GAS KIT USER MANUAL

KIT PART NUMBERS

BOSSWELD

RELIABLE WELDING GEAR

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INDEX PAGE

BOSS GAS WELDING EQUIPMENT

Dear customer,

Thank you for your purchase of our BOSS oxygen acetylene welding kit. The BOSS range of gas welding and cutting equipment has been rigorously tested by independent laboratories and conforms to the following Australian Standards for gas welding and cutting processes:

Gas hose	AS1335
Regulators	AS4267 including the Promoted Ignition Test
Flashback Arrestors	BAM[1] certified to AS4603
Other Equipment	Requirements referred to in AS4839

BOSS strives to meet all relevant Australian Standards. Should there be change to existing or creation of new Australian Standards, BOSS will endeavour to ensure that all products and services comply with those standards.

This manual refers to safety measures that must be adhered to for the safe operation of your BOSS gas cutting, welding and heating equipment. Please read and understand these warnings and instructions before use. Failure to do so could result in serious injury or death. BOSS gas cutting, welding and heating equipment should only be used by operators who are properly trained and qualified in the safe use of this type of equipment.

[1] BAM is the Federal Institute for Materials Research and Testing, located in Berlin, Germany

GENERAL SAFETY INFORMATION

Safety consideration for both the operator and surroundings must be given to the heat source produced by mixing compressed oxygen with a fuel gas and igniting the resulting mixture. When using these processes, particular safety considerations apply with respect to:

a) Burns from flames, hot objects, malfunctioning hand-held equipment, mol ten particles, etc.

b) Explosions from mixed gas concentrations created by fuel gas leakage from cylinders, bulk supplies, hoses, welding equipment, breakable connections, etc.

c) Fire caused by ignition of flammable materials, leakage of fuel gases, contact with hot slag, poor condition of welding equipment, etc. (Plant, building, ship and bush fires have occurred)

d) Ignition of materials not normally considered flammable due to oxygen enrichment

e) Violent rupture or explosion of components due to pressurisation beyond their designed working pressures

f) Asphyxiation due to the displacement of atmospheric, breathable air by inert or toxic gases. For example, leakages in confined spaces or lack of oxygen resulting from excessive rusting in confined spaces

g) Radiation damage (to eyes principally and other exposed surfaces)

h) Fumes originating from the particular materials being welded, heated or cut

i) Electric shock which could result when gas welding or cutting on cables or other conductors at high voltage

j) Influence on the workplace from the above hazards (containers, vessels, heights, etc)

GAS PROPERTIES AND PARTICULAR HAZARDS

Gases Used

The flames used with these gas welding, heating and cutting kits are obtained by the ignition of mixtures of oxygen and acetylene. Acetylene, when mixed with compressed oxygen, is capable of releasing very large amounts of energy in the form of heat or explosion, requiring minimum energy to start the reaction. Consequently, it should be treated with great care and in accordance with well defined safety procedures.

Some industrial gases may be flammable, oxidising, toxic or corrosive, and users need to take special precautions in handling them. Users should always have on hand Material Safety Data Sheets, normally available from Gas Suppliers, for each of the gases stored and used at any location. The properties of these and other commonly used gases are listed in the table below. This table summarises the properties, characteristics and hazards of the more common gases used in gas welding, cutting and allied processes.

CHART 1 - Gas Properties

Property	**Oxygen (O_2)**	**Acetylene (C_2H_2)**
Density relative to air	1.103	0.901
Ignition limits V% - in air	-	2.5 to 8.0
Ignition limits V% - in oxygen	-	2.5 to 8.0
Ignition temp ∞C - in air	-	423
Ignition temp ∞C - in oxygen	-	428
Flame temp in air	-	2325
Flame temp in oxygen	-	3100
Smell	Odourless	Pungent (Sweet)
Colour	Colourless	Colourless
Gas cylinder colour (AS4484)	Black	Maroon
Regulator colour (AS4267, AS4480)	Black	Red
Welding Hose colour (AS1335)	Blue	Red
Safety device colour	Blue	Red

PHYSICAL AND SAFETY PROPERTIES OF GASES

Oxygen

Cylinders containing oxygen are black in colour. It has no smell, and is generally considered non-toxic at atmospheric pressure. Oxygen should not be confused with nor should it be called “air” as it normally constitutes only 21% of air. When the concentration of oxygen in air exceeds 21%, flammable materials become increasingly easier to ignite and will burn more rapidly, with a higher flame temperature.

Oxygen itself does not burn, but supports and accelerates combustion of other substances. Those substances not normally considered combustible, including metals, may be readily ignited by sparks in the presence of oxygen. Great caution must be exercised in preventing oxygen enrichment of the atmosphere, particularly in confined space situations.

Oxygen in contact with oil, grease, other hydrocarbons or oil based substances can cause spontaneous ignition and consequential fire or explosion. Hence, all oxygen systems (e.g. cylinders, pipe work and all equipment contained in this kit) must be kept completely free from grease and oil.

Proper advice from gas suppliers and equipment manufacturers should be sought before using any materials for oxygen service, especially lubricants, seals and thread sealants, including PTFE tape, which have not been supplied for use with oxygen and marked accordingly.

When the oxygen concentration in the atmosphere is less than 21%, gradual and sometimes undetectable changes occur in operator’s alertness and efficiency. Each year many accidents, occasionally fatal, occur because of oxygen misuse or the failure to understand its properties and their significance. Some lessons which have been learnt through misuse or unsafe use of oxygen are:

a) DO NOT use oxygen to refresh air. There is often a temptation to use oxygen to ‘sweeten’ air whilst welding or cutting operations are being carried out in confined spaces. Large amounts of oxygen can be released locally in a short time from gas cylinders under pressure. In one situation where this was done, hot work in the form of flame cutting was carried out with a subsequent ignition of worker’s clothes and fatal burns.

b) TAKE CARE in confined spaces. Do not leave blowpipes or hoses connected to the supply gases within confined spaces overnight or during work breaks. Slow leaks can result in very hazardous situations, with possible fire and explosion on re-ignition of the blowpipe.

c) VENTILATE confined spaces. In flame cutting not all of the oxygen released from the cutting nozzle is necessarily used in cutting. In confined spaces this may result in a dangerous increase in oxygen content in the air, pointing to the need for adequate ventilation in such situations.

d) DO NOT use oxygen as a substitute for compressed air. There are many examples of this situation where oxygen has been used, such as in cleaning, resulting in serious and fatal accidents due to fire or explosion from spontaneous ignition. NEVER use oxygen to start engines, drive air tools etc.

e) DO NOT use oxygen or compressed air to dust off clothes. Clothes can become readily flammable and even self-igniting through oxygen enrichment.

f) DO NOT kink pressure hosing. Kinking or nipping hose to interrupt gas flows or whilst changing torches is a very dangerous practice. Gas can still bleed through the system, or more seriously, escape rapidly should the hose rupture or the operator lose their grip.

Acetylene

Oxygen and acetylene combinations warrant care in use, from handling of the gas supplies through to the point of intended ignition. There are greatly increased risks of fire and explosion in the case of leaks. Asphyxiation is also possible due to exclusion of air in leakage situations.

Cylinders containing acetylene are claret or maroon in colour. Acetylene has a distinctive garlic smell and although it is non-toxic, asphyxiation is possible through depletion of oxygen. It is lighter than air and is not likely to collect in ducts and drains, but could collect in roof spaces.

Acetylene requires minimal energy to ignite in air or oxygen. A concentration of as little as 2.5% in the air can burn and is therefore a potential fire and explosion hazard. Hot metallic particles or hot slag can cause ignition of leaks remote from the area where welding or cutting is taking place. Adequate ventilation and leak free systems are required.

In its free state under pressure, acetylene may decompose with explosive violence and hence is supplied in special cylinders. Explosions may occur when pure acetylene is subjected to excessive temperature or pressure. Mechanical shock to the cylinder due to mishandling, or overheating when under high pressure, may also cause decomposition, giving rise to high temperatures and possible detonation even in the absence of oxygen. Another possible cause of detonation is flashback in welding, heating or cutting blowpipes. Flashback arrestors are required to be used on both blowpipe inlets and regulator outlets.

Under certain conditions, acetylene can react with metals such as copper and silver to produce explosive acetylides. This places a restriction on materials which can be used for the construction of pressure regulators, other equipment and piping. Copper alloys containing more than 70% copper or 43% silver should never be used with acetylene. Free acetylene must never be used outside the cylinder at pressures exceeding 150 kPa.

The properties of acetylene are taken into account in systems developed for its storage and supply and with adherence to safe procedures, dangerous situations will not arise.

GAS SUPPLY
General

Your BOSS gas welding and cutting equipment is designed to be used by gases delivered to the point of use from portable compressed gas cylinders. In all cases, gas supplies may be subject to statutory or regulatory provisions. Many Australian Standards cover the subject. The location, separation, allowed quantities and signage of gas storage should be in accordance with the relevant statutory requirements and manufacturer's provisions.

Cylinder Types and General Care

Cylinders used for oxygen and acetylene, are in effect thin walled highly pressurised vessels. Due to the presence of gases under pressure, full or partially filled cylinders may cause damage or serious/fatal injuries should they rupture. Also, slow leakage of gas may result in a high risk of fire or explosion or the possibility of asphyxiation.

Oxygen, hydrogen, carbon dioxide and inert gas cylinders are fitted with a bursting disc safety device. LPG cylinders have a spring-loaded pressure relief valve. Acetylene cylinders differ from those used for other gases in that they are filled with a porous substance saturated with acetone in which the acetylene is dissolved under pressure. Acetylene is unstable and highly reactive at high pressure. The porous substance or filler is therefore intended to quench heat of spontaneous decomposition and reduce the risk of explosion.

Fusible safety plugs are fitted in the shoulder of the cylinder to permit the gas to escape rather than the cylinder exploding in the event of overheating. Because of these factors and the particular properties of the stored gases, particular care is always required in the handling and usage of cylinders as follows:

a) Cylinders are generally obtained on loan or hire from gas suppliers. This allows the periodic testing, specified in Australian Standards and statutory regulations, to be carried out by the owner of the cylinder.

b) Do not tamper with the markings or colour coding of cylinders. Do not use non colour coded cylinders or those without safety and information labels.

c) Do not guess the contents of a cylinder - return the cylinder to the supplier.

d) Refilling of cylinders must be carried out only by your gas supplier with the correct gas and with the owner's approval. Refilling with any other gas is not permitted.

e) Gas should only be used for the particular intended purpose, e.g. never use oxygen for cleaning (dusting), or to provide ventilation or to support breathing

f) Gases should only be identified by their correct name so as to avoid dangerous confusion or misunderstanding.

g) Never attempt to disguise or repair damage to a cylinder such as denting. Such cylinders must not be used until advice is obtained from the gas supply company.

h) Valve seats and outlets should be protected by keeping all kinds of dirt and contamination away from cylinders, especially during connection and disconnection. Grit, loose fibres and other dirt may lodge in connectors or valve seats causing leaks or may be picked up by high velocity gas streams, causing hot spots in regulators, potentially resulting in ignition. Organic matter such as oil, grease and hydrocarbon liquids which may ignite spontaneously in high pressure oxygen is another hazard to regulators and other downstream equipment. Any damage to valves or outlets should be reported.

g) Avoid flame impingement from the welding or cutting blowpipe. Keep cylinders away from all sources of artificial heat (furnaces, boilers, radiators or flames). The fusible plugs at the top of an acetylene cylinder are particularly sensitive to heat and operation can lead to an extensive acetylene flame vertically from the top of the cylinder.

h) Do not tamper with safety devices.

i) Return cylinders with the valve closed.

CYLINDER STORAGE, TRANSPORT, HANDLING AND USE

Storage

All storage areas must comply with statutory requirements. AS4332 - Dangerous Goods Regulations gives complete requirements. Cylinder storage areas should be well ventilated, away from sources of heat and preferably external. Protection from weather is desirable but should not be at the expense of ventilation. Other products should not be stored with cylinders, especially oil, paints or corrosive liquids.

Oxygen cylinders must be separated from fuel gas cylinders by a distance greater than 3 meters. LPG cylinders in excess of 50 kg total capacity should not be stored within 3 meters of any other cylinders, including acetylene.

Cylinders, whether full or empty, should always be stored upright and restrained to prevent falling. Full cylinders should be segregated from empty ones and fuel gases from oxygen. "NO SMOKING OR NAKED LIGHTS" signs should be displayed where fuel gases are stored.

Transport

Take sensible precautions and ensure Australian Dangerous Goods Codes and other regulatory requirements are met whilst transporting gas cylinders. Ensuring adherence to all relevant State and Territory requirements and regulations, use only open vehicles, wherever possible. Ensure all valves are fully closed and that there are no leaks. Secure cylinders carefully to protect against movement within the vehicle. Do not allow any part of the cylinder to protrude from the vehicle (this prohibits cylinders being carried horizontally across forklift tines). Disconnect all equipment (e.g. pressure regulators) from cylinders. Acetylene cylinders must be transported upright even when empty to ensure that the safety device is in contact with vapour and not liquid, maintaining its integrity.

Handling

Do not move cylinders with the cylinder valves open. Use a cradle when lifting cylinders by crane and never lift cylinder with magnets, chains or slings. Never roll a cylinder along the ground as this may damage the identification labels and may cause the valve to open. Use a trolley for manual handling and ensure that the trolley incorporates a heat shield because of the proximity of the fuel gas to the oxygen.

Cylinder Use

The manufacturer's instructions and recommendations should always be followed.

a) Never "crack" a fuel gas cylinder valve when adjacent to an ignition source.

b) Damaged valves or regulators or those suspected to be damaged should not be used until checked by an authorised and qualified service agent.

c) Cylinders must never be used as rollers to assist moving other objects.

d) Acetylene cylinders must always be in the vertical or near vertical position when in use and when empty.

e) Acetylene may only be used to a maximum pressure of 150 kPa as explosion may occur with increasing pressure due to the instability of this gas.

f) Opening of cylinder valves should only be carried out with approved keys or hand wheels. Do not use excessive force or extension keys to open or close cylinder valves.

g) Acetylene valves should not be opened more than about one and a half turns, one turn is preferable to allow for quick closing in an emergency.

h) Empty cylinders should have the valves closed, any protective caps fitted and be suitably identified, e.g. “MT” in chalk.

Connection to Regulators and Hoses

Keep the cylinder valves clean, especially the outlet connection, with no grit, dirt, oil or dirty water present. Particles of dirt and residual moisture may be removed by “cracking” open the valve momentarily and then closing it.

Note: Great care must be taken when “cracking” as serious injuries can occur.

Make sure the BOSS pressure regulator is suitable for the gas and pressure in the cylinder and that its inlet connection is the same thread as that in the cylinder valve. Fuel gas connections have left handed threads, whilst oxygen connections have right handed threads. Never force any connection that does not fit and never remove, replace or swap connections.

Open the cylinder valve slowly using its hand wheel or a suitable key for key-operated cylinder valves. If the valve spindle is too stiff to turn with the hand wheel or the correct key, do not increase the leverage on the spindle and return the cylinder to the gas supplier. When closing the valve, do not over tighten as this will destroy the soft seating material in the valve and may in time, cause leaks.

EQUIPMENT SPECIFICATIONS AND ASSEMBLY

General

BOSS gas cutting and welding equipment has been properly designed, manufactured and independently tested to meet relevant Australian Standards. It must be maintained and used with full consideration to the hazards inherent with the use of oxy-fuel gas mixtures detailed previously.

Pressure Regulators and Gauges

Gas cutting and welding applications should never be supplied directly from compressed gas cylinders. A BOSS pressure regulator must be connected to the gas cylinder to control the pressure of the gas at the welding or cutting blowpipe. BOSS regulators are fitted with two pressure gauges to allow monitoring of the cylinder contents and the delivery pressure to the end application.

Although accidents rarely occur as a direct result of regulator failure, care must be continuously exercised because the potential hazards are severe. This is particularly true of oxygen regulators where ignition and explosion is possible under adverse conditions. The following recommendations should be observed in order to ensure continued safe operation:

a) BOSS regulators should be used only with the gas and maximum cylinder pressure for which they are designed and labelled (see AS4267).

b) Never test a regulator for gas leaks with a naked flame.

c) Acetylene and LPG regulators should only be used with the gas for which they are designed. Use of an LPG regulator on acetylene cylinders could result in exceeding the maximum safe working pressure of acetylene.

d) Regulators with any damage (e.g. to pressure gauges or inlet and outlet connections) should never be used. Inlet and outlet connections should never be changed from the original manufacturer's specification.

e) Do not use oil or grease on any regulator. Do not handle a regulator with a rag, hands or gloves contaminated with oil or grease.

f) Keep your regulators clean. When not in use, dust covers should be fitted to protect the inlet and outlet connections.

g) Never use a regulator that is leaking gas or exhibiting signs of excessive creep (build up of gas pressure when blowpipe valves are closed). Pressure build up beyond 30% is excessive and the regulator should be removed from use and either repaired by an authorised person or replaced. (See the section on Detailed Inspection and Maintenance, page 22, for details on how to test)

h) To avoid damage to the regulator, the operator must always fully release the pressure adjustment knob by turning it in an anticlockwise direction before opening the gas cylinder valve and subjecting the regulator to high pressure. Note: Never release the regulator adjusting knob whilst there is pressure in the gas hoses.

i) Ensure the regulator is securely attached to the gas cylinder before opening the cylinder valve and subjecting the regulator to high pressure.

j) Do not stand in front of the regulator when opening the cylinder valve, always stand to one side.

Hoses and Fittings

Requirements

BOSS hoses and fittings for use in gas welding, cutting and allied processes meet the requirements, including colour coding, specified in AS1335 and AS4267.

Colour coding

AS1335 specifies different test methods and states acceptable colours for acetylene hose (red), LPG hose (orange) and oxygen hose (blue). These hoses should never be interchanged.

Location

Hoses should be located away and protected from heat, mechanical damage, traffic, sparks, slag, grease and oil so that accidental damage such as piercing and burning cannot occur. Placing or running hoses over sharp edges or manifolds or under sparks or hot slag from welding or cutting processes should be avoided.

Fittings

These must be as specified in AS1335, of an appropriate type, securely made and leak tight. Wire should never be used to fasten hose to fittings. Oxygen fittings have right hand threaded nuts, fuel gases have left hand threaded nuts. Use only BOSS gas hoses and connectors when replacement is required.

Length and Diameter

It is recommended that the maximum hose length should not exceed fifteen (15) metres for each gas. The hose length should also not exceed a length which will allow the operator of hand-held equipment to be in sight of the gas supply cylinders at all times. The 5mm ID hose supplied with the BOSS gas welding and cutting kit is suitable for use with all of the kit components. Other diameters and lengths are available for specialised applications from BOSS.

General Maintenance of Gas Hoses

Never use insulation tape to affix hose connections or to attempt repair or lengthening of gas hoses. Do not crimp or kink gas hoses to temporarily stop the gas flow. Gas hoses must be replaced immediately if they show signs of leaking, damage from flashback, physical damage or weakness due to ageing. Examine all hoses regularly for leaks, wear and tear and loose connections. Gas hoses can be tested for leaks by immersion in water at normal operating gas pressures.

Blowpipes, Cutting Attachment and Mixers

Blowpipes perform the gas control and mixing function with the aid of a gas mixer, therefore, the blowpipe and the mixer must perform the mixing of oxygen and fuel gas with due consideration to potential back-flow of gases and flashback.

The following points must be considered before use:

a) The inlet connections are suitable for the welding hose fittings supplied. Never attempt to connect hoses with fittings that are not compatible. Ensure that all connections are tight and not leaking. Never force a connection.

b) The control valves are clearly marked 'oxygen' and 'fuel' (by the abbreviations 'O' and 'F'), and colour coded blue for oxygen and red for fuel gas.

c) Only suitable mixers and other attachments should be fitted to a blowpipe.

d) Keep all equipment clean. Do not use oil or grease on any blowpipe, cutting attachment, mixer or accessory to suit. Do not handle any of these items with a rag, hands or gloves contaminated with oil or grease.

e) Particular attention should be paid to the recommended maximum and minimum operating pressures and flows for the blowpipe-mixer tip or nozzle combination. These should always be respected.

f) Never hang a blowpipe or gas hose on a regulator or cylinder valve.

g) Never test for leaks with a naked flame.

Tips, Nozzles and Attachment Fittings

The following is information on the BOSS range of tips and cutting nozzles:

a) The tips and nozzles are identified and have information relating to their correct use including size, gas pressures and plate thickness to be cut.

b) They have been manufactured for use with particular fuel gases. See the cutting guide Chart 2 below for the appropriate nozzle recommendations.

c) Operate safely and efficiently over a limited range of flows. Below a minimum flow the flame will recede into the tip or mixer with a potential flashback hazard. Manufacturer's recommendations should always be followed.

d) Recommended operating pressures for tips and nozzles should take into account the pressure drop caused by long lengths or small diameters of hoses and any added safety devices and restrictions.

CHART 2 - Guide for Type 41 Oxygen-Acetylene Nozzles

Plate Thickness (mm)	Nozzle Size	Oxygen Pressure (kPa)	Acetylene Pressure (kPa)	Cutting Speed (mm/min)	Typical Consumption (L/min)	
					Oxygen	Acetylene
6	8	200	100	450	19	3
12	12	200	100	380	38	4
20	12	250	100	360	45	5
25	15	220	100	320	56	6
40	15	350	100	270	75	7
50	15	400	100	240	84	7
75	15	150	100	180	95	8
*100	20	400	100	150	134	9
125	20	450	100	150	155	10
150	24	450	100	130	211	11
200	24	500	100	100	234	14
250	32	600	100	90	420	20
300	32	600	100	90	420	20

* Maximum thickness recommended for cutting attachments

CHART 3 - Guide for Type 51 Oxygen-Acetylene Tips

Tip Size	Oxygen Pressure (kPa)	Acetyleme Pressure (kPa)	Fuel Gas Consumption (L/min)
4	50	50	1.5
6	50	50	1.5
8	50	50	2
10	50	50	3
12	50	50	4
15	50	50	6.5
20	50	50	12
8 x 12	150	100	41 - 55

Note: All figures are approximate and may vary

Flashback Arrestors

It is outlined in Australian Standards that for optimum protection, flashback arrestors should be fitted at both the regulator outlet and blowpipe inlet on oxygen/fuel gas systems. The arrestor itself, must comply with AS4603. Each State has varying regulatory requirements, for example in Western Australia, the use of flashback arrestors on both ends of the gas delivery hose is compulsory.

The flashback arrestors included will provide sufficient flow rate for the equipment and welding hose configurations supplied in this cutting and welding kit. Should equipment requiring higher flow rates be used with this kit (e.g. a large heating head), consideration must be given to fitting flashback arrestors with higher flow rates (as well as extra supply cylinders and larger diameter hose) to ensure correct gas flow for the operation of that equipment. Nozzle and tip flow rates are available from the manufacturer.
Note: The use of flashback arrestors does not reduce the need to follow correct and safe operating procedures.

Personal protective equipment

Personal protective equipment should be used by all operators of oxy-fuel gas equipment to ensure their protection of body and clothing from:

a) The heat from the work

b) Burns which may result from contact with hot components or small globules of hot metal

c) Ultraviolet light which may burn the skin or eyes

d) Radiation which may burn the skin or eyes

This protection is achieved by the use of flame resistant clothing, gloves and footwear that is suitable to prevent the entry of hot particles or objects. Aprons, sleeves, shoulder covers, leggings or spats of pliable flame resistant leather and other suitable materials may also be required where the areas of the body will encounter hot metal. Protection of the eyes from ultraviolet and other radiation is also very important. The recommended minimum shade numbers are listed below, however if any discomfort is felt, darker filters may be used.

Flame cutting and gouging	- Light	Shade 4
	- Medium	Shade 5
	- Heavy-close	Shade 6
Gas Welding	- Low heat input	Shade 3
	- Light fusion welds	Shade 4
	- Heavy fusion welds	Shade 5

Cylinder Trolleys

Cylinder trolleys should be designed and built with due regard to stability in operation. The cylinders, a maximum of one each oxygen and fuel, should rest fully and securely on the base of the trolley. Means of restraint of the cylinders, e.g. a chain or strap, should be used. The maximum size of cylinder stated on a permanent label on the trolley should not be exceeded. Consideration should be given to possible release of the cylinder safety devices, and unimpeded gas release from them should be provided.

SYSTEM ASSEMBLY
General Compatibility

Your BOSS gas welding and cutting kit comprises many components. It is important for safe operation that replacement parts purchased in the future are genuine BOSS parts or parts that have been recommended by BOSS as compatible and suitable for use with BOSS gas equipment.

Fuel gas

The choice of fuel gas uniquely determines several of the system operating parameters, especially the operating pressures used. Only equipment specified by the manufacturer for use with the particular fuel gas chosen should be used.

Acetylene should not be used at pressures exceeding 150 kPa downstream from the outlet of the pressure regulator when flowing (see AS4267). It should be noted that gas suppliers recommend that the maximum acetylene gas draw-off rate should not exceed 1/7 of the cylinder contents per hour, please consult with your gas supplier for data sheets. LPG equipment, including regulators and hoses, should never be used on acetylene systems.

LPG systems should comprise only equipment designated for LPG service except for multi-fuel gas components where the manufacturer specifies LPG amongst the recommended supply fuels. LPG systems are not subject to maximum outlet pressure limitations except when at low temperatures the vapour pressure in the cylinders for some mixtures may prevent high system pressures. The commonly used maximum outlet pressure is 400 kPa.

Flow capacity

The tip or nozzle being used, determines the required flow rate of the system and hence the regulator outlet pressure settings. Particular care must be taken in allowing for pressure drop, especially through long lengths of small diameter hose or the use of multiple safety devices or other restrictive devices. A system with excessive pressure drop may become unstable, resulting in possible retreat of the flame into the tip leading to overheating, backfire or flashback. Pressure drop is particularly important to consider in acetylene systems because of the limitation of the maximum operating pressure to only 150 kPa.

SETTING UP PLANT SAFELY
System operation

Before operation these important steps must be carried out:

a) Leak testing

After the gas supply is introduced to a system and prior to the initial use of the equipment, all connections, glands and valves must be checked for leakages, using leak detecting fluid, measuring pressure drop or by other safe means. **NEVER** test for leaks with a flame.

b) Purging

It is strongly recommended to purge oxygen and fuel gas hoses prior to use at the start of the day and after the blowpipe has been shut down for a extended period of time, such as lunch breaks. This must not be done in confined spaces or in the presence of an ignition source. Always refer to the operating instructions for correct purging procedures.

c) Ignition

Flint lighters or stationary pilot lights should be used for the ignition of flames. Blowpipes must not be lit or re-lit by hot metal, matches, hot electrodes or welding arc. When lighting, ensure that the flame cannot touch either nearby personnel or any combustible material. Always refer to operating instructions for the correct lighting procedures. (See Chart 5)

d) Work Interruption

When blowpipes are not in use, the oxygen and fuel gas should be closed off at the supply and hoses blown down to prevent possible leakage and gauge failure. Blowpipes and hoses should be safely placed to minimise accidents or damage occurring.

EQUIPMENT INSPECTION AND MAINTENANCE
Inspection and Maintenance

Inspection and maintenance should be carried out on a routine basis for all items of BOSS gas welding and cutting equipment (See Charts 4 and 5). Servicing of equipment must only be completed by BOSS, BOSS accredited repairers or by an organisation specialising in the maintenance and repair of such equipment.

Detailed inspection and maintenance

Some useful guidance on inspection and maintenance follows:

a) Checks for gas leakage should be carried out on all regulators, valves and cylinders regularly and each time the equipment is set up.

b) Repair and maintenance of regulators must only be carried out by the manufacturer or approved person/organisation.

c) If a regulator shows excessive “creep”, it should be replaced immediately and the defective regulator repaired or discarded.

Note: To check for static rise (“creep”), close the blowpipe valves whilst the regulator is open and check for continuing increase in pressure beyond the pressure that has been set when flowing. AS4267 allows for an increase of 30% from dynamic pressure (flowing) to static pressure (not in use). A pressure build up beyond this value is considered excessive.

d) Gauge accuracy should be checked at least annually. If the gauge needle does not return to its origin when the pressure is released, replacement or repair is required.

e) Damaged hose must be discarded. Rubber hose should never be repaired with adhesive tape or other such material. If a flashback occurs, all hoses must be discarded due to the resulting internal damage to the hose.

f) All blowpipes, welding tips and cutting nozzles should be handled carefully and protected from dirt. Blowpipes must not be left burning on a bench unless supported in a safe holder.

g) Regular dismantling and cleaning of blowpipes, by either the manufacturer or other approved person/organisation is recommended (See Chart 4).

h) Cutting nozzles and welding tips should be cleaned only by methods which have been recommended by the manufacturer. Drills should not be used for this purpose as any damage may change the flow characteristics and promote the occurrence of flashback. Nozzles and tips should be stored in such a way as to minimise damage to the seating area.

i) Safety devices should be inspected annually, according to the requirements in AS4603

j) O-rings used on regulator inlet connections, mixer attachments and the like should be replaced regularly, or when they show signs of damage. Use only those parts supplied or approved by the manufacturer.

k) All PTFE tape and other materials used on the system must be cleaned and approved for oxygen service.

GUIDANCE ON EQUIPMENT MAINTENANCE

CHART 4 – Inspection, Refurbishment and Replacement

<table>
<tr><th>EQUIPMENT</th><th>WEEKLY [1]</th><th>AS NOMINATED [2]</th><th>REFURBISHMENT OR REPLACEMENT[3]</th></tr>
<tr><td>REGULATORS
(Including their integral protective devices)</td><td rowspan="2">Visual examination to determine suitability for service, condition of threads and sealing surfaces, oil or grease contamination.
Leak test all joints at working pressure.</td><td>Six monthly: [4]
Functional tests to ensure the correct operation of internal components.</td><td rowspan="2">Manufacturer or supplier recommendation, but not exceeding 5 years.</td></tr>
<tr><td>FLASHBACK ARRESTORS
and other external devices (including non-return valves)</td><td>Yearly:
As detailed in AS4603 or following a flashback</td></tr>
<tr><td>HOSE ASSEMBLIES</td><td>Visual examination to determine suitability for service, condition of cover, threads and sealing surfaces of the end fittings.
Leak test all joints at working pressure</td><td>Six monthly:
Check for the absence of cuts and excessive wear by bending the hose in a tight radius, to ensure reinforcement is not visible.</td><td>Determined by the hose assembly condition.</td></tr>
<tr><td>BLOWPIPES, MIXERS, and ATTACHMENTS</td><td>Visual examination of damage to the threads and sealing surfaces of the hose and attachment connections.
Leak test all joints at working pressure.</td><td>Six monthly:
Test control valve function.
Blank the attachment connection and leak test for internal malfunction.</td><td>Manufacturer or supplier recommendation, but not exceeding 5 years.</td></tr>
</table>

Notes:

[1] If in constant use, weekly inspections are sufficient. If usage is more sporadic, these tests should be performed by the operator before each use.

[2] To be carried out by a qualified service agent, person or organisation.

[3] Refurbishment or replacement is determined by equipment condition.

[4] Regulator elastomers and seals will deteriorate whether in service or not. Items stored for 1 year without use, should receive inspection as per the annual maintenance inspection.

EMERGENCIES AND INCENTS

Backfires and Flashbacks

Instability of a flame in a tip or nozzle is a common cause for emergencies and incidents in oxygen-fuel gas systems. These emergencies may occur at any time and are often results of incorrect light up procedures. Neglecting to purge hoses, having insufficient flow at the tip or nozzle due to inadequate gas supply or having damaged or poorly maintained equipment may cause the following:

a) Backfire is the return of the flame into the blowpipe with a popping sound, the flame being either extinguished or re-ignited at the nozzle.

b) Sustained Backfire is the return of the flame into the blowpipe with continued burning within the neck or handle. This is distinguished by an initial “pop”, followed by a hissing sound.

c) Flashback is the return of the flame through the blowpipe. Without safety devices, a flashback may travel through the hoses and regulator and in severe cases may also reach the acetylene cylinder, causing heating and decomposition of its contents.

If any of these events occur, especially flashback, immediately turn off the gases at the blowpipe, oxygen first, then the fuel gas. Close both the cylinder valves, then check the condition of the nozzle or tip, that the gas pressures are correct and that the connections to the torch and cylinder are sound. Replace or repair all damaged equipment before re-ignition. If the cylinders heat up, or ignite, treat as described below.

Gas leaks

Leaking gas is a potential hazard wherever it occurs and whichever the gas. Fuel gases present the greatest hazard since all commonly used fuels can ignite even when in low concentrations in air and require minimum energy to do so. Oxygen makes all materials more readily combustible and will increase the intensity and severity of any fire. Inert gases may displace oxygen and cause unnoticed loss of alertness and then asphyxiation.

The sources of gas leaks may include:

a) Poor condition or damage to cylinder fittings, valves, safety devices, hoses or connections within the system (scored or dirty nipples, conical seatings or O-rings).

b) Valves not closed when equipment is not in use.

Whenever a gas leak is suspected or detected, operation of the equipment should cease. The leak should be immediately rectified, if possible, heat sources should be removed or switched off and the area cleared until the gas has dispersed.

IGNITION OF REGULATORS, HOSES AND HIGH PRESSURE EQUIPMENT

Although accidents of this type are rare, when they do occur the results may include serious injury, a major fire or even fatality. Care in use and maintenance of all high pressure equipment is therefore extremely important.

Ignition may occur due to:

a) Spontaneous ignition of oil, grease or hydrocarbon liquids in high pressure oxygen. Keep oil and grease away from all equipment. Do not use oil or grease as a lubricant or use oily rags, tools or operate with oily hands.

b) The use of equipment, for example regulators, manifolds and high pressure leads that are not designated as suitable for high pressure oxygen and rated to the same pressure as the cylinders in use. Use only equipment cleaned and suitable for oxygen service with an appropriate pressure rating that is in sound working order.

c) Particles entrained in high-velocity gas streams. This would commonly cause ignition in cylinder valves or regulator seats and seals but may be avoided with cleanliness and good housekeeping practice. Ensuring safety beforehand, always “crack” the cylinder valve prior to fitting equipment.

d) Rapid opening of the oxygen cylinder valve. The cylinder valve MUST BE OPENED SLOWLY or it might cause high temperature at the regulator seat and seals.

Cylinders in Fires

The most common incidents are those involving ignitions of fuel leakages from regulators and hose connections near the cylinder. If either occurs, the cylinder valve should be closed and the pressure adjustment knob of the regulator should be unwound using a gloved hand and the fire extinguished as soon as possible. Otherwise, use of a dry powder or CO2 fire extinguisher should be followed by closing of the cylinder valve to prevent re-ignition. If it is not possible to extinguish fires of any type quickly with a fire extinguisher, further attempts should not be made and:

a) The area should be evacuated (100 metres minimum).

b) The fire brigade should be called.

c) Attempts to fight the fire should be done only from a protected position and using copious quantities of water.

d) Cylinders not involved in the fire which have not become heated should have their valves closed and be moved away as quickly as possible, provided this can be done without risk. Cylinders which have been heated can explode even after the fire has been extinguished, particularly acetylene cylinders.

e) When the fire brigade arrives, they should be notified of the location and number of cylinders involved in the fire, and the names of the gases they contain. If unknown, actions should be those taken for acetylene cylinders.

f) Inform the gas supplier as soon as possible.

Acetylene Cylinder Overheating

Acetylene cylinders may become hot, either through flashback or due to accidental heating. To prevent serious accidents, the following procedure should be carried out immediately overheating is noted:

a) Shut the cylinder valve quickly and have the supplier notified as soon as practicable. If the cylinder is on fire, call the fire brigade.

b) Clear all personnel from the area.

c) Cool the cylinder with a plentiful supply of water, preferably from a fire hydrant and with the person behind a suitable protective barrier.

d) If the cylinder safety device functions and issuing gas ignites, cool as above, but DO NOT extinguish the flames.

e) Where gas does not ignite, all sources of ignition must be removed from the area if this can be done safely.

f) Continue cooling but with stops at intervals to check if the cooling water dries off the cylinder or if it remains wet.

g) When the cylinder remains wet on removal of the water, the cylinder should be removed to an open space away from any ignition source and placed under water, for example, in a 200 litre drum.

h) Continue cooling for 24 hours or as advised by a competent authority.

Oxygen Cylinder Explosions

Accidents have been reported which involve the explosion of an oxygen cylinder due to direct flame impingement from an adjacent acetylene cylinder. Such accidents arise when the fusible plugs melt due to cylinder overheating with the escaping gas igniting and the flame impinging on the oxygen cylinder. This causes softening, bulging and bursting of the oxygen cylinder without an appreciable increase in its internal pressure, i.e. without causing the bursting disc to rupture.

Where oxygen and acetylene cylinders in use are adjacent to each other, consideration should be given to protecting the oxygen cylinder by placing a non-flammable shield, for example, a 2-3 mm sheet of steel or refractory fibre between the cylinders. The shield should extend from at least the shoulder of the acetylene cylinder to the top of the regulator mounted atop the oxygen cylinder.

SAFE PROCEDURE FOR SETTING UP EQUIPMENT

To ensure safety, it is important that the steps below are followed in turn and in full:

1. Check that all equipment, equipment connections and especially both valve outlets and regulator inlets are clean and free from oil and grease.

2. Standing to one side of the cylinder, individually crack both cylinder valves. {Fig. 1}

Caution: For oxygen ensure there is no oil and grease and for fuel gases, ensure there are no ignition sources and only open the valve slightly.

3. Screw regulators into the cylinder valves, using an appropriate spanner. Make sure the regulator adjusting knobs are fully released (turn anticlockwise). {Fig. 2}

4. Fit flashback arrestors to the regulators, then connect the gas hoses to the flashback arrestor outlets, using an appropriate spanner. {Fig. 3 and Fig. 4}

5. Slowly open the oxygen cylinder valve, then the acetylene cylinder valve. {Fig. 5}

6. Purge each hose by adjusting the oxygen regulator to allow a small flow through the hose and then release the pressure adjustment knob fully. Repeat for the fuel gas hose.

7. Connect the blowpipe to the flashback arrestors, then in turn to the other hose ends using the appropriate spanner. {Fig. 6 and Fig. 7}

8. Connect any required attachments, mixers, tips or nozzles to the blowpipe. {Fig. 8}

Fig.1

Fig.2

Fig.3

Fig.4

Fig.5

Fig.6

Fig.7

Fig.8

LIGHTING PROCEDURE FOR CUTTING EQUIPMENT

Please ensure that Steps 1 through 8 of the setup procedure have been completed:

1. Open the oxygen blowpipe valve completely and then open the oxygen preheat valve enough to allow flow through the cutting tip. {Refer to Fig. 9 for component parts}.

2. With the oxygen cutting lever depressed, set the oxygen regulator pressure according to Chart 2 (Page 17).

3. Release the lever and close the preheat oxygen valve.

4. Open the acetylene blowpipe valve enough to allow flow through the cutting tip, set the acetylene regulator pressure according to Chart 2 (Page 17) and then close the acetylene blowpipe valve.

5. Depress the oxygen cutting lever once to purge the oxygen passage and then open the acetylene blowpipe valve one half turn. Ignite the issuing gas using the flint lighter provided. {Fig. 10, Fig. 11, Fig.12}

6. Increase the flow of fuel gas until the flame leaves the end of the tip and the flame stops smoking. There should be a gap between the flame and the tip. Decrease the flow of fuel gas until the flame goes back to the tip.

7. Increase the flow of oxygen by opening the oxygen preheat valve until the flame has sharp, defined inner cones of about 3 – 6mm, indicating a neutral flame (or until the desired flame is achieved). {Fig. 13 and Fig. 15}

8. Depress the oxygen cutting lever and again adjust the oxygen preheat valve until the flame is neutral (or until the desired flame is achieved). {Fig. 14 and Fig. 15}

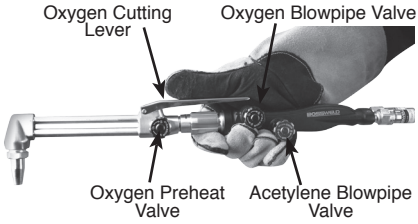

Fig.9


Fig.10


Fig.11


Fig.12


Fig.13


Fig.14

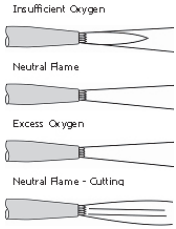

Fig.15

Note: Fig. 15 shows diagrams of flames as seen through cutting goggles.

LIGHTING PROCEDURE FOR WELDING AND HEATING EQUIPMENT
Please ensure that Steps 1 through 8 of the setup procedure have been completed:

1. Open the oxygen blowpipe valve enough to allow flow through the welding or heating tip, set the oxygen regulator pressure according to Chart 3 and then close the oxygen blowpipe valve.

2. Open the acetylene blowpipe valve enough to allow flow through the welding or heating tip, set the acetylene regulator pressure according to Chart 3 and then close the acetylene blowpipe valve.

3. Open the acetylene blowpipe valve one half turn. Ignite the issuing gas using the flint lighter provided. {Fig. 16 and Fig. 17}

4. Increase the flow of fuel gas until the flame leaves the end of the tip and the flame stops smoking. There should be a gap between the flame and the tip. Decrease the flow of fuel gas until the flame goes back to the tip.

5. Increase the flow of oxygen by opening the oxygen blowpipe valve until the flame has a sharp, defined inner cone, indicating a neutral flame (or until the desired flame is achieved). {Fig. 18 and Fig. 19}

Fig.16

Fig.17

Fig.18

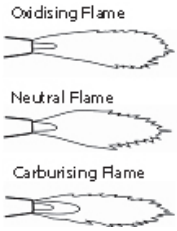

Fig.19

Temporary shut down procedure for oxy-acetylene equipment

1. Close the acetylene blowpipe valve.
2. Close the oxygen blowpipe valve.

Permanent shut down procedure for oxy-acetylene equipment

1. Follow temporary shut down procedure.
2. Close both cylinder valves.
3. Open the oxygen blowpipe valve to allow the gas to drain out of the system. **Ensure that the contents pressure gauge reads zero.**
4. Turn the oxygen regulator pressure adjustment knob to the closed position (**Turn Anti-Clockwise**).
5. Repeat procedures 3 and 4 for the acetylene blowpipe valve and regulator.
6. Once the nozzles and/or tips are cool to touch, disassemble the equipment fully.
7. Place the individual components into the toolbox provided and store in a cool, dry location.

Emergency shut down procedure for oxy-acetylene equipment

Please see the section titled Ignition of Regulators, Hoses and High Pressure Equipment on page 26, for detailed instructions on shutting down an oxygen-acetylene system in an emergency.

Norms and Standards
The flashback arrestors contained in the BOSS gas welding, heating and cutting kit are certified by BAM to meet the requirements in AS4603. Ensure that all local national safety regulations are met in the use of the arrestors.

Information
For any questions, please call Dynaweld on +61 2 9772 1144 or email sales@dynaweld.com.au.

Function
The flashback arrestors are designed to protect upstream equipment from creeping and sudden reverse flow of gas and flashbacks. Protection on regulator mounted models is also given against burnbacks with the incorporation of a thermal cut off valve. All models guard against contamination of the system through the insertion of a dust filter at the inlet

Working Pressure
See data on product body.

Correct Usage
Flashback arrestors should only be used in line with the given data on the product body and installed at those points suitable for the intended operation of the flashback arrestor.

Warnings
1. Use only in the prescribed gas direction and do not exceed the maximum working pressure of the unit
2. Use only the prescribed gas on each unit.
3. Do not connect flashback arrestors directly to high pressures (e.g. cylinders)
4. Compressed air controlled valves are no longer allowed to be used in oxygen systems.
5. Do not attempt to repair flashback arrestors. There are no user repairable parts.
6. Only one operating unit may be installed in conjunction with a flashback arrestor.
7. Additional marking, stamping or engraving of the product body by the user is strictly forbidden, as this may cause damage or structural weakness.

Assembly Instructions
Always used open ended spanners for each connection as shown in Fig. 20. Before commencing, check visually that all connections are clean and undamaged. When assembled, check for possible leaks by increasing the system pressure to the maximum working pressure. Ensure that when using oxygen, all connections and the complete unit are free from grease and oil.

Maintenance
Flashback arrestors must be tested at regular intervals by a trained and authorised person, at least once per year for through flow, reverse flow and gas tightness. Where acetylene generators are used, a gas purifier must be installed directly before the arrestor. An adequate water filter should be installed before an arrestor where there is a possibility of condensed water in the acetylene delivery pipes or hoses. Apart from replacing the dust filter at the inlet of an arrestor, all other repairs may only be carried out by the manufacturer or representative of the manufacturer.

Instructions in the Event of Breakdown

No Gas Flow	- Check the flow direction, operating pressure, gas cut off valves, gas source and thermal cut off valves.
Gas Return Flow	- Replace device.
External Leakage	- Replace device.

The connections on flashback arrestors may leak if they are damaged or dirty, check them regularly and replace if they are damaged or clean if they are dirty.

Flashback Arrestor Features

Model		GG	DGN
Safety Element		SHT	SRT
Dust Filter		X	X
Gas Non-Return Valve	NV	X	X
Flame Block	FA	X	X
Thermal Cut Off Valve	TV		

Flow Rate Chart (m^3/h)

Model	GG	DGN	SHT	SRT
Inlet Pressure				
0.9 Bar	4.5	6.8	4.5	4.5
1.5 Bar	7.3	10.5	7.3	7.3
5.0 Bar	26.0	34.5	26.0	26.0
10.0 Bar	47.0	61.0	47.0	47.0

Key to Gas Types:
Acetylene (A); Propane (P); Hydrogen (H);
Methane, Natural Gas (M); Town Gas (C);
Gas Mixtires (Y); Oxygen (O)
Compressed Air (D)

Conversion Factors:

Acetylene (C_2H_2)	x1.2
Oxygen (O_2)	x0.95

WARRANTY
BOSS undertakes to repair or replace, at its option, any new BOSS product which fails due to a defect in materials or workmanship during the 12 month warranty period. Any repair work must be carried out by an authorised BOSS repair agent.

This warranty does not apply to, or in any way cover:
1. Normal everyday wear and tear.
2. Failure due to improper use.
3. Failure of, or caused by, parts or components which are not original BOSS parts.
4. Failure arising from accident, abuse, fire, vandalism, contaminated fluids or neglect or failure to store or use the BOSS product in accordance with the instructions provided in this manual.

Note:
The following items are not included in the 12 month warranty period:
Cutting nozzles, welding tips, welding goggles, tip cleaners, tool box and flint lighter

DISCLAIMER
Whilst the above information is provided in good faith, BOSS does not warrant the accuracy of the information provided or assume any legal responsibility for it or for any damage which may result from reliance on or use of it or from any negligence of BOSS or other person(s) with respect to it.

Referenced Australian Standards
AS1335
AS4267
AS4332
AS4603
AS4839

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