

# Hand Equipment Operating & Safety Instructions



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## EQUIPMENT

Suitable equipment is required to supply the gases at the correct pressure and to ensure their efficient combustion.

The following constitute the basic welding/cutting equipment:

- Gas cylinders - Oxygen and Fuel Gas
- Pressure Regulators - Oxygen and Fuel Gas
- Flashback Arrestors
- Flexible Hoses - Oxygen and Fuel Gas
- Hose Check Valves
- Blowpipe and Nozzles
- Spanners and Cylinder Valve Keys

## GAS CYLINDERS

Only experienced and properly instructed persons should handle compressed gases. Such persons should be conversant with relevant data and safety sheets available from gas supplier.

ATTENTION is drawn particularly to regulations governing the use of acetylene. Users should seek guidance if in doubt from H.M. Inspectorate of Explosives.

## FLASHBACK ARRESTORS

Flashback arrestors should conform to BS EN731-1 or equivalent ISO or EN standard. When used on hose of over 10ft long or of over 6.3mm bore they should be fitted with thermal or pressure sensitive shut-off valve.

Cylindrical types should be fitted to a regulator then two spanners used for fitting or removing the hose, one on flats at FSA outlet and one on hose nut.

## REGULATORS

Regulators should conform to BS EN ISO 2530.

Regulators are sensitive instruments designed to reduce the gas cylinder pressure to the required working pressure at the blowpipe nozzle. Ideally, pressure reduction is in two stages (multi-stage regulators) although a single stage regulator can be used where precise regulation is not essential e.g. metal cutting.

Before attaching a regulator to a cylinder, check first that the cylinder is correctly identified and that the regulator is the proper one for the gas and the operation. If in doubt do not use.

Regulators are designed and marked with a maximum inlet pressure, do not use on a cylinder which exceeds this pressure. Make sure that there are no particles of dirt in the cylinder outlet and that the pressure adjusting screw is wound out (fully anticlockwise).

With the exception of hydrogen, this can be done by 'sniffing' some gas through by opening and closing the valve momentarily. When 'sniffing', the operator should be sure that there is no possible source of ignition in the vicinity, should stand clear of the gas stream and on no account deflect the gas stream with the hand or face.

Final tightening of regulator to cylinder should be achieved by applying a sharp blow with the hand on the spanner shaft, do not use a hammer or mallet.

**DANGER!** NEVER remove, change or replace any regulator peripherals or components.  
Never stand directly in front of a regulator when operating a cylinder valve

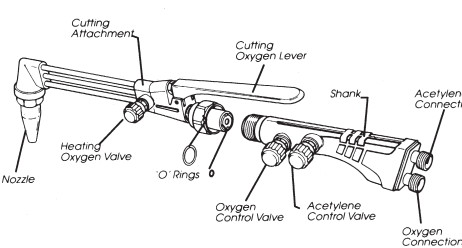
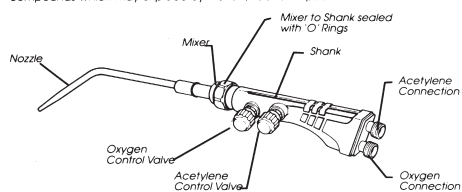
## HOSES AND ACCESSORIES

Hoses for cutting and welding should comply with BS EN 559 to give the required degree of protection for the operating conditions.

The use of excessive lengths of hoses should be avoided, normally 5m lengths are adequate for most welding operations and 15m lengths for cutting. When necessary, additional lengths should be connected by suitable hose couplers. These extra lengths should be removed when not required.

The ends of the hose should be joined by approved hose clips only. Wire or worm drive clamps must never be used to secure hose joints. Damaged hoses may be repaired by splicing, but never by use of copper tube. Damaged or perished hoses must be scrapped.

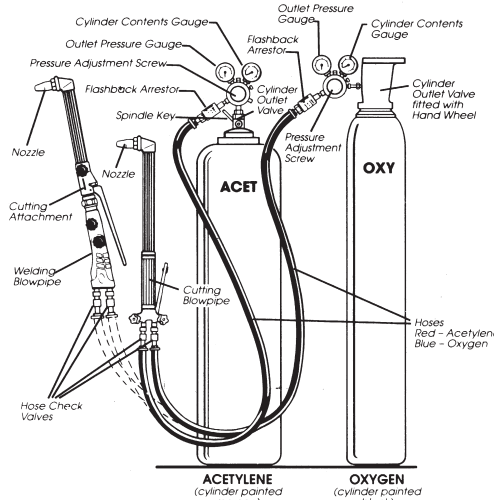
**NOTE:** When in contact with copper, pure acetylene can form dangerous compounds which may explode by friction, heat or impact.



## ASSEMBLING EQUIPMENT

1. Stand oxygen and fuel gas cylinders vertically and secure by chains to a wall, rack or cylinder trolley.
2. Do not use any joining compound or tape between the regulator and cylinder valve.
3. Connect the oxygen regulator to the oxygen cylinder valve (RH thread).
4. Connect the fuel gas regulator to the fuel gas cylinder (LH thread).
5. Final tightening should be with the correct spanner and achieved by applying a sharp blow with the hand on the spanner shaft.
6. Connect flashback arrestor to each regulator.
7. Blow through the hoses with all free compressed air or nitrogen to remove any foreign material which may otherwise render the hose check valve inoperative and connect to the respective regulator outlets via the flashback arrestor.
8. Fit hose check valve to blowpipe end of both hoses.
9. Connect to the blowpipe - oxygen connection RH, fuel gas connection LH.
10. Refer to data chart and fit the appropriate nozzle to blowpipe.
11. Leak test at working pressure with 0.5% tealol in water solution.

## GAS WELDING / CUTTING STATION

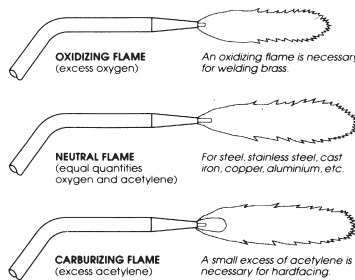


## LIGHTING ROUTINE

### Lightweight, GA4 Combination and Model 2000 Cutter

1. Check oxygen and fuel gas valves on blowpipe are closed.
2. Check pressure adjusting screw on regulator is wound out fully.
3. Open the cylinder valves SLOWLY by one turn (rapid movement can damage the regulators and is highly dangerous). The contents gauge will register the pressure remaining in the cylinder and will decrease to zero as the contents are used.
4. Set the regulators to the required working pressure (re-information on data chart), by turning pressure adjusting screw clockwise, this will register on the outlet gauge; when gas flow commences this may require further adjustment.
5. Open the fuel gas control valve on the blowpipe, check the working pressure and allow a sufficient time for the air to be purged from the hose. Close control valve.
6. Open the oxygen gas control valve on the blowpipe and purge oxygen hose as above in No. 5. Assume the contents of BOTH hoses will be explosive until purged out.
7. Open fuel gas control valve on the blowpipe and light with a sparklighter, adjust the fuel gas until the flame ceases to smoke. Open oxygen control valve and adjust the flame to the neutral condition.

**NOTE:** Data given is in BARS and lbf/in<sup>2</sup> (1 BAR = 14.5 lbf/in<sup>2</sup>)



## CUTTING ATTACHMENTS (Gas-Arc Type 4 & Lightweight)

With cutting attachment assembled to shank, pre-heat flame adjustment is made between the fuel gas valve on the shank and the oxygen valve on the cutting attachment.

To allow sufficient oxygen flow for both pre-heat and cutting to commence the oxygen valve on the shank must be fully opened and remain in that position whilst in use.

Fuel gas and oxygen valves on shank to be closed and oxygen purged by depressing cutting oxygen lever before cutting attachment is removed from shank.

Hold blowpipe by handle not at hose connections

## SHUTTING DOWN ROUTINE

1. Close the fuel gas control valve on the blowpipe.
2. Close the oxygen gas control valve on the blowpipe.
3. Close both cylinder valves.
4. Open both control valves on the blowpipe to release pressure in the hoses.
5. Wait until all the gas has vented from the regulators.
6. Unscrew the adjusting screws on the oxygen and fuel gas regulators to relieve the spring pressure.
7. Close both control valves on the blowpipe.

## PROTECTION OF THE HOSES

Hoses should be routed and positioned to avoid damage from the work in hand and passing traffic. Kinks in hoses and chafing against sharp edges must also be avoided.

## SPARKS

Sparks from a cutting process can travel a considerable distance. Exclude flammable materials from the work area or protect them with a suitable screen.

## NOZZLE DATA CHARTS

### SWAGED WELDING NOZZLE DATA CHART

NOZZLE	NOZZLE										
	1	2	3	5	7	10	13	18	25		
MATERIAL THICKNESS	SWG	20	18	14	12	10	8	6	3	0	
	INS										
ACETYLENE PRESSURE	PSI	2	2	2	2.6	3.2	4	5	6.5	8.2	
	BAR	0.14	0.14	0.14	0.14	0.14	0.21	0.28	0.28	0.42	
OXYGEN PRESSURE	PSI	2	2	2	2	2	3	4	4	6	
	BAR	0.14	0.14	0.14	0.14	0.14	0.21	0.28	0.28	0.42	
ACETYLENE CONSUMPTION	CFH	1	2	3	5	7	10	13	18	25	
	L/M	0.47	0.94	1.4	2.4	3.3	4.7	6	8.5	12	
OXYGEN CONSUMPTION	CFH	1	2	3	5	7	10	13	18	25	
	L/M	0.47	0.94	1.4	2.4	3.3	4.7	6	8.5	12	

### ANM AND PNM NOZZLE DATA CHART

Size	Plate Thickness	Acetylene Pressure		Propane Pressure		Heating Oxygen Pressure		Cutting Oxygen Pressure		Pre-Heat Consumption Oxy Acet		Pre-Heat Consumption Oxy Prop		Cutting Oxygen Consumption	
		PSI	BAR	PSI	BAR	PSI	BAR	PSI	BAR	CFH	L/M	CFH	L/M	CFH	L/M
1/32"	3-6	1/8-1/4	0.15	0.15	1.5	1.5-2.0	8.7	8	23	6	20-25				
1/64"	6-20	1/4-3/4	0.15	0.15	2.0	2.0-3.0	10	9.5	30	8	40-50				
1/16"	20-75	3/4-3	0.15	0.2	2.5	3.0-4.0	13	11.5	41	10	80-110				
1/8"	75-125	3-5	0.15	0.25	2.5	3.5-4.5	14.5	13	50	12	130-160				
3/32"	125-175	5-7	0.2	0.3	3.0	4.0-5.0	20	18	68	17	170-200				
1/4"	175-225	7-9	0.2	0.4	3.0	5.0-6.5	26	23	80	20	250-300				
1/2"	225-300	9-12	0.3	0.5	4.0	6.0-7.0	27	24	96	24	350-400				

## DAMAGED CYLINDER VALVES

Cylinder valves must be protected against damage at all times. Extensions to recommended spanners should NEVER be used to obtain increased torque.

## FIRE

Cutting and welding are high temperature processes, consequently fires can be caused by leakage of fuel gas in the proximity of combustible material. Normal oxygen content in air is approximately 21%, should this be increased by a small amount, e.g. to 25%, many materials which would normally char or smoulder in air will burn vigorously e.g. clothing, human hair, cigarettes etc.

Users of these processes must be properly trained in the use of fire fighting equipment and emergency procedures. Prompt action can usually limit the extent of a fire provided the person is not put at risk. Fire fighting equipment should be clearly marked and regularly maintained.

Dry powder and CO<sub>2</sub> extinguishers are effective for extinguishing gas fires. Water is suitable for cooling equipment provided that no electrical apparatus is present.

Work in confined spaces or in 'dirty' or 'greasy' atmospheres should only be carried out under a 'Permit to Work' system.

## PRACTICAL PROBLEMS

### DAMAGED CONNECTORS

Use only the correct tools for tightening connections. Damaged connections which prevent secure tightening will give rise to leaking joints.

### PURGING HOSES

Separate purging of each hose is necessary to be carried out in a well ventilated area to ensure that no mixed gases are present.

Excessive hose lengths can be difficult to handle and can create hazards when purging.

DO use the requisite protective clothing/equipment - boots, gloves and goggles, glasses, visor or other suitable eye protection.

DO check cylinder contents before use.

DO purge hoses before, and empty after use.

DO leak test and inspect equipment regularly for signs of misuse and accuracy of gauges.

DO ensure a key is in each key operated cylinder valve while the cylinder is in use.

DO keep emergency equipment readily accessible.

DO keep the work area clear of all foreign material.

DO NOT modify or interfere with the equipment as supplied.

DO NOT use dirty or faulty equipment.

DO NOT use equipment in confined spaces without breathing apparatus or adequate ventilation.

DO NOT commence work until you are certain that the environment is safe, e.g. lighting, working clearance, overcrowding.

DO NOT support work on empty drums.

DO NOT expose hoses to heat, slag, sparks, traffic, oil or grease.

## IMPORTANT

### ALWAYS FOLLOW THE RECOMMENDED OPERATING PROCEDURES

Open the cylinder valves slowly.  
Test equipment regularly for leaks with 0.5% Teapol in water solution.

### BACKFIRE

Return of the flame into the blowpipe with a bang, sometimes re-lighting immediately.

### SUSTAINED BACKFIRE

Return of the flame into the blowpipe with continued burning within the neck of mixer. May be recognised by initial popping followed by whistle and roar of continued internal burning. To prevent damage close OXYGEN valve immediately.

### FLASHBACK

Return of the flame through the blowpipe into the hoses, passing through, in extreme cases, the regulator into the cylinder and with acetylene there is a possibility of decomposition of the contents.

### IMMEDIATE ACTION

Close oxygen control valve followed by fuel gas control valve.

### POSSIBLE CAUSES

- Insufficient purging of hoses.
- Kinked or blocked hose.
- Damaged or partially blocked nozzle.
- Incorrect pressure settings.
- Faulty equipment.

### WHEN THESE MALFUNCTIONS OCCUR

1. Close oxygen control valve on blowpipe.
2. Close fuel gas control valve on blowpipe.
3. Close cylinder valves.
4. Close oxygen and fuel gas regulators by turning pressure adjusting screws fully anti-clockwise.
5. Cool overheated nozzle and blowpipe head.
6. Check equipment for damage.
7. Recommence lighting procedure.

If malfunction re-occurs, return blowpipe to supplier for repair.

**NOTE:** Normal shutting down procedure, close fuel gas control valve first.

All welding and cutting equipment must be repaired or serviced by the original manufacturer or repairer working to BCGA Code of Practice No. 17. Tampering with equipment and the use of unsuitable materials and replacement parts must be avoided. It is dangerous to interchange or use components on the wrong make of equipment even though they may appear to be identical.