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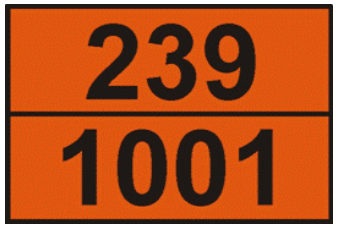

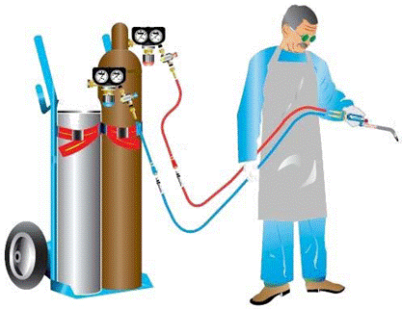

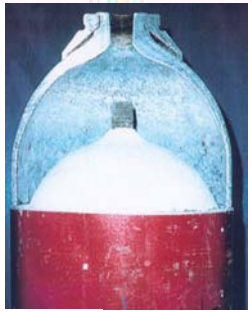

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Preventing Accidents through Better Gas Welding Knowledge

Charles Gobi

Renaissance Kuala Lumpur

14th October 2010

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WHAT YOU WILL LEARN TODAY?

Oxygen gas characteristics

Acetylene gas characteristics

Regulator

Flashback arrestor

Hoses

Welding/Cutting torch

Safe lighting up procedure

Safe closing down procedure

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Oxy-fuel Equipment

The equipment required for Oxy-fuel process consists of:

- 1 cylinder of Oxygen
- 1 cylinder of Dissolved Acetylene
- 1 Oxygen regulator (colour coded Blue or Black)
- 1 Acetylene regulator (colour coded Red)
- Oxygen & Acetylene hoses complete with fitting.
- 1 blowpipe handle and mixer or cutting torch
- Selection of welding tips or cutting nozzles
- Cutting or welding goggles with correct lens and shade
- Gloves, filler rods, gas lighter, cylinder, spanner, flux, tips cleaners.
- Flashback arrestors (recommended)
- Leak detector (recommended)
- Trolley (recommended)

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Compressed Oxygen (black cylinder)

Black colour

RAL 9005

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Compressed Oxygen (black cylinder)

Oxygen is compressed to > 150 Bars (2175 psi)

The pressure in the cylinder is directly related to the quantity of gas stored. If pressure falls to half, then the content would be half [assuming no change in the temperature].

Oxygen under pressure accelerates combustion.

Oxygen is non-flammable, but readily supports combustion. Never permit oil, grease, rust or other readily combustible substances to come into contact with high concentrations of oxygen

If cylinder ruptures, pressure shock waves and flying objects may cause injury and damage.

Noise of rupture may cause hearing loss.

Preventing Accidents through Better Gas Welding Knowledge

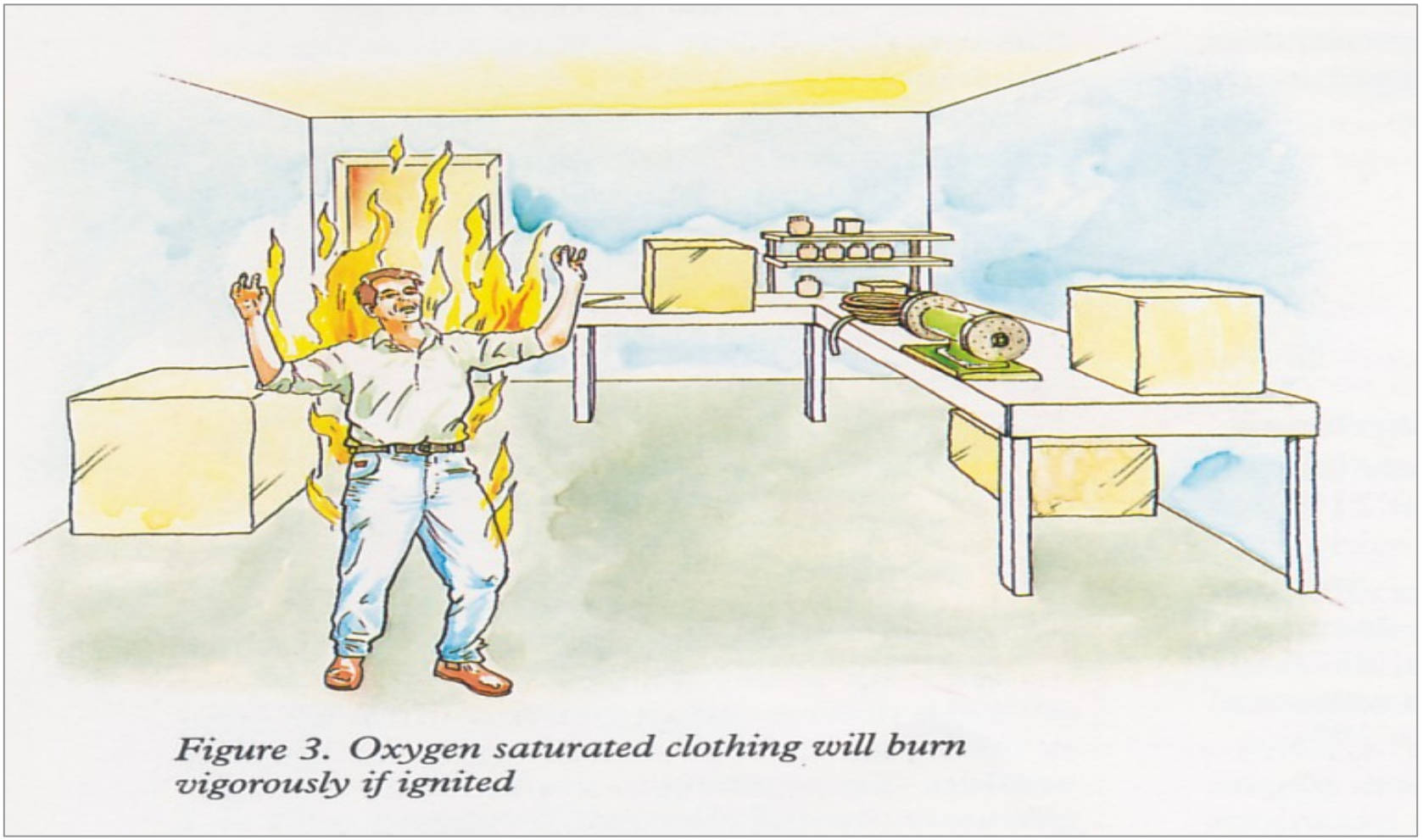

Figure 3. Oxygen saturated clothing will burn vigorously if ignited

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Acetylene (Maroon cylinder)

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Acetylene Cylinder (Maroon)

Fusible plug

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Dissolved Acetylene (maroon cylinder)

- Is a highly flammable gas in both air and oxygen.
- The cylinder is filled with porous mass and acetone.
- The acetylene gas is dissolved in the acetone hence the name dissolved acetylene or 'DA'.
- This allows acetylene to be stored safely at up to 250-300 psi (1724-2069 kPa).

- Acetylene reacts with copper to form unstable copper acetylites.
- Never use copper or alloy containing more than 70% copper or 43% silver with acetylene under pressure.
- DA cylinders have a fusible plug in the neck ring. The plug will melt in the event of a fire.
- Acetylene is lighter than air so leaked acetylene will dissipate.
- The oxy-acetylene flame at 3100^{0}C is the hottest flame available for welding mild steel.

REGULATOR

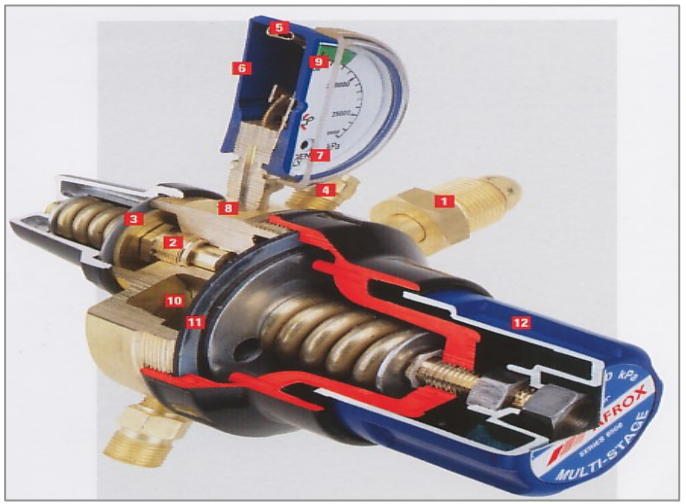
What does a regulator do ?

Gas regulators perform two very important functions:

- They reduce the high pressure gas stored in the cylinder to a safe working pressure.
- They maintain the required working pressure during operation.

Designs :

- Multi-stage
- Single-stage



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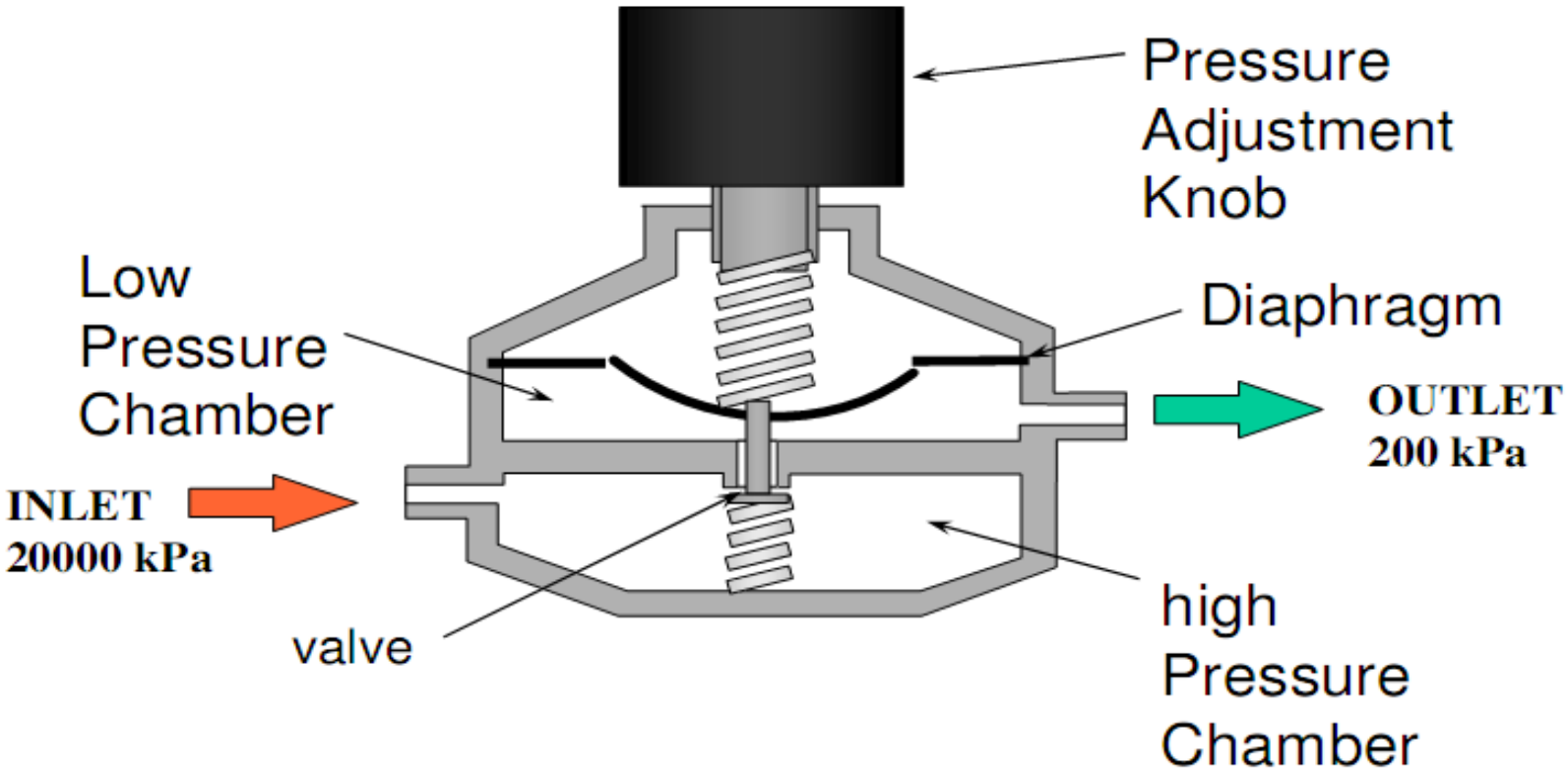
Damaged regulator

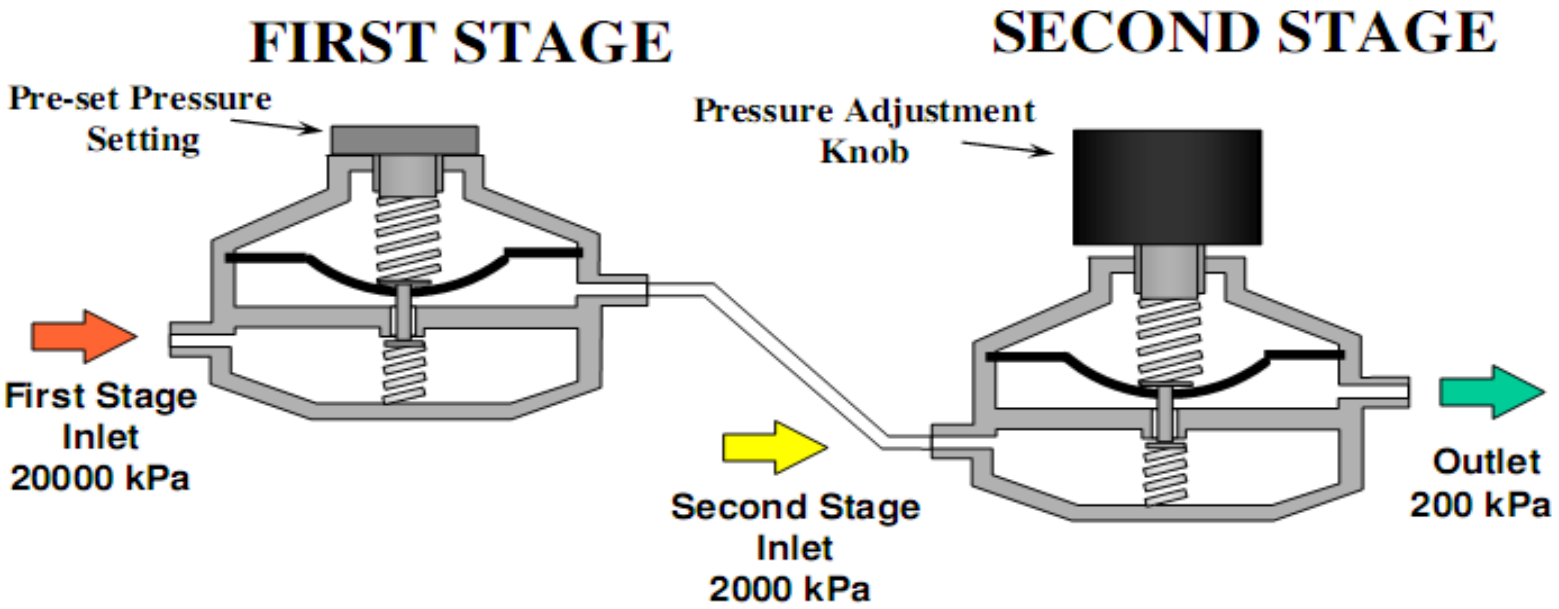





SINGLE STAGE OPERATION



MULTI-STAGE OPERATION



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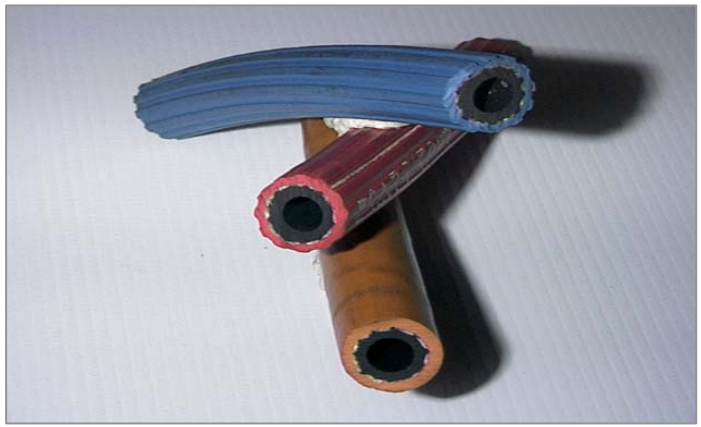
Hoses

- Industrial welding hose is usually colour coded for gas service identification.
- Oxygen hose is usually green/blue and Acetylene hose is red.



Important Safety Notes

- Keep welding hoses clear of any falling metal, slag or spark.
- Never allow hoses to become coated with oil, grease or dirt, such coating could conceal damaged areas.
- Examine the hoses before attaching to welding torch or regulator. If cut, burns, worn areas or damaged fittings are found, replace the hose.
- Completely replace welding hose if it contains multiple splices or when cracks or severe wear is noticed.

Flashback Arrestors

Flashback Arrestors are recommended to limit the damage that may be done by flashbacks.

Flashbacks can occur due to :

- incorrect pressures
- incorrect procedures
- nozzle blockage or faulty equipment.

One of the main causes of flashback is due to back feeding hig pressure stream.

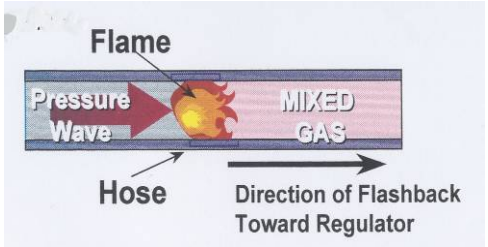
Flashback arrestors will

- prevent oxygen and fuel gas mixing in the hose
- prevent fire, injury and damage.

Flame burns back into the torch, it can be the sign of some fault in the equipment or the gas supply

Symptoms :

Characterized by a sharp bang



Causes:

Wrong pressure settings, or cylinder running too low

Pressure drops due to length, bore, or constriction of the hose

Dirt, or carbon blocking flow through torch / mixer or nozzle

Equipment becoming overheated

Action:

Turn off oxygen first, then cool and clean equipment

Practical way of preventing back feeding:

Fit a non-return valve or check valve. This is the simplest and cheapest method of preventing back feeding, but it must be considered as the minimum requirement.

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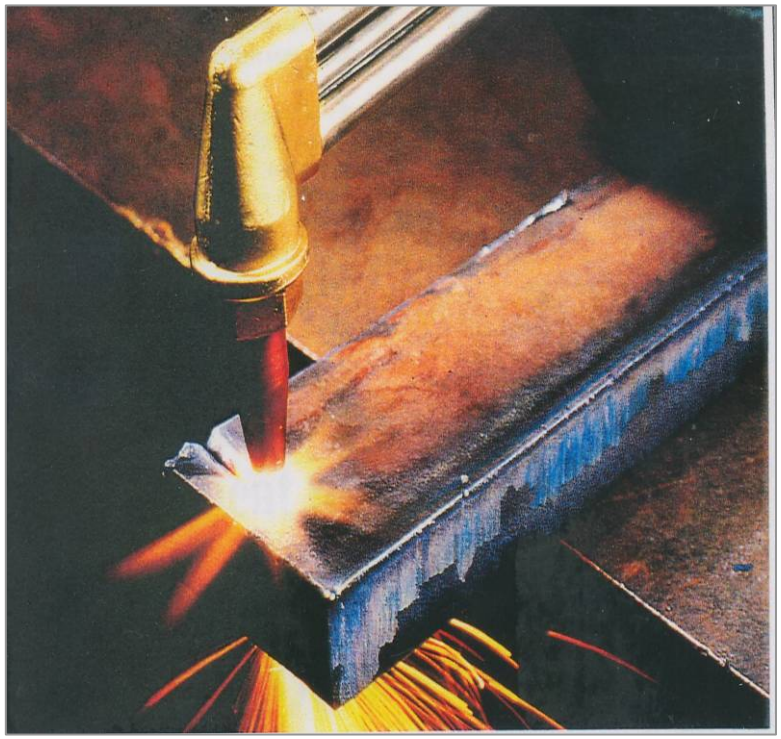
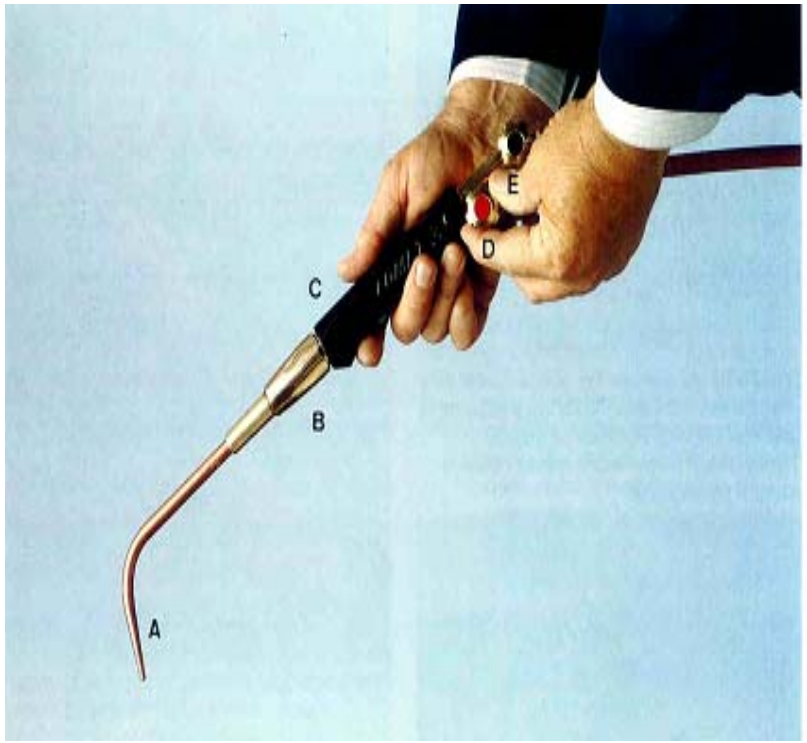
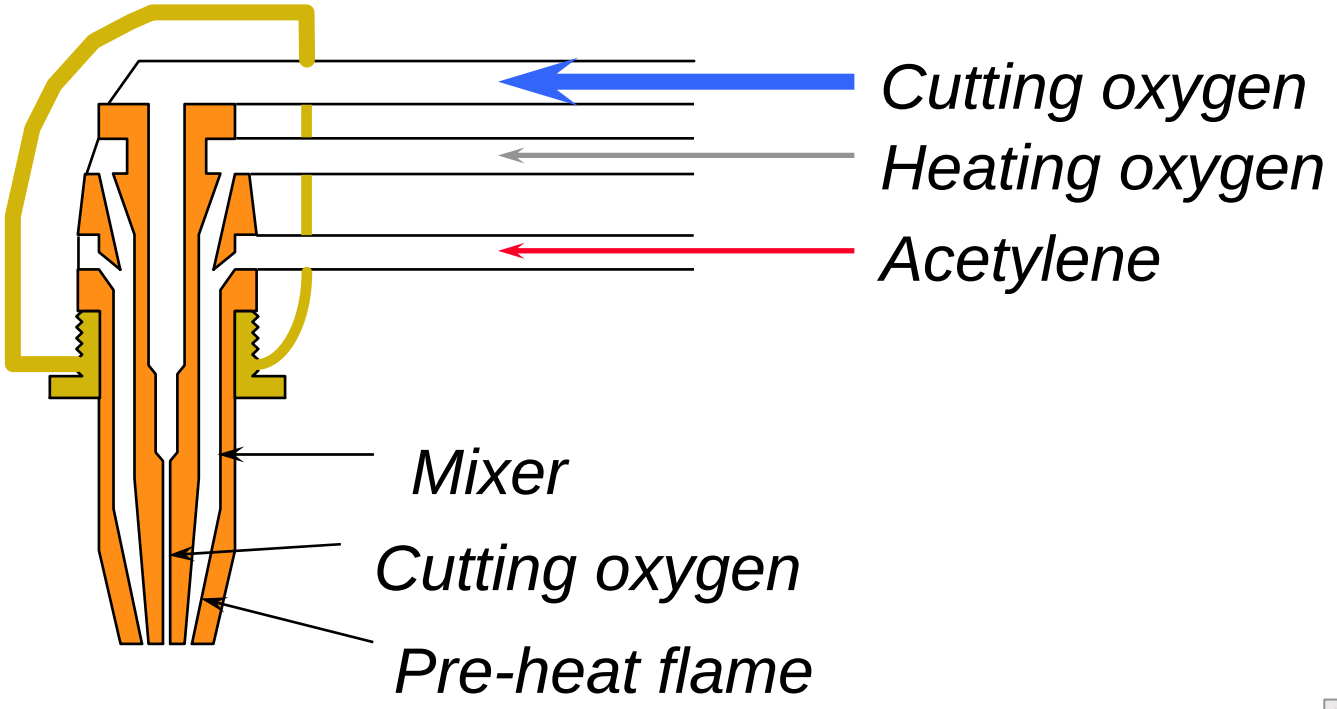
Welding Blow pipe & Cutting torch





Cutting Nozzle



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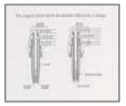

Nozzle selection

The two most commonly used cutting nozzles are the
ANME - Acetylene Nozzle Mix Extended (87 mm in length, ANM - 76 mm)
PNME - Propane Nozzle Mix Extended (- ditto -)

It is not technically possible to produce one nozzle type to work with either gas because of variations in their burning characteristics.

In general selection of nozzle will depends on :

- Fuel gas type
- Thickness of material

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Nozzle Selection Chart

NM250 – cutting data With ANM nozzles

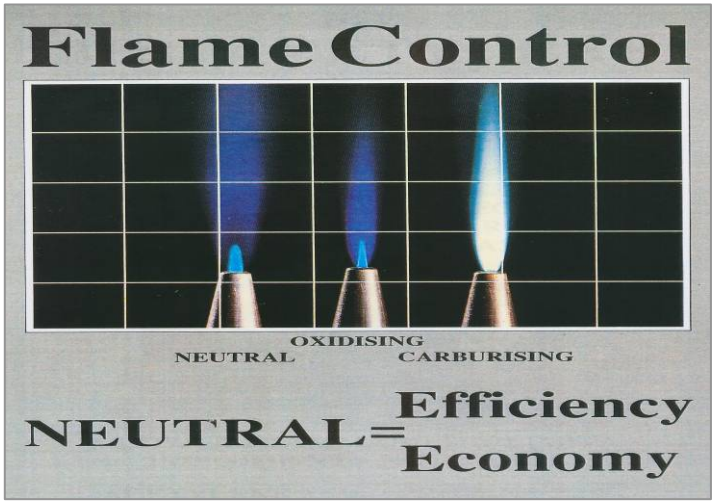
Material type		Mild steel									Cast iron	
Material thickness	mm	6	13	25	50	75	100	150	200	250	25 to 40	50 to 75
	in	1/4	1/2	1	2	3	4	6	8	10	1 to 1 1/2	2 to 3
Nozzle size		1/32	3/64	1/16	1/16	1/16	5/64	3/32	7/64	1/8	7/64	1/8
Acetylene pressure	bar	0.14	0.14	0.14	0.14	0.14	0.14	0.21	0.21	0.21	0.28	0.28
	lbf/in^2	2	2	2	2	2	2	3	3	3	4	4
Oxygen pressure	bar	1.8	2.1	2.8	3.5	4.2	3.2	3.2	4.2	5.3	4.2	6.3
	lbf/in^2	25	30	40	50	60	45	45	60	75	60	90
Acetylene consumption	l/h	460	510	690	690	690	800	1080	1260	1440	1440	1560
	ft^3/h	16	18	24	24	24	28	38	44	50	50	55
Heating oxygen consumption	l/h	490	570	750	750	750	850	1140	1320	1560	1440	1560
	ft^3/h	17	20	26	26	26	30	40	48	55	50	55
Cutting oxygen consumption	l/h	800	1510	3960	4900	5700	6660	9400	14400	21480	14400	24900
	ft^3/h	28	54	140	170	200	240	330	510	760	510	880
Cutting speed	mm/min	560	510	430	330	230	160	140	110	80		
	in/min	22	20	17	13	9	6.5	5.5	4.5	3		

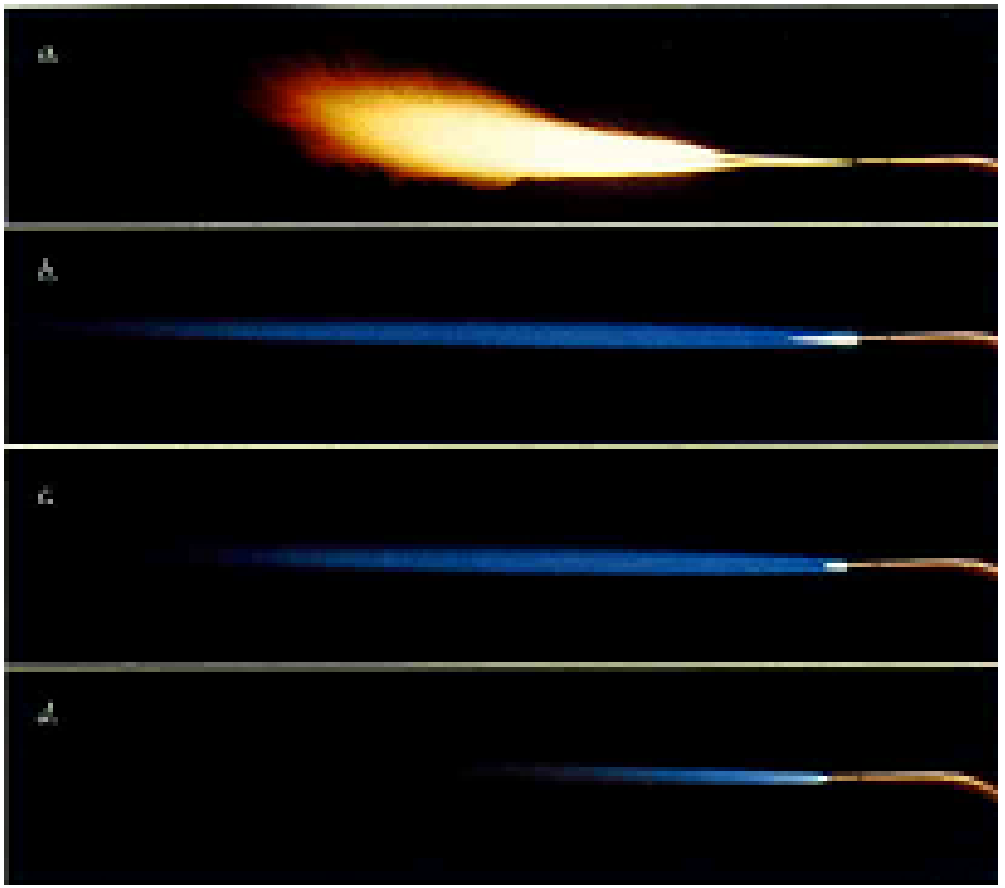
Operating data for gouging

Nozzle		A GNM13	A GNM19	A GNM25
Acetylene pressure	bar	0.49	0.49	0.56
	lbf/in^2	7	7	8
Oxygen pressure	bar	4.2	5.3	5.6
	lbf/in^2	60	75	80

Selection flame type and control

a. Acetylene burning with air
b. Carburizing flame
c. Neutral flame
d. Oxidizing flame





Accessories

Lighting Up

1) Open Both Cylinder Valves Gently.
2) Check That There Is Ample Gas In Both Cylinders.
3) Set The Fuel Gas Regulator Pressure, Using The Following sequence :
    a) Open The Fuel Gas Valve On The Blowpipe.
    b) Adjust The Pressure Regulating Screw In Accordance with Nozzle Size
    c) Close The Blowpipe Fuel Gas Valve.
4) Set The Oxygen Regulator Pressure, Using The Same Sequence.
5) Open Blowpipe Fuel Gas Valve - PURGE.
6) Open Blowpipe Oxygen Valve - PURGE.
7) Light The Fuel Gas.
8) Open The Oxygen Valves On The Blowpipe Gradually And Adjust To The Desired Flame. (Always Use A Spark Lighter To Ignite Gas - Never A Naked Flame).

Shutting Down

1) Close The Fuel Gas Valve On The Blowpipe.
2) Close The Oxygen Valve On The Blowpipe.
3) Close Both Cylinder Valves.
4) Open And Close Blowpipe Valves, Oxygen First, To Relieve Pressure In The Hoses.
5) Wind Back Both Regulator Screws To Relieve The Spring Pressure.

Thank you for your attention.