acetylene and liquefied petroleum gas (LP Gas).

Typical oxy-fuel gas equipment



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1. TRANSPORTING GAS CYLINDERS IN VEHICLES

1.1 How should I transport gas cylinders in my work ute, tray truck or trailer?

When transporting gas cylinders on utilities, open vehicles, or trailers:

- Remove regulators before loading on to vehicle and transporting.
- Ensure cylinder valves remain closed and use valve protection guards or caps, where possible.
- Secure cylinders in an upright position, to prevent them tipping or falling over.
- Avoid careless handling, do not drop or allow heavy objects to fall on them.
- Remove or secure loose tools and materials that can damage and rupture cylinders.
- Carry fire fighting equipment on your vehicle.
- Park vehicle in the shade, where possible.

DO NOT smoke, use naked flame or non flameproof electrics anywhere near a vehicle carrying fuel gases.

DO NOT transport fuel gas cylinders in a separate enclosed cargo compartment (such as utilities with canopies), unless the compartment is permanently vented to outside.

DO NOT cover utilities, open vehicles, or trailers with a tarpaulin when transporting fuel gas cylinders.

DO NOT leave cylinders unattended in vehicles where they are accessible to unauthorised persons.

1.2 Is it OK to transport gas cylinders in my work van?

Yes - provided additional safety precautions are taken.

Where the cargo compartment is open to the passenger compartment and/or engine compartment (as in most types of vans) then you must house the fuel gas cylinders in a separate airtight compartment, which must be permanently vented to the outside of the vehicle. The number of cylinders carried will be dependant on the size of the fuel gas compartment.

Ensure cylinder valves are closed and checked for leaks, (e.g. with soapy water) before loading into van.

DO NOT use cylinders whilst they are still in your van. Always remove them to open air before use.

Note: Whenever possible, gas cylinders should be transported on open vehicles, or trailers.

2. STORING GAS CYLINDERS ON CONSTRUCTION SITES

Storage requirements vary depending on the quantity of gas being stored and whether the store is classified as a minor storage. For this reason it is essential to determine the quantity of gas cylinders on-site, so that cylinders are stored in an appropriate manner and in accordance with dangerous goods legislation.

Note: Quantities of gas in use, as stand-by or empty, should be minimised as far as possible.

2.1 What quantity of gas is classified as a minor storage?

Refer to the tables below and the following work example to determine if the quantity of gas on-site is classified as a minor storage.

TABLE 2.1 MAXIMUM QUANTITIES OF GASES PERMISSABLE FOR CLASSIFICATION AS MINOR STORAGE AS 4332 - 2004 Section 2.3	
Division (Class) of Gas	Maximum Aggregate Water Capacity
Division (Class) 2.1 Flammable gas (LPG, Acetylene)	500 litres
Division (Class) 2.2 Non flammable gas (Nitrogen, Argon)	2000 litres
Division (Class) 2.2 with Class 5.1 subsidiary risk (Oxygen)	1000 litres
Mixed Gases with no individual class to exceed its subclass in table 2.1	2000 litres

AGGREGATE WATER CAPACITY OF CYLINDERS AS 4332 - 2004 Appendix C			
Type of Gas	Cylinder size		
	G	E	D
Oxygen	48 litres	24 litres	10 litres
Acetylene	48 litres	24 litres	10 litres
	Cylinder Size		
	45 kg	15 kg	9 kg
LPG	108 litres	44 litres	23 litres

For an example, see Attachment 1 - WORK EXAMPLE: Determining minor quantities.

2.2 How should gas cylinders be stored?

Cylinder storage areas should be well ventilated and preferably outdoors. Protection from weather is desirable, but not at the expense of ventilation.

Within the storage area oxygen cylinders should be stored at least 3 metres from fuel gas cylinders, unless separated by a firewall (minimum 4 hour fire rating).

STORAGE OF FUEL GASES EXAMPLES

EITHER Use a screen wall (Diagram A) to achieve the segregation distance,

OR Maintain 3 metre segregation (Diagram B).

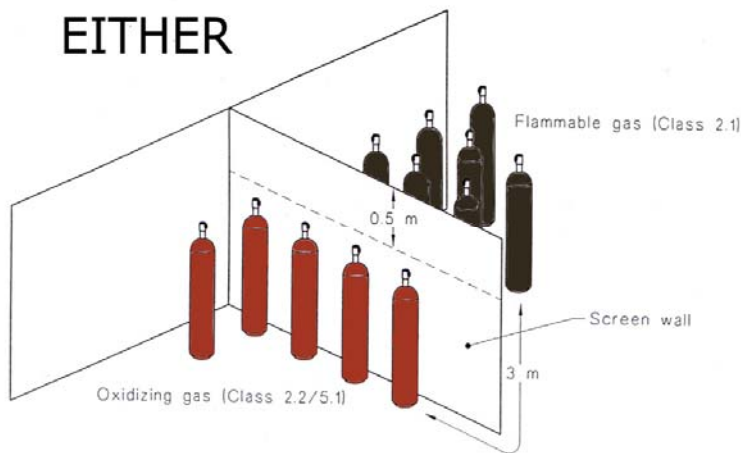


Diagram A

OR

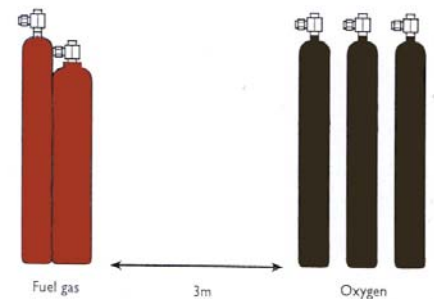


Diagram B

All cylinders should be treated as full, regardless of their content and the following safety precautions observed:

- Secure cylinders in an upright position, in a well ventilated area.
- Keep cylinders away from ignition or artificial heat sources (eg. welding leads, flames, heaters etc.) and other flammable materials.
- Store full and empty cylinders separately.
- Protection from direct sunlight is recommended.
- Display “Danger: No Smoking, No Ignition Sources” and “Restricted Area, Authorised Personnel Only” signage in the cylinder storage area.

DO NOT repaint cylinders or obscure cylinder labels, even if the cylinder is rusty, dirty or damaged.

DO NOT use cylinders that cannot be clearly identified.

Note: Cylinders should not be accessible to unauthorised persons.

2.3 What if the quantity of gases in cylinders is greater than those given for minor storage?

Cylinders should be kept in a purpose-designed store or storage area:

- Store to be at ground level, the base or floor shall be level and constructed of non-combustible materials.
- Store to be constructed of non combustible materials.
- Store to be separated from other buildings or have a 4 hour rated fire wall and the roof of the store shall be 3 hour fire rated if another building is on top.
- Store and cylinders to be protected from impact by vehicles, forklifts etc. and fenced and secured against unauthorised access.
- Electrical equipment in flammable gas stores shall comply with AS/NZS 3000 and the storage area shall have NO IGNITION sources.
- Cylinder store doors shall open outwards.
- Store to be ventilated either by mechanical or natural means.
- Store to be fitted with appropriate fire protection system - refer to AS 4332 table 7.2 .

Further information on the storage of gas cylinders exceeding the maximum quantities classified as a minor storage can be found in AS 4332, Section 4, Table 2.1.

2.4 Can I store gas cylinders in unmodified shipping (freight) containers?

No. Unmodified shipping containers should not be used as an alternative to a purpose built cylinder store or stillage. AS 4332 - *The storage and handling of gases in cylinders*, Section 4 provides guidance on the construction, location and ventilation of stores and should be referenced prior to storing cylinders in modified shipping containers.

2.5 What signage (placarding) do I need on a gas cylinder store or stillage?

Gas stores and stillages (classified as a minor storage) should have the following signs attached:

- A warning sign to prohibit smoking and to exclude other sources of ignition, e.g. DANGER: NO SMOKING, NO IGNITION SOURCES.
- A warning sign to restrict entry e.g. RESTRICTED AREA, AUTHORISED PERSONNEL ONLY.

Dangerous goods placards and HAZCHEM outer warning placards shall be displayed at premises if the quantity of dangerous goods exceeds minor storage quantities (Refer to Table 2.1 when determining storage quantities). These placards warn the emergency services of the chemical hazards present and provides the information necessary for them to deal safely with an emergency at the premises.

3. USE, CARE AND HANDLING OF GAS CYLINDERS

3.1 What do I need to consider before manually lifting and carrying cylinders?

Gas cylinders can be awkward to move due to their size, shape and weight. Lifting and carrying of cylinders is a high risk activity, therefore proper control measures should be put in place when moving cylinders.

Employers need to consider the use of appropriate lifting or transport equipment to minimise manual handling risks associated with moving full and empty cylinders.

Where it is not practical to use mechanical lifting aids, and cylinders are manually lifted and carried, the smallest sized cylinder suitable for the job should be used.

Do Not roll cylinders along the ground in a horizontal position, as this can open or damage the cylinder valve.

Note: *Cylinder valves should not be used as a lifting anchor point at any time. Also, care should be taken when manually lifting and carrying cylinders up stairs and between floor levels and should be avoided where possible.*

3.2 Can I use gas cylinders that are lying in a horizontal position?

No. Gas cylinders should only be used whilst they are in an upright position and secured against falling.

The transportation or storage of acetylene cylinders horizontally should be avoided.

Where acetylene cylinders have been transported or stored horizontally, the cylinder should be allowed to stand upright for a minimum of 12 hours prior to use. This will allow the acetone to evenly re-distribute within the cylinder and prevent acetone being carried in to the flame.

Note: *An indication that acetone is being carried to the flame can be the discoloration of the flame.*

3.3 Can I use oxy fuel gas equipment in poorly ventilated areas?

Yes. Where practicable, forced ventilation should be provided to the area. Cylinders should be located outside poorly ventilated areas and equipment should be leak tested at working pressure prior to being used.

3.3 Can adjustable worm drive clips (jubilee clips) be used to clamp gas hoses?

No. The use of jubilee clips could cause gas leaks due to under-tightened (loosened connections) or over-tightened (cut in hose) conditions.

4. FLASHBACK ARRESTORS

4.1 What are some of the common causes of flashback?

A flashback is the burning-back of the flame into the blowpipe or the ignition of an explosive mixture in one of the gas lines. Frequently, the only sign of flashback is a cloud of carbon smoke issuing from the welding tip when the blowpipe valves are open. The least amount of damage caused by a flashback is the burning of the inside of the hose lining which, if repeated over a period of time will result in disintegration of the hose.

Common causes of flashbacks are:

- Incorrect operating pressures
- Blockage in the welding tip
- Faulty equipment, such as worn or malfunctioning torch valves
- Back feeding, which occurs when higher pressure gas feeds back up a lower pressure gas line
- Flow rate of acetylene exceeds withdrawal rate
 - Withdrawal rate, refers to the rate at which acetylene gas is able to withdraw from acetone liquid
 - Flow rate, refers to the amount of gas passing through the regulator

Therefore, the flow rate should be less than the withdrawal rate. Where it exceeds the withdrawal rate, acetone liquid will be withdrawn with acetylene gas from the cylinder.

Acetone liquid being withdrawn from the cylinder is one of the major causes of flashback with acetylene equipment and is characterised by the flame taking on a yellow or green tinge.

For further information regarding flow rates and withdrawal rates, contact your local gas equipment supplier.

Guidance can be found in *AS 4267 Pressure regulators for use with industrial compressed gas cylinders*.

Note: Acetylene regulators should be designed in such a way that it shall not be possible to adjust them to an outlet pressure exceeding 150 kPa in the flowing condition.

4.2 Do I need to use flashback arrestors?

Yes. Suppliers of all common fuel gas systems recommend the use of flashback arrestors (compliant with AS 4603) to prevent flames travelling back into the cylinders. It is recommended that flashback arrestors with adequate (high) flow capacities be used.

The fitment of incorrect flashback arrestors can result in reduced flow capacity, which may be below the minimum required by the heating or cutting device. This has the potential to cause an increase in flame instability at which point the installed safety devices (flashback arrestors) may increase rather than decrease the risk of flashback.

For high flow applications, especially heating, the operator needs to ensure higher flow flashback arrestors are used. Consult manufacturers or suppliers specifications for further information.

4.3 Where should flashback arrestors be fitted?

Supplier's advice should be followed to ensure the correct placement and fitting of the flashback arrestors.

WorkSafe recommends:

- for hoses 3 metres or less, flashback arrestors fitted to each gas line at the regulator outlet is sufficient
- for hoses longer than 3 metres, two flashback arrestors should be fitted to each gas line; one at the blowpipe connection and one at the regulator outlet

The regulator end of the gas hose should incorporate a flame arrester, non return valve and a temperature actuated cut off valve.

The torch end of the gas hose should incorporate a flame arrester and non-return valve.

5. FIRE PROTECTION EQUIPMENT

5.1 Do I need to have access to a fire extinguisher?

Yes. An appropriate fire extinguisher needs to be readily accessible in case of a fire. Typically, a suitable fire extinguisher (Dry Chemical or CO₂) should be either attached to the cylinder trolley or be in the immediate area where fuel gases are being used.

In certain applications, fire hose reels, garden hoses and fire blankets can also be used to extinguish fires.

Note: *The most common incidents to occur are ignitions of leakages of fuel gas from hose connections or defective hose. An appropriate emergency plan needs to be in place in case of a fire and/or explosion and should form part of the safe work procedure.*

6. MAINTENANCE OF OXY-FUEL GAS EQUIPMENT

6.1 Who should carry out maintenance work on oxy-fuel gas equipment?

It is expected that maintenance work is carried out by a technically competent person who has sound knowledge and experience of oxy-fuel gas equipment and understands the importance of integrity and safety in the use of oxy-fuel gas equipment.

6.2 What inspection and maintenance regime should I have in place for my oxy-fuel gas equipment?

As with all types of plant and equipment, regular inspection and periodic maintenance should be carried out on oxy-fuel gas components including:

- Regulators (including their integral protective devices)
- Flashback arrestors
- Hose assemblies
- Blowpipes, mixers and attachments

A suitable inspection and periodic maintenance regime includes:

Daily inspection: a pre-operation visual check should be carried out when connecting equipment to cylinders. Damaged equipment must be withdrawn from service.

Weekly inspection: visually examine and check equipment for its suitability for continued use. All threads and sealing surfaces to be checked for damage, **oil or grease** contamination and leak tested where deemed appropriate.

Six month inspection: equipment to be function tested to ensure correct operation of internal components. Hose assemblies to be checked for cracks and other signs of wear and tear.

Refurbishment and replacement program: Faulty components should be refurbished and replaced in accordance with the manufacturers or suppliers recommendations. All repaired components should be function and leak tested before use.

Records of inspection and maintenance should be kept by the person who owns the oxy-fuel gas equipment. One means of compliance may be to tag or attach stickers to oxy fuel gas equipment that has been inspected and tested.

Note: *If fuel gas and oxygen components are subjected to harsh working conditions or rough treatment, it may be necessary to inspect them on a more regular basis.*

6.3 Who can inspect and test flashback arrestors?

Inspection and testing of flashback arrestors can be carried out by the manufacturer or supplier of the flashback arrestors or a technical competent person. The testing must be done every 12 months on machinery purpose built for the task and approved by the manufacturer of the flashback arrestor.

Testing will include checks on:

- Through flow
- Non-return
- Leak tightness

7. PERSONAL PROTECTIVE EQUIPMENT

7.1 Why can't I use sunglasses as eye protection when carrying out hot work processes?

Only eye protection that complies with AS 1336 should be worn when carrying out hot work and using oxy-fuel gas systems.

In gas welding or cutting, and resistance welding or brazing, suitable eye protection shall be provided to guard against invisible radiation and to reduce the visible radiation to a comfortable level.

For such processes, sufficient protection will usually be given by goggles and glasses with filters of Shade Numbers 3 to 7, inclusive.

Guidance can be found in Australian Standard AS 1336 *Recommended practices for occupational eye protection*, Section 5, Eye protection against ultraviolet and infrared radiation.

7.2 What clothing should I wear during hot work?

Clothing should be well fitting, yet easy to remove and free from oil or grease and made from heavy cotton or wool. Leather work boots should be worn to protect the feet from sparks hot slag and other objects. Leather gloves should be worn to protect the hands and safety glasses should be worn when working with gas under pressure.

Synthetic or other flammable clothing, including some types of high visibility vests and nylon, flying jackets, should not be worn by workers involved in gas cutting or welding.

Guidance can be found in Australian Standard AS 4839, *The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes*, Section 10, Safety Instructions.

Attachment 1:

WORK EXAMPLE: Determining minor quantities.

When determining minor storages, the total capacity allowed for any particular situation shall include cylinders in use, spare cylinders not in use and cylinders awaiting removal.

Step 1 - Conduct a stocktake of all gas cylinders on-site including empties, checking size of cylinder and quantity.

Stocktake reveals the following list of cylinders is on-site; 6 Oxygen size G, 6 Acetylene size G, 4 Oxygen size E and 4 Acetylene size E.

Step 2 - Multiply the number of cylinders by the water capacity of each cylinder.

6 Oxygen size G	(6 x 48L)	=	288 litres
6 Acetylene size G	(6 x 48L)	=	288 litres
4 Oxygen size E	(4 x 24L)	=	96 litres
4 Acetylene size E	(4 x 24L)	=	96 litres
		=	768 litres

Note: each individual division (class) of gas is less than the maximum aggregate water capacity; Acetylene 384 litres (500L Max), Oxygen 384 litres (1000L Max) and the combined mixed gas capacity are less than 2000 litres.

Therefore the above store of gas cylinders is classified as a MINOR STORAGE.

FURTHER INFORMATION

Alerts and Guidance Notes

WorkSafe Guidance Note - Elevating work platforms and the placement of gas cylinders for cutting or welding.

WorkSafe Victoria

Go to the WorkSafe homepage, www.worksafe.vic.gov.au choose an industry or publication category

Contact the advisory service on 1800 136 089 OR email info@worksafe.vic.gov.au

Standards Australia

AS 4332: 2004 - The storage and handling of gases in cylinders

AS 4839: 2001 - The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes

AS 4603: 1999 - Flashback arresters - Safety devices for use with fuel gasses and oxygen or compressed air.

AS 1336: 1997 - Recommended practices for occupational eye protection.

AS 1674.1: 1997 - Safety in welding and allied processes

Copies of standards can be obtained by contacting Standards Australia on 1300 654 646 or by visiting the web site at www.standards.com.au

Note: This guidance material has been prepared using the best information available to WorkSafe Victoria. Any information about legislative obligations or responsibilities included in this material is only applicable to the circumstances described in the material. You should always check the legislation referred to in this material and make your own judgement about what action you may need to take to ensure you have complied with the law. Accordingly, the Victorian WorkCover Authority extends no warranties as to the suitability of the information for your specific circumstances.