

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

Copper Piping - Welding / Brazing

OBJECTIVE

On completion of this element you will be able to join pipes in the down-hand position, by means of the recognised oxy-acetylene silver soldering and copper joining methods, competently to specifications given in this element, applicable to domestic / small plant refrigeration systems.

SAFETY PRECAUTIONS

Safety is very important. Carelessness can cause accidents, so it is necessary that at all times great care must be taken to act and work safely to prevent harming yourself and others.

You must familiarise yourselves with all safety rules and obey and apply them.

PROTECTIVE CLOTHING

- All parts of your body must be covered when welding.
- You must wear:
 - Overall – that fasten up to the neck with long sleeves and legs that fit properly.
 - Leather gloves.
 - Safety shoes or boots.
 - Dark welding glasses when using oxy-acetylene equipment.

SAFETY SIGNS

Familiarise yourself with these standard safety signs, and watch out for them at all times. These signs are used to prevent accidents happening by making you aware of the dangers and precautions to take. They must be OBEYED, so for your own safety, do not ignore them.

WORKING AREA

The working area or workshop must be kept CLEAN and TIDY at all times.

Tidy your workshop at the end of the day.

Pick up paper, rags and scrap metal.

Place all rubbish in the bins provided.

Coil gas hoses and welding cables neatly.

Do not leave any items lying around.

Do not balance any items on top of each other.

Keep your floor space clear, clean and dry.

Do not weld in wet places.

Do not weld in confined spaces unless there is adequate fresh air to breath.

Do not weld near inflammable materials.

GENERAL

- Wear your protective equipment at all times.
- Always wear good overalls and good boots. Avoid loose sleeves when working with machinery.
- Avoid wearing oily or greasy clothes when performing welding and cutting operations.
- Be careful when chipping. Flying chips may injure yourself or others.

WELDING EQUIPMENT

- Welding equipment is expensive and can be dangerous if not treated properly.
- Always look after equipment.
- Do not use damaged and broken equipment.

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

- Check gas connections regularly for leaks, ONLY USE SOAPY WATER.
 - Do not weld on gas cylinders.
 - Keep gas bottles and hoses away from heat and flames.
 - Do not drop or knock over gas cylinders.
 - Do not oil gas connections.
 - Turn off gas supplies when not in use.
 - Only use gas cylinders that are standing upright.
 - Do not roll gas cylinders along their sides.
 - Do not smoke near gas or gas cylinders.
 - Do not play with equipment.
 - **Act sensibly and you will not get hurt!**
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- **IF UNSURE – ASK! DON'T TAKE RISKS.**
 - **USE SAFETY PRECAUTIONS WHEN USING OXY-ACETYLENE EQUIPMENT.**

SAFETY PRECAUTIONS WHEN USING OXY-ACETYLENE EQUIPMENT

- Keep oil and grease away from oxygen fittings.
- Inspect oxygen and acetylene hoses periodically to see that it is free from cuts, cracks, burnt or worn places.
- Do not test for leaks on oxygen or acetylene fittings with a naked light or flame. Escaping acetylene can be detected by its peculiar smell, or soapy water should be applied with a brush to connections to test for leaks.
- Do not cut or weld on tanks or other vessels, which may have contained petrol, oils, spirits, paint or any inflammable or explosive material.
- Remember sparks that are caused by welding, and particularly from oxy-acetylene cutting, can travel a considerable distance. Such work should be carried out in a safe manner to prevent all risk of causing fires.
- When flame cutting or welding painted or galvanised plates etc., wear an approved respirator.

N.B. Operators affected by fumes from this work should see a doctor without delay.

Colour coding:

Hoses and accessories are colour coded as follows...

Oxygen: **BLUE**

Acetylene: **RED**

Regulators are fitted to both cylinders, to lower the pressure being delivered to a constant value. This is set to be at just above the requirement of the brazing torch.

You make final adjustments, using the needle valves on the torch to get the correct flame. (This procedure will be given shortly). In this way the pressure being supplied to the torch remains steady even though gas is being used and the cylinder pressure therefore could be high or low.

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

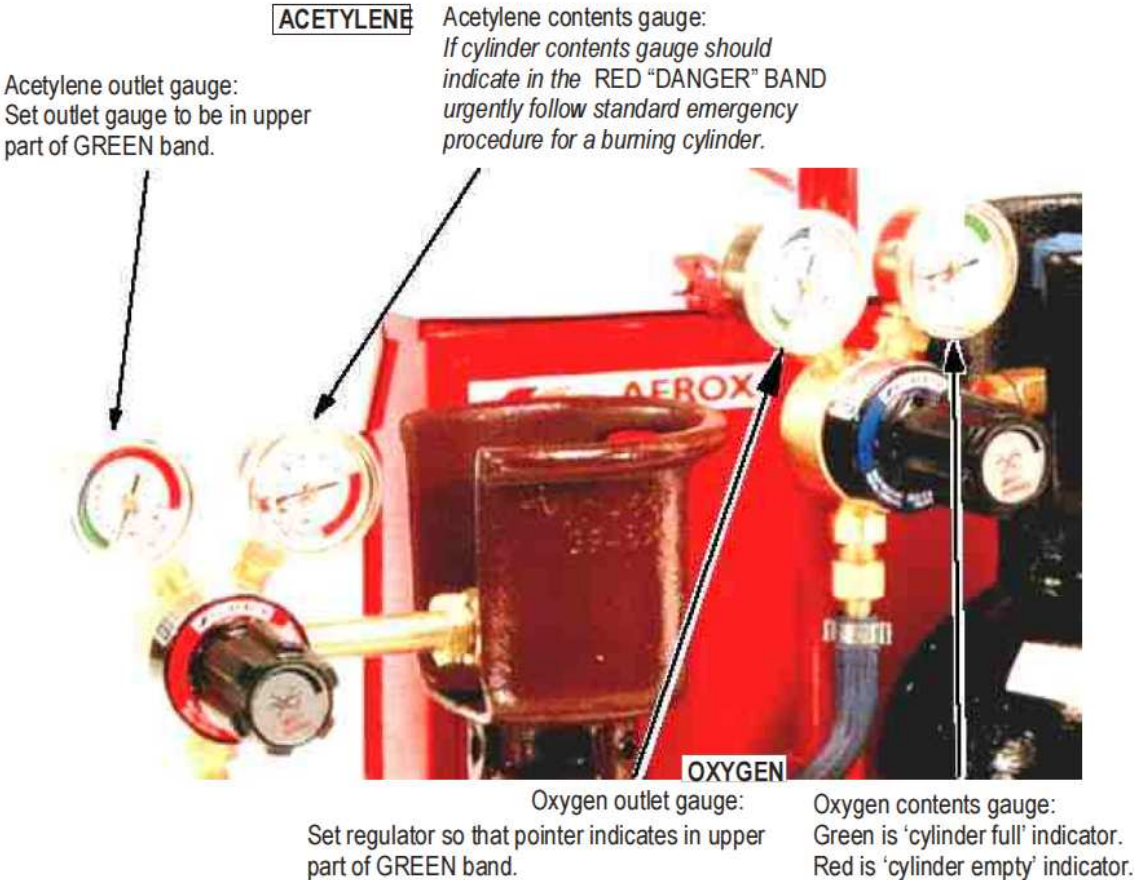


Figure 6



OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

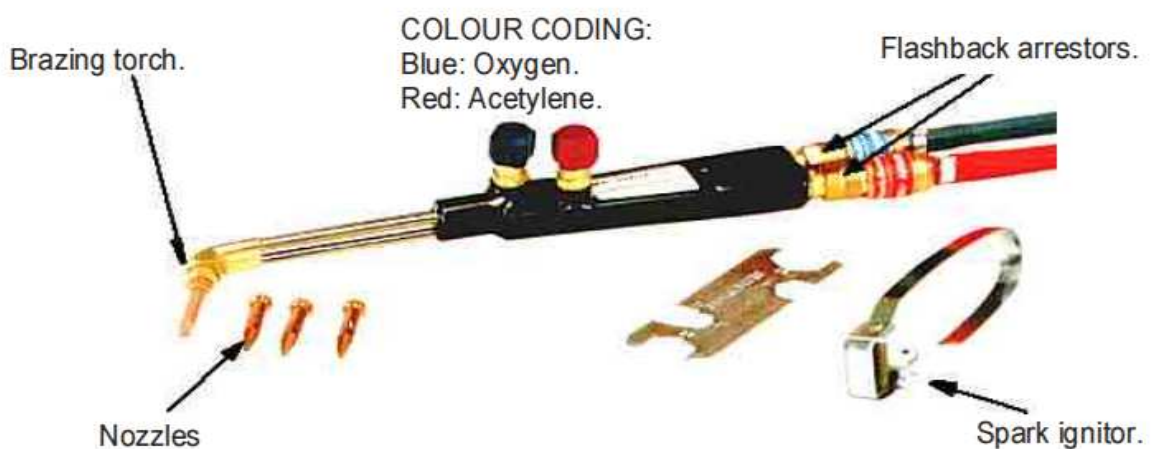
GAS WELDING EQUIPMENT IS SAFE TO USE IF OPERATED CORRECTLY.

INCORRECTLY OR CARELESSLY USED, IT CAN BE DANGEROUS.

THIS "HOW TO" MANUAL DOES NOT COVER ALL SAFETY PROCEDURES.

**FOR EXPERT ADVICE ON SAFETY MEASURES AND DETAILED USAGE INSTRUCTIONS,
OBTAIN FROM AFROX AND STUDY WITH CARE THEIR MANUAL
'GAS WELDING AND CUTTING GUIDE'.**

When you first start using gas brazing equipment, do so only under the careful supervision of a well-experienced person. Always have such a person watching over you until you have become familiar and comfortable with operating the equipment



Now back to making your first brazed connection.

The opening and closing procedures is as follow.

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT



Visually check equipment. It should be in good condition.
Faulty equipment is dangerous



Check oxygen and Acetylene regulators —pressure adjusting knobs should be set to zero. This will help ensure long regulator life and avoid regulator damage.


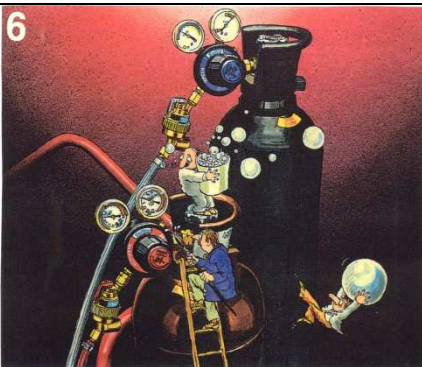
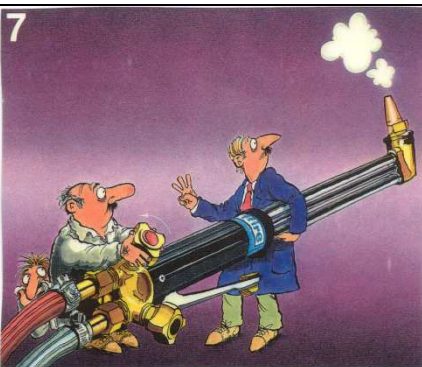



Open the cylinder valves slowly and watch the cylinder contents pressure gauge / indicator rise slowly. This will help avoid a hazard known as compression ignition and also extend regulator life.


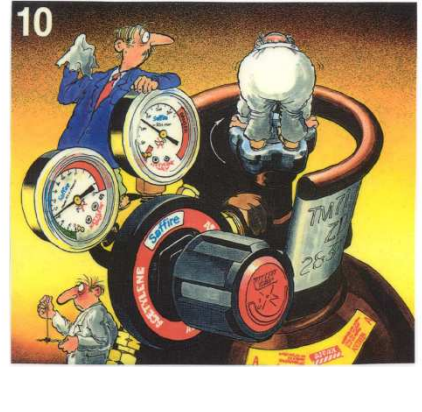
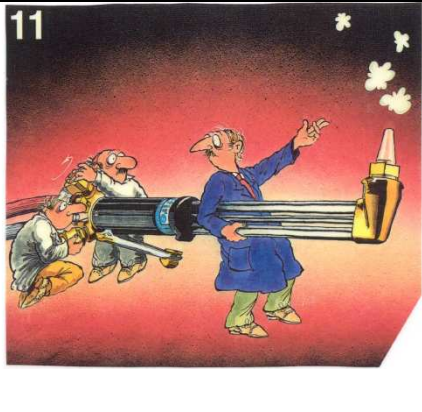



Check the cylinder contents gauge to ensure you have enough gas for the job in hand. This is for your Convenience and helps prevent back-feeding of gas should the cylinder run out of gas.

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

	<p>Set the correct working pressures with the gas flowing. Turn off torch valves. Each nozzle is designed to operate at specific pressures — too high pressure wastes gas and can cause malfunctions. Too low pressures may cause instability</p>
	<p>Now check your equipment for leaks using a solution of soap and water. Gas leaks in confined spaces can be extremely dangerous due to explosion hazard. Clothes saturated in oxygen burn as if soaked in petrol.</p>
	<p>Purge both oxygen and fuel gas hoses by opening torch valves, count to three (6 meter hose) close torch valves. This ensures you have no mixed gas / air in your hoses which could be explosive.</p>
	<p>Open acetylene torch valve, light the gas with a spark lighter. Adjust until all black smoke disappears. Open oxygen torch valve and set flame required. This helps prevent back feeding of gas — the major cause of all flashbacks.</p>

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

<p>9</p> 	<p>Turn off fuel gas valve to extinguish flame, then oxygen. This prevents unnecessary bangs and the possibility of sustained backfire.</p>
<p>10</p> 	<p>Close cylinder valves —finger tight only for hand wheel valves. This makes opening easier and prevents a sudden surge of gas when opening the cylinder.</p>
<p>11</p> 	<p>Turn off fuel gas valve to extinguish flame, then oxygen. This prevents unnecessary bangs and the possibility of sustained backfire.</p>
<p>12</p> 	<p>Check torch valves are shut. This prevents air from entering the system, producing an explosive mixture.</p>

13



Release pressure setting of regulators — turn pressure adjusting knob to zero. This relaxes spring pressure in the regulator, ensuring longer regulator life and aids correct opening procedure.

Now we need to study and follow the closing down procedure:

CLOSING DOWN

1. Close first the acetylene valve on the torch, and then the oxygen valve.
2. Close the cylinder valves - oxygen and acetylene.
3. Open torch valves, one at a time, to release pressure from the hoses and regulators.
4. Reset the regulators to zero by slackening off the adjustment knobs.
5. Again close the torch valves. Always ensure that torch valves are closed when not in use.

The Correct nozzle size for the correct job!

When brazing copper to copper or when using silver solder how do I select the correct nozzle size? Is the flame adjustment important as I even seen people brazing with a cutting torch?

The correct nozzle selection is very important and is determined in this case by pipe sizes. You should have a chart supplied by your specific brazing equipment supplier. A slightly bigger nozzle size is preferable to a slightly too small a nozzle size.

The following table represents a sample chart of a supplier's recommendation with regard to nozzle size selection for brazing copper tubing.

Nozzle size	Copper tubing sizes	
00	1/8" - 3/4"	(3-19mm)
0	1/4" - 1"	(6-25mm)
1	1/4" - 1"	(6-31 mm)
2	1;2" – 1 1/2"	12-38mm)
3	3/4" – 1 3/4"	19-44mm)
4	3/4" - 2"	(19-51mm)

As can be seen for this manufacturer a size 1 or 2 represents a comfortable selection for most small Air Conditioning and Refrigeration applications.

The correct adjustment of the flame is very important. The flame can be adjusted in one of three ways.

AN OXIDISING FLAME



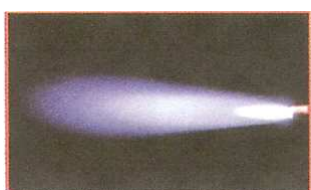
This setting has an excess of oxygen. This flame is not used for brazing. The excess oxygen causes increased oxidation during the brazing process and is to be avoided. This flame is characterized by a small thin inner cone and a hissing sound.

A NEUTRAL FLAME



In this setting both the acetylene and oxygen are used in balanced quantities with no excess. This flame is used for copper to copper as well as general brazing. The inner cone is clearly defined with no thinning or the formation of a secondary cone.

A CARBURISING FLAME



This setting has an excess of acetylene and is typically used for silver soldering. The inner cone is clearly defined with a formation of a secondary cone. The secondary cone should extend for approximately twenty millimetres.

The use of a cutting torch nozzle indicates that the joint requires more heat that can be supplied by the current nozzle, possibly due to the correct size nozzle not being available or not been used. Use of a cutting torch nozzle in addition increases the likelihood of excess oxygen which as stated before is undesirable.

Location of the cylinder storage area

- The storage area shall not be directly beneath normally occupied work areas.
- It shall be at least three metres from air conditioning inlets or other air intakes.
- The area should be located 3 metres from other identifiable hazards, for example, bulk storage of dangerous substances.
- Light fittings as well as all electric switches in stores containing acetylene and LPG or other flammable gases shall either be of flame-proof type or shall be placed outside the building. The electrical installation shall be in accordance with National Regulations such as SANS 10142-1, Electrical Machinery Regulations and Electrical Installation Regulations.

Storage area and requirement

- The storage area should be suitably protected and enclosed by a fence of 2 meters in height.
- Cylinders must be stored in an upright secured position in a safe, cool and well-ventilated area.
- They must be protected from sunlight, rain and corrosive conditions. It should be free from excessive temperature variations.
- Cylinders must be individually chained or clamped and such securing chains or clamps must not lower than two thirds from the bottom of the cylinder. Location arrangements for the bottom of the cylinder must also be provided for in permanent storage areas.
- The surface should be concrete or another material, with no gaps or trenches, able to withstand the weight of cylinders and vehicles requiring access.
- If a roof is required; it should be of safe corrugated roof sheeting.

Safety Signs

- Signs should be prominently displayed at the storage area proclaiming "No smoking" and "No naked lights".
- Full and empty gas cylinders must be clearly marked using "Full" and "Empty" sign boards.
- In addition cylinder identification charts, signs directing the use of personal safety equipment and giving general safety information should be sited as necessary (such as maximum storage capacity). Display emergency telephone numbers and telephone number of a contact person. See signboard SB.0143 (below):

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT



Fire Protection

- Suitable extinguishers should be available for use on minor fires. The dry powder type is recommended (see the Material Safety Data Sheet (MSDS) for the different types of compressed gasses).
- There should be a minimum of one (6kg) dry powder type fire extinguisher located outside at the entrance or exit of the storage area. Fire protection equipment must be suitable for use: quantities and capacities.
- An adequate supply of water should be available with fixed point hose reels to cool cylinders should a fire occur.

Storage requirements for inside storing (e.g. workshops)

- The storage room inside the building must be of fire resistant material.
- The storage room must be on the normal ground level – never in a basement.
- This room is only for storage of gas cylinders.
- The room needs sufficient bottom and top venting to outside. The minimum opening is 1% of the surface area.
- The storage area must have a lockable door or gate.
- Loose standing gas cylinders in the workshop must be either individually chained or clamped or be chained on a gas trolley (in an upright position). Gas cylinders which are less than 600mm in height (i.e. acetylene and oxygen) are exempted providing that they are stored upright and in such a manner to prevent tipping or falling over.

Cylinder storage and separation

Note: In defining a cylinder storage area, the main objective is to keep products which could potentially react with each other or which could create a higher risk when placed near each other, a safe distance apart. For example oxidant gasses should be stored a minimum distance of 3 metres from flammable gasses. The acceptable safe distance is 3 metres. This can often be achieved by placing inert gasses between reactive gasses or by building a non-combustible wall between them.

1. Cylinders of different gasses should be stored separately and should be clearly identified.
2. Full and empty gas cylinders must be kept apart and must be clearly marked using "Full" and "Empty" sign boards.
3. LPG must be a minimum of 3 metres from all other stored cylinders, including empties. LPG cylinders and cylinders with gas heavier than air (such as propane, methane and Quick Cut) shall not be stored within 3 metres of drains.
4. There should be adequate space for handling between rows of gas cylinders.

Training, knowledge and PPE

1. It is the responsibility of supervisors to ensure that gas cylinder users are suitably trained in the use of gas cylinders.
2. A gas cylinder that is not sealed with a plastic cap or shrink wrap or is supplied without a safety cup/cover must be returned to the supplier.
3. Never use compressed gasses to blow off clothing or skin.
4. Always use the correct spanners or spindle keys when connecting or disconnecting equipment.
5. During cutting tasks the following PPE will be worn: eye protection such as tinted safety glasses, ear protection, multi cell gas monitor protective clothing such as gloves, shoes, arm protection, overall and respirator for dust and fumes.

OPENING AND CLOSING PROCEDURE GAS CUTTING EQUIPMENT

Transportation, off-loading and use of gas cylinders

1. Ensure gas cylinders are always secured in an upright position. This includes oxygen cylinders on trolleys.
2. Cylinders must be stored upright in a cage which is provided with a safety chain.
3. Cylinders shall be moved by means of an approved hand trolley or cart. Cylinders shall never be dragged, rolled, or slid even for short distances. (Hand movement is allowed between the cart/trolley and cylinder store)
4. Do not lift cylinders by means of electromagnetic lifts or chain slings. A lifting cage is to be used for this purpose.
5. Cylinders must not be allowed to drop or slide or come into violent contact with each other or other hard or sharp objects.
6. The restraint system during transportation must be designed to prevent the cylinder(s) from falling and subsequently striking the floor or other objects.

Valves of cylinders

· Valves of full and empty cylinders must be firmly shut at all times when not in use. If a cylinder valve is found open, close it and attach a note stating: "warning – cylinder valve left open when cylinder was empty". This will ensure that moisture and purity tests are carried out before the cylinder is refilled.

Hose connections and fittings

1. Hoses are colour coded: blue for oxygen, red for acetylene and orange for propane. If oxygen were to pass through an old acetylene hose, a dangerous combustible mixture might result.
2. All oxygen fittings are right-handed thread while acetylene fittings are left-handed.
3. Do not repair leaking hoses with tape. Splice in a new piece of hose or discard. When splicing a hose, use standard brass splicing nipples, never copper tubing.
4. Hose connections and fittings must only be purchased from suppliers approved by the responsible 2.7(a).
5. Do not use copper hose connections or fittings with acetylene gas as explosive compounds (copper acetylated) may be formed.
6. Do not use steel hose connections or fittings with oxygen gas.
7. Ensure that all fittings are free of oil.
8. Oxygen and acetylene hoses may be bound together using hose approved binders or masking tape. The practice of tying hoses together with wires, cable ties or insulation tape could lead to dangerous circumstances, as should one of the hoses ignite it will not be possible to separate the two hoses quickly.
9. Do not use an ordinary wire or jubilee clamp to bind the hose to a connection. Jubilee clamps have been found to cause accelerated damage to hoses at the point where they are fastened resulting in leaks, which could have serious consequences. Use a crimping clamp for the specific size of the hose with a crimping tool.

Inspection of gas cylinder trolleys

1. The responsible supervisor is to appoint a competent person(s) to inspect gas welding and cutting sets regularly.
2. All equipment must be in good condition (including equipment on gas cylinder trolleys such as fire extinguisher).
3. Inspect gas cylinder trolleys every three months (good practice).