Gases used for welding and gas flame combinations

Objectives: At the end of this lesson you shall be able to
- **name the different types of gases used for welding**
- **compare the different types of gas flame combinations**
- **state the temperatures and uses of the different gas flame combinations.**

In the gas welding process, the welding heat is obtained from the combustion of fuel gases in the presence of a supporter of combustion (oxygen).

(Oxy-acetylene gas flame combination is used in most gas welding processes because of the high temperature and heat intensity.)

Comparison of different gas flame combinations and their uses

Sl. No	Fuel gas	Supporter of combustion	Name of the gas flame	Temperature	Application/uses
1	Acetylene	Oxygen	Oxy-acetylene flame	3100 to 3300°C (Highest temperature)	To weld all ferrous and non-ferrous metals and their alloys; gas cutting & gouging of steel;brazing bronze welding; metal spraying and hard facing.
2	Hydrogen	Oxygen	Oxy-hydrogen flame	2400 to 2700°C (Medium temperature)	Only used for brazing, silver soldering and underwater gas cutting of steel.
3	Coal gas	Oxygen	Oxy-coal gas flame	1800 to 2200°C (Low temperature)	Used for silver soldering underwater gas cutting of steel.
4	Liquid petroleum gas (LPG)	Oxygen	Oxy-liquid petroleum gas flame	2700 to 2800°C (Medium tempeature)	Used for gas cutting steel heating purposes. (Has moisture and carbon effect in the flame.)
5	Acetylene	Air	Air-acetylene flame	1825 to 1875°C (Low temperature)	Used only for soldering, brazing, heating purposes and lead burning.

Chemistry of oxy-acetylene flame

Objectives : At the end of this lesson you shall be able to
- **identify the features and illustrate the different zones of an oxy-acetylene flame with their corresponding temperatures**
- **explain the chemical reaction between oxygen and acetylene during primary and secondary combustion in the flame.**

Oxy-acetylene flame is produced by the combustion of a mixture of oxygen and acetylene in various proportions. The temperature and characteristics of the flame depend on the ratio of the two gases in the mixture.

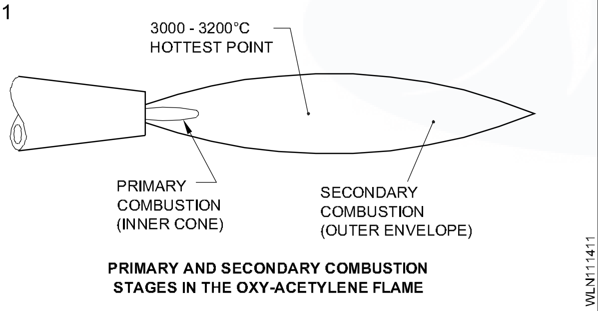
To know the characteristics and effects of oxy-acetylene flame a welder must know the chemistry of the flame.

Features of neutral flame: Oxy-acetylene flame consists of the following features by appearance.

- Inner cone
- inner reducing zone
- Outer zone or envelope (Fig 1)

Different zones and temperature: To know and make the best use of oxy-acetylene flame, the temperature in different zones is shown in Fig 1.

Fig 1



PRIMARY AND SECONDARY COMBUSTION STAGES IN THE OXY-ACETYLENE FLAME

The greatest amount of heat is produced at just ahead of the inner cone called the hottest point or region of maximum temperature.

Combustion ratio of oxygen and acetylene in flame

For complete combustion/burning one volume of acetylene requries two and a half volumes of oxygen.

Acetylene	:	Oxygen + O
1 litre	:	2.5 litres

Equal volumes of acetylene and oxgen are supplied from the blowpipe to produce a neutral flame. (Fig 1)

Acetylene	:	Oxygen
1 litre	:	1 litre

(primary combustion)

So another 1.5 litres of oxygen is required for complete burning of acetylene.

The flame takes an additional 1.5 litres of oxygen from the surrounding atmosphere. (Secondary combustion) (Fig 1)

Chemical reaction: 1 volume of acetylene combines with 2 1/2 volumes of oxygen and burns to form 2 volumes of carbon dioxide and 1 volume of water vapour plus heat.

Primary combustion: It takes place in the inner cone right in the tip of the nozzle. (Fig 1)

In the bright nucleus:

$C_2 H_2 \uparrow 2C + H_2$ + Heat

In the inner cone - first burning stage:

$2C + H_2 O_2 \uparrow 2CO + H_2$ + Heat

CO and H_2 have reducing effect (no oxides are forming) Maximum heat (Hottest point) is just in front of the inner cone.

One volume of oxygen combines with one volume of acetylene (delivered through the torch) and burns to form. Two volume of carbon monoxide and one volume of hydrogen plus heat.

Secondary combustion: It takes place in the outer envelope of the flame.

In the outer envelope - secondary burning

$2CO + O_2 \uparrow 2CO_2$ + Heat

$2H_2$ + O2 $\uparrow 2H_0O$ + Heat

Combustion in air (Fig 1): Two volumes of carbon monoxide and 1 volume of hydrogen (Product of primary combustion) combine with 1.5 volume of oxygen from the surrounding air and burn to form. two volumes of carbon dioxide and 1 volume of water vapour.

The product of primary combustion is further burnt in the reducing zone.

The region surrounding the inner cone and its tip is called reducing zone

The reducing zone protects the molten metal from atmospheric effects as it uses the atmospheric oxygen for secondary combustion.

Types of oxy - acetylene flames

Objectives: At the end of this lesson you shall be able to
- **name the different types of oxy-acetylene flames**
- **state the characteristics of each type of flame**
- **explain the uses of each type of flame.**

The oxy-acetylene gas flame is used for gas welding because

- it has a well controlled flame with high temperature
- the flame can be easily manipulated for proper melting of the base metal
- it does not change the chemical composition of the base metal /weld.

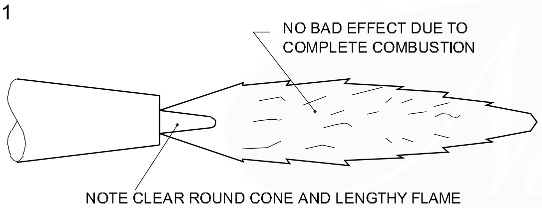
Three different types of oxy-acetylene flames as given below can be set.

- Neutral flame
- Oxidising flame
- Carburising flame.

Characteristics and uses

Neutral flame (Fig 1): Oxygen and acetylene are mixed in equal proportion in the blowpipe.

Fig 1



NEUTRAL FLAME
(EQUAL QUANTITIES OF OXYGEN AND ACETYLENE)

WLN111421

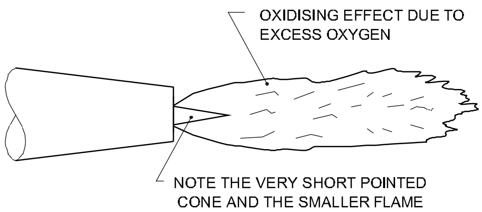
Complete combustion takes place in this flame.

This flame does not have a bad effect on the base metal/ weld i.e. the metal is not oxidised and no carbon is available for reacting with the metal.

Uses: It is used to weld most of the common metals, i.e. mild steel, cast iron, stainless steel, copper and aluminium.

Oxidising flame (Fig 2): It contains excess of oxygen over acetylene as the gases come out of the nozzle.

Fig 2



OXIDISING FLAME
(EXCESS OXYGEN)

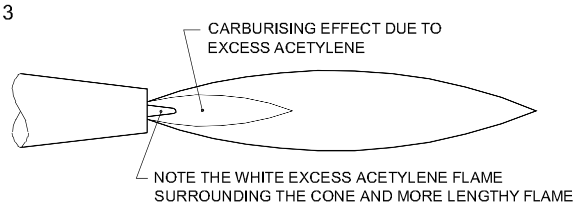
WLN111422

The flame has an oxidising effect on metals which prevents evaporation of zinc/tin in brass welding/brazing.

Uses: Useful for welding of brass and for brazing of ferrous metals.

Carburising flame (Fig 3): It receives an excess of acetylene over oxygen from the blowpipe.

Fig 3



CARBURISING FLAME
(EXCESS ACETYLENE)

WLN111423

Uses : Useful for stelliting (hard facing), 'Linde' welding of steel pipes, and flame cleaning.

The selection of the flame is based on the metal to be welded

The neutral flame is the most commonly used flame. (See the chart given below.)

	Metal	**Flame**
1	Mild steel	Neutral
2	Copper (de-oxidised)	Neutral
3	Brass	Oxidising
4	Cast iron	Neutral
5	Stainless steel	Neutral
6	Aluminium (Pure)	Neutral
7	Stellite	Carburising

Principle of gas cutting and application

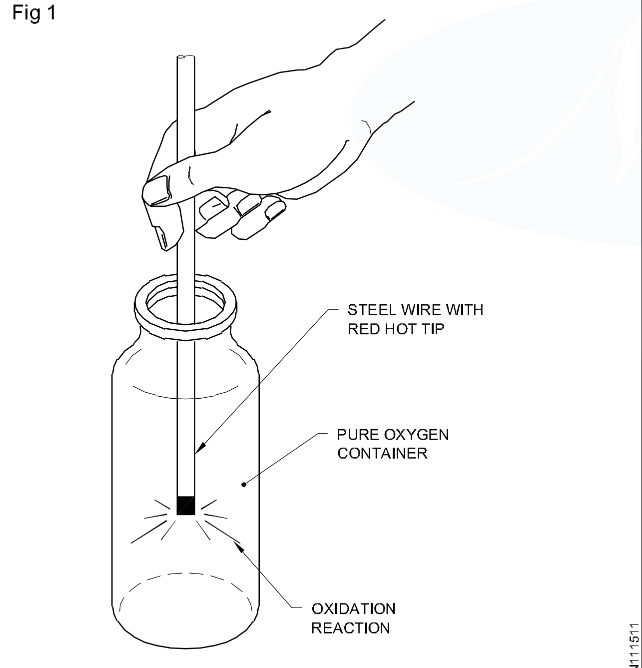
Objectives : At the end of this lesson you shall be able to
- **explain the principle of gas cutting**
- **describe the cutting operation and its application.**

Introduction to gas cutting: The most common method of cutting mild steel is by an oxy-acetylene cutting process. With an oxy-acetylene cutting torch, the cutting (Oxidation) can be confined to a narrow strip and with little effect of heat on the adjoining metal. The cut appears like a saw-cut on a wooden plank. The method can be successfully used to cut ferrous metals i.e. mild steel.

Non-ferrous metals and their alloys cannot be cut by this process.

Principle of gas cutting: When a ferrous metal is heated to red hot condition and then exposed to pure oxygen, a chemical reaction takes place between the heated metal and oxygen. Due to this oxidation reaction, a large amount of heat is produced and cutting action takes place.

Fig 1



OXIDATION

When a piece of wire with a red hot tip is placed in a container of pure oxygen, it bursts in to flame immediately and is completely consumed. Fig 1 illustrates this reaction. Similarly in oxy-acetylene cutting the combination of red hot metal and pure oxygen causes rapid burning and iron is changed into iron oxide (oxidation).

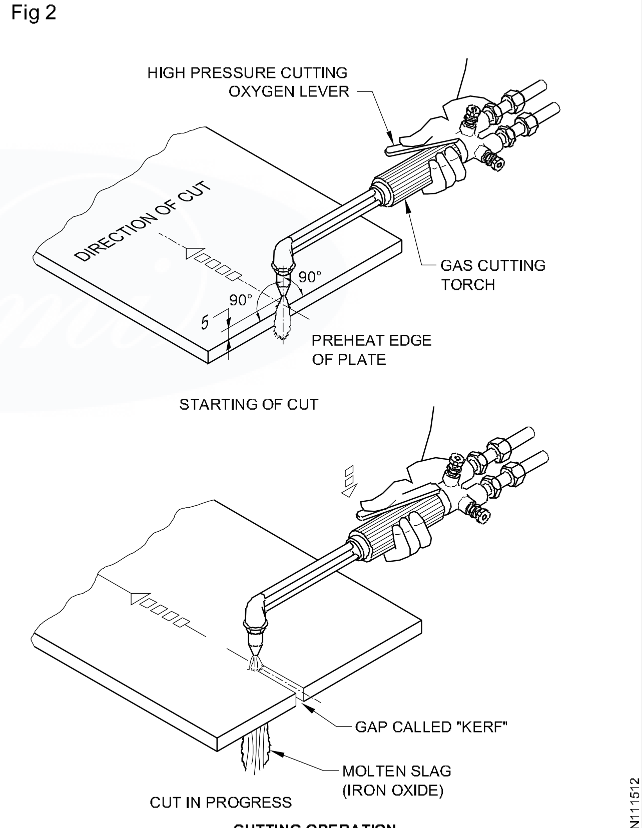
BY this continuous process of oxidation the metal can be cut through very rapidly.

The iron oxide is less in weight than base metal.

Also the iron oxide is in molten condition called slag. So the jet of oxygen coming from the cutting torch will blow the molten slag away from the metal making a gap called 'Kerf'. Fig.2

Cutting operation (Fig 2**):** There are two operations in oxy-acetylene gas cutting. A preheating flame is directed on the metal to be cut and raises it to bright red hot or ignition point (900° C app.). Then a stream of high pressure pure oxygen is directed on to the hot metal which oxidizes and cuts the metal.

Fig 2



CUTTING OPERATION

The two operations are done simultaneously with a single torch.

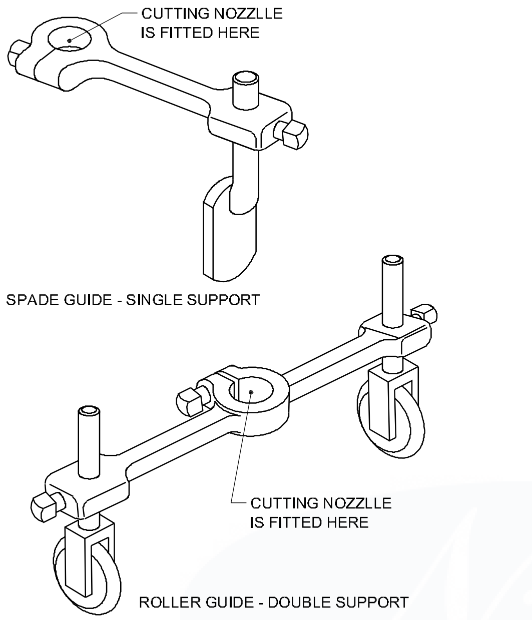
The torch is moved at a proper travel speed to produce a smooth cut. The removal of oxide particles from the line of cut is automatic by means of the force of oxygen jet during the progress of cut.

300 litres of oxygen are required to oxidize one kilogram of iron completely. The ignition temperature of steel for gas cutting is 875°C to 900°C

Application of cutting torch: Oxy-acetylene cutting torch is used to cut mild steel plates above 4mm thickness. The M.S plate can be cut to its full length in straight line either parallel to the edge or at any angle to the edge of the plate. Beveling the edges of a plate to any required angle can also be done by tilting the torch. Circles and any other curved profile can also be cut using the cutting torch by using a suitable guide or template.

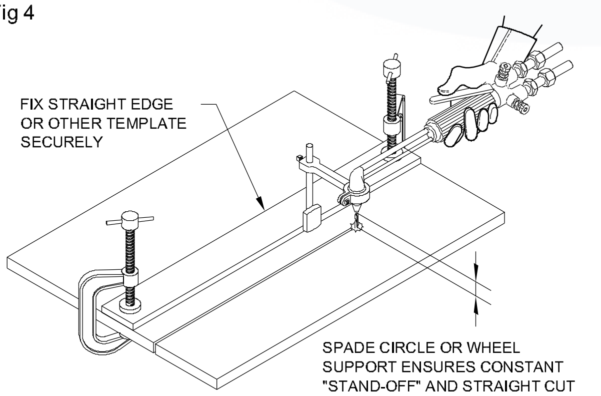
Fig 3 to Fig 7 Shows the guides used to cut straight lines, bevel and small circles.

Fig 3



GUIDES

Fig 4

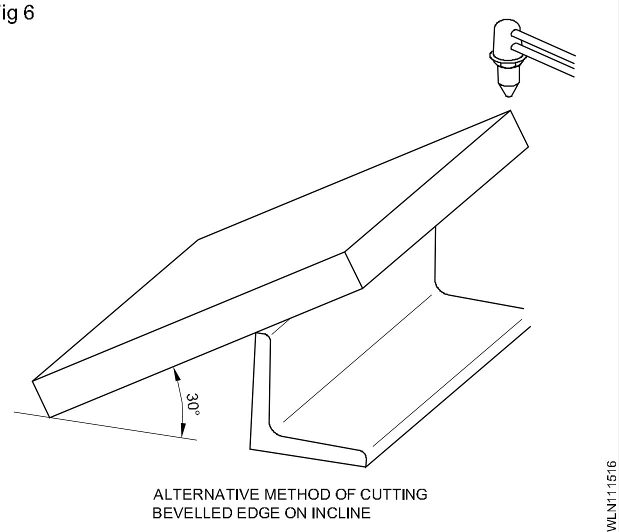


CUTTING WITH STRAIGHT EDGE AND SINGLE SUPPORT

Cutting torch guides: Guides are sometimes used during oxy acetylene cutting.

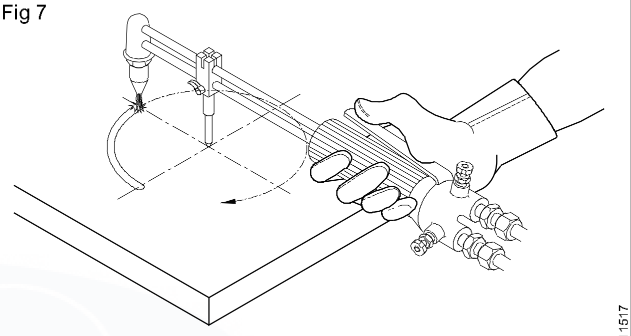
They can be either a roller guide, double support or spade guide with single support.

Fig 6



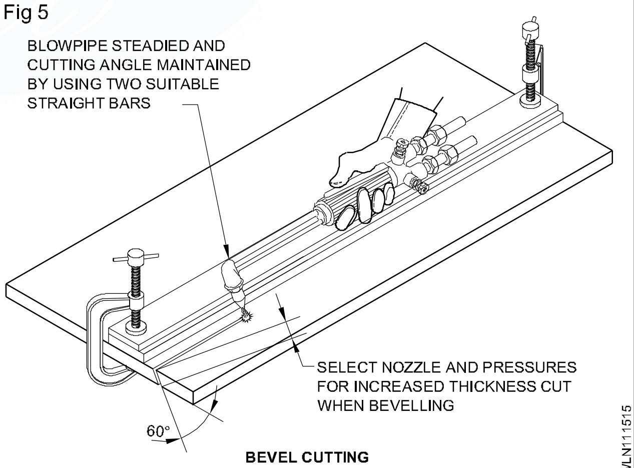
ALTERNATIVE METHOD OF CUTTING
BEVELLED EDGE ON INCLINE

Fig 7



SMALL CIRCLE CUTTING

Fig 5



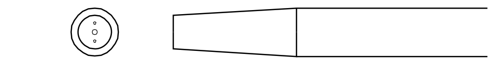
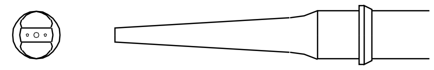
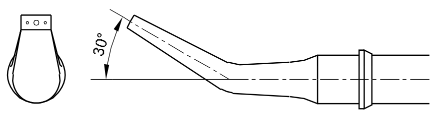
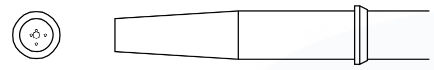
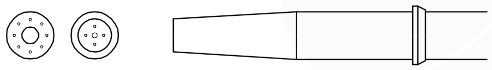
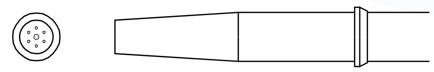
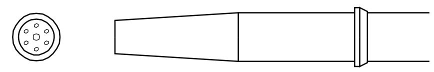
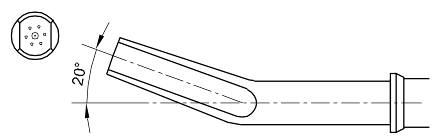
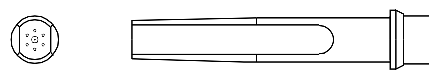
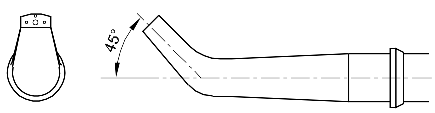
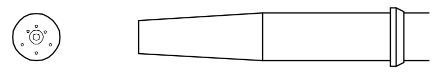
BEVEL CUTTING

Cutting guides are held onto the nozzle of the cutting torch by tightening a clamp bolt. the clamps, where they are fitted, are adjusted so the inner cones of the preheat flames are approximately 2-3mm above the surface of the metal to be cut. The tip of the cutting nozzle is held at distance of 5-6mm above surface of the plate being cut.

Oxy-acetylene hand cutting - piercing hole and profile cutting

Objectives : At the end of this lesson you shall be able to
- **explain the special types of nozzles for gas cutting and their application**
- **describe the parts of a cutting equipment and their functions**
- **explain trouble shooting and the remedy of the faults in oxygen cutting.**

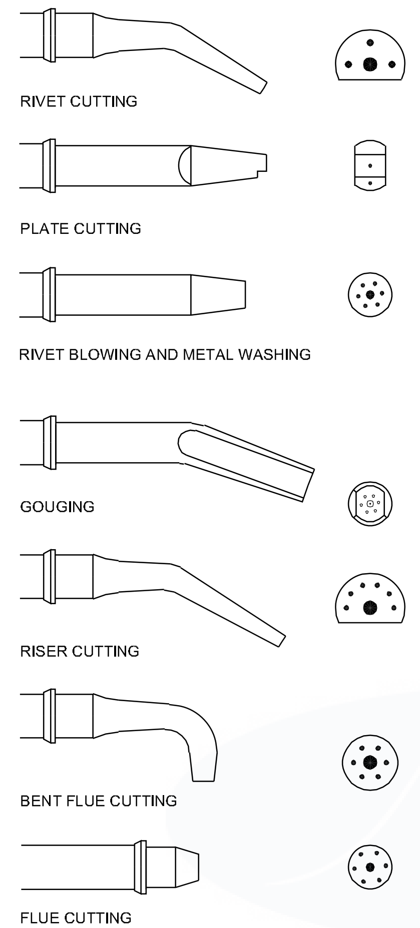
Table of some common cutting torch tips and their uses

Number of preheat orifices in cutting torch tips	Degree of preheating	Application
 2	Medium	For straight line or circular cutting of clean plates.
 2	Light	For splitting angle iron, trimming plates and sheet metal cutting.
 30° 2	Light	For hand cutting rivet heads and machine cutting 30 deg. bevels.
 4	Light	For Straight line and shape cutting clean plate.
 4,6,8	Medium	For rusty or painted surfaces.
 6	Heavy	For cast iron cutting and preparing vee for cast iron welding.
 6	Very heavy	For general cutting; also for cutting and stainless steel.
 20° 6	Medium	For grooving, flame machining, gouging and removing imperfect welds.
 6	Medium	For grooving, gouging or removing imperfect welds.
 45° 3	Medium	For machine cutting 45° deg. bevel or hand cutting rivet heads.
 6 WLN111611	Heavy	Flared cutting orifices provide a large oxygen stream of low velocity for rivet head removal (Washing).

Special purpose nozzle: For profile cutting. Different types of nozzles are used for cutting metals in different shapes.

Nozzles used for cutting profiles are shown in Fig 1.

Fig 1



SPECIAL TYPES OF NOZZLES USED FOR GAS CUTTING

Cutting torch: Fig 2 Oxygen and fuel gas are mixed and then the gas is carried to the tip of the orifice to form 'preheat' flames. If oxygen is carried directly to the tip it oxidises the metal and blows it away to form the cut.

Method of piercing a hole: Hold the cutting blow pipe at right angles on the point where the hole is to be made. The point will be brightened. Release the cutting oxygen slowly. Raise the torch, tilt the nozzle slightly to the left and right direction so that the sparks may not fuel the nozzle. Thus the hole may be pierced.

For cutting of the profile hold the blow pipe head in such a way that the oxygen stream is directed by the correct tilting of the blow pipe. It is obvious that the angle between the nozzle and the plate must remain constant and this poses the greatest difficulty for the beginners.

Position of the preheating flame as related to the plate surface is very important.

Fig 2

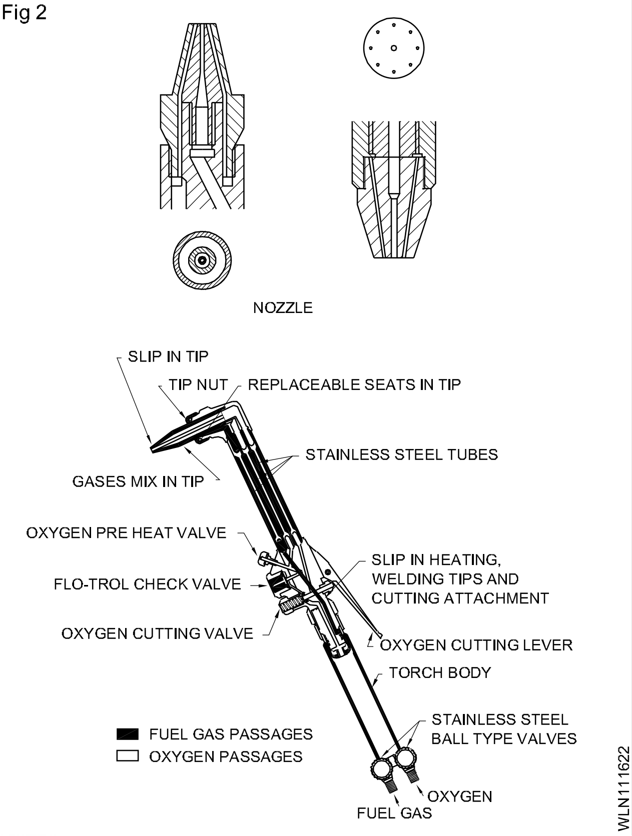
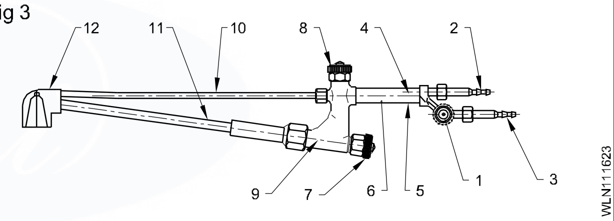


Fig 3



Names and function of the parts of a cutting torch (Fig 3 and Table 1)

Table 1

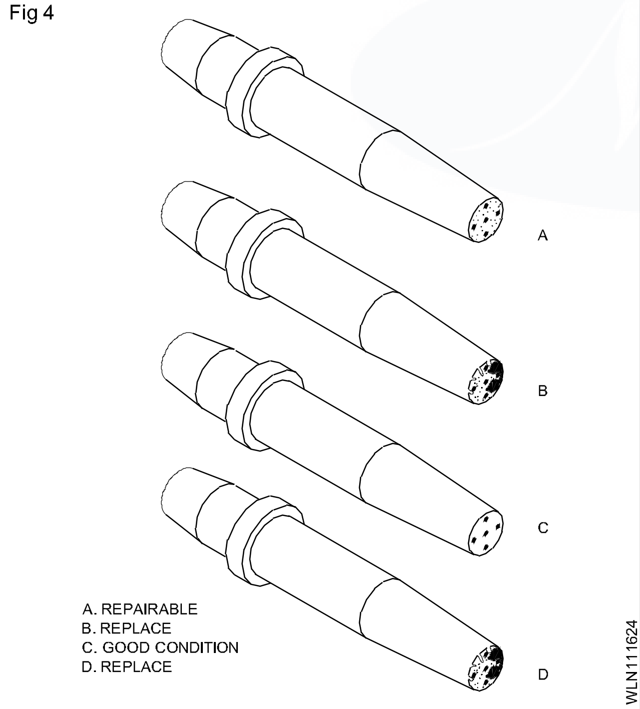
No.	Name	Function
1	Acetylene gas valve	To adjust the flow rate of acetylene gas.
2	Oxygen Regulator	To connect Regulator
3	Acetylene gas hose joint	To connect with the acetylene gas hose.
4	Oxygen conduit	To lead oxygen.
5	Acetylene gas conduit	To lead acetylene gas.
6	Grip	To hold the torch.
7	Preheating oxygen valve	To adjust the preheating flame.
8	Cutting oxygen valve	To adjust the cutting oxygen flow rate.
9	Injector	To mix the acetylene gas with oxygen.
10	Cutting oxygen conduit	To lead the cutting oxygen.
11	Mixed gas conduit	To lead the mixture of acetylene gas and oxygen.
12	Torch head	To attach the nozzle.

Troubleshooting

Object	Trouble	part to be	Method	Remedy	
Torch	Gas leakage	Hose joint	soap water or water	Tighten further or replace.	At the beginning of the work.
		Valve & regulator	Soap water or water	Replace the torch.	At the beginning of the work.
		Cutting tip attaching part	soap water or water	Tighten further or replace.	At the beginning of the work.
	Suction of Acetylene	Injector	plug the fuel gas hose mouth with your finger.	Replace.	Periodical check for the low pressure torch.
	Preheating flame shape		Neutral flame visual inspection	Clean or replace.	At the beginning of the work or at random.
	Cutting oxy gen flow		Visible gas Visual inspection	Clean or replace.	At the beginning of the work or at random.

Care and maintenance: The cutting oxygen orifice should be cleaned at regular intervals by using different size wire of nozzle cleaner. (Fig 4)

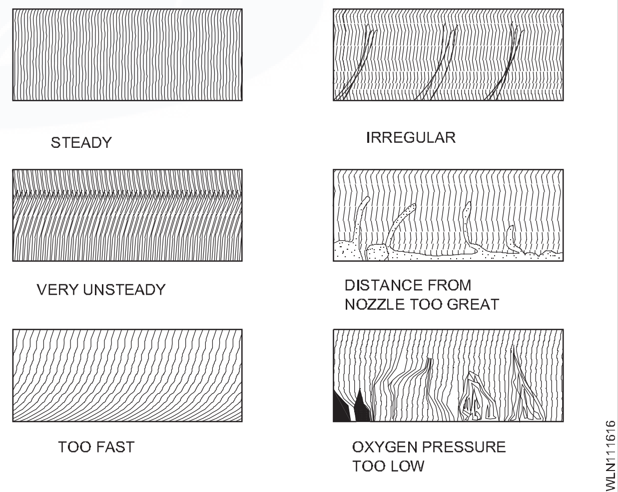
Fig 4



Characteristics of analysis of cutting: This analysis has been made on referring to the cutting face and the formation of cut in this surface.

This can be analyses as shown in the figure . (Fig 5)

Fig 5



Oxy-acetylene cutting equipment

Objectives: At the end of this lesson you shall be able to
- **explain the features of the oxy-acetylene cutting equipment, its parts and cutting torch**
- **describe the oxy-acetylene cutting procedure**
- **differentiate between cutting and welding blowpipes**.

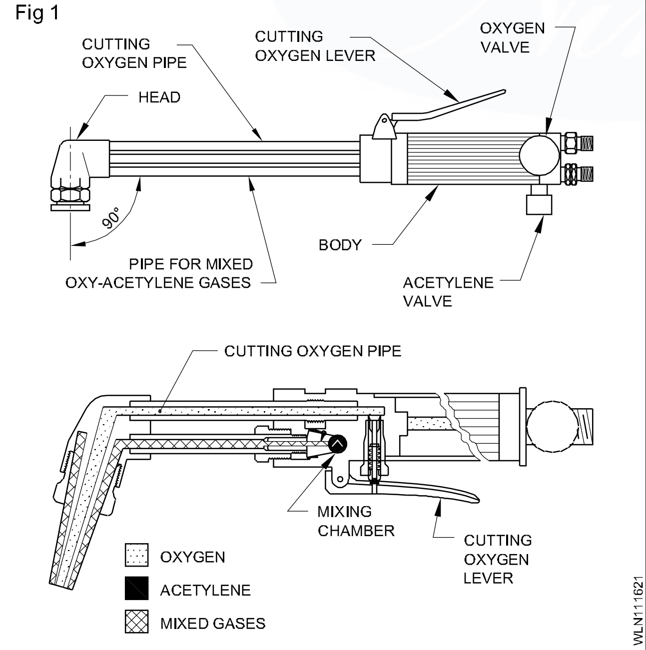
Cutting equipment: The oxy-acetylene cutting equipment is similar to the welding equipment, except that instead of using a welding blowpipe, a cutting blowpipe is used. The cutting equipment consists of the following.

- Acetylene gas cylinder
- Oxygen gas cylinder
- Acetylene gas regulator
- Oxygen gas regulator (Heavy cutting requires higher pressure oxygen regulator.)
- Rubber hose-pipes for acetylene and oxygen
- Cutting blowpipe

(Cutting accessories i.e. cylinder key, spark lighter, cylinder trolley and other safety appliances are the same as are used for gas welding.)

The cutting torch (Fig 1): The cutting torch differs from the regular welding blowpipe in most cases: it has an additional lever for the control of the cutting oxygen used to cut the metal. The torch has the oxygen and acetylene control valves to control the oxygen and acetylene gases while preheating the metal.

Fig 1



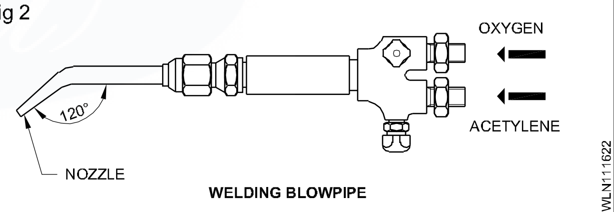
The cutting tip is made with an orifice in the centre surrounded by five smaller holes. The centre opening permits the flow of the cutting oxygen and the smaller holes are for the preheating flame. Usually different tip sizes are provided for cutting metals of different thicknesses.

Oxy-acetylene cutting procedure: Fix a suitable size cutting nozzle in the cutting blowpipe. lignite the cutting torch the same way as was done in the case of the welding blowpipe. Set the neutral flame for preheating. To start the cut, hold the cutting nozzle at angle 90° with the plate surface, and the inner cone of the heating flame 3 mm above the metal. Preheat the metal to bright red before pressing the cutting oxygen lever. If the cut is proceeding correctly, a shower of sparks will be seen to fall from the punched line. If the edge of the cut appears to be too ragged, the torch is being moved too slowly. For a bevel cut, hold the cutting torch at the desired angle and proceed as is done in making a straight line cut. At the end of the cut, release the cutting oxygen lever and close the control valves of the oxygen and acetylene. Clean the cut and inspect.

Difference between cutting blowpipe and welding blowpipe: A cutting blowpipe has two control valves (oxygen and acetylene) to control the preheating flame and one lever type control valve to control the high pressure for oxygen for making the cut.

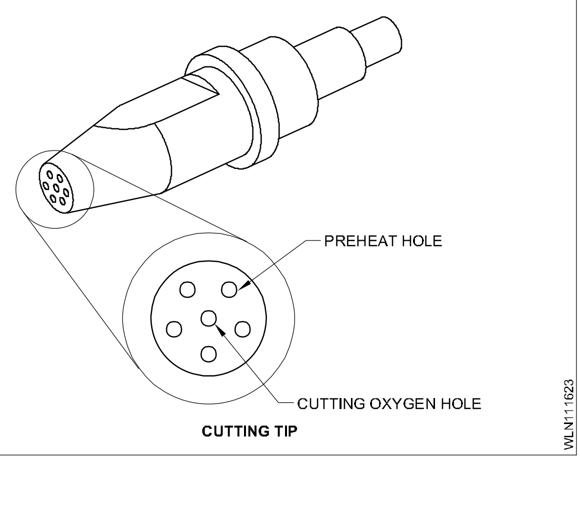
A welding blowpipe has only two control valves to control the heating flame (Fig 2).

Fig 2



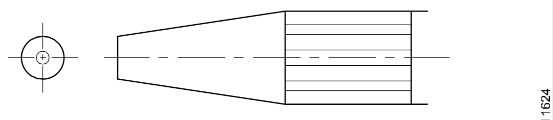
The nozzle of the cutting blowpipe has one hole in the center for cutting oxygen and a number of holes around the circle for the preheating flame. (Fig 3)

Fig 3



The nozzle of the welding blowpipe has only one hole in the center for the heating flame. (Fig 4)

Fig 4



WELDING NOZZLE

The angle of the cutting nozzle with the body is 90°

The angle of the welding nozzle with the neck is 120°

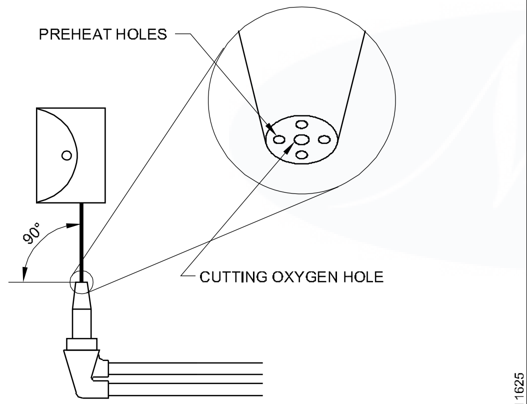
The cutting nozzle size is given by the diameter of the cutting oxygen orifice in mm.

The welding nozzle size is given by the volume of oxy-acetylene mixed gas coming out of the nozzle in cubic meter per hour.

Operating data for cutting mild steel

Cutting nozzle size-mm	**Thickness of plate (mm)**	**Cutting oxygen Pressure kgf/cm^2**
0.8	3-6	1.0 - 1.4
1.2	6-9	1.4 - 2.1
1.6	19-100	2.1 - 4.2
2.0	100-150	4.2 - 4.6
2.4	150-200	4.6 - 4.9
2.8	200-250	4.9 - 5.5
3.2	250-300	5.5 - 5.6

Fig 5



CLEANING THE HOLES OF CUTTING NOZZLE

However, the oxidation of metals has also certain useful effects, i.e a stream of pure oxygen if applied (used) on a red hot mild steel plate through a nozzle, the plate will get cut into 2 pieces. Hence the principle of oxidation is effectively used in gas cutting and gouging of mild steel.

Care and maintenance: The high pressure cutting oxygen lever should be operated only for gas cutting purposes.

Care should be taken while fitting the nozzle with the torch to avoid wrong thread. Dip the torch after each cutting operation in water to cool the nozzle.

To remove any slag particles of dirt from the nozzle orifice use the correct size nozzle cleaner Fig.5. Use an emery paper if the nozzle tip is damaged to make it sharp and to be at 90° with the nozzle axis.

Oxy-acetylene machine cutting

Objectives : At the end of this lesson you shall be able to
- **explain different types of gas cutting machines**
- **explain profile cutting using templates**
- **state gas cutting defects, their causes and remedies.**

There are two types of cutting machines.

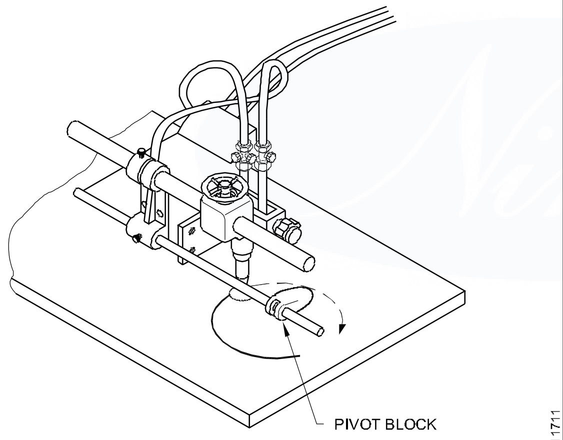
- Manually driven cutting machines
- Electrically driven cutting machines

Manually operated cutting machines

A manually driven cutting machine normally consists of:

- a crank or wheel to drive the cutter via a screw thread and this machine can be used for straight line cutting and bevel cutting
- a system of links or rods which are used with the machines and by which simple circles, ellipses, squares, etc. can also be cut. (Fig 1)

Fig 1



SMALL CIRCLE CUTTING

The speed of the manually operated cutting machines is liable to variation and the range of speed is also limited.

Electrically driven cutting machines

There are two types of machines available.

Portable machines

Static machines

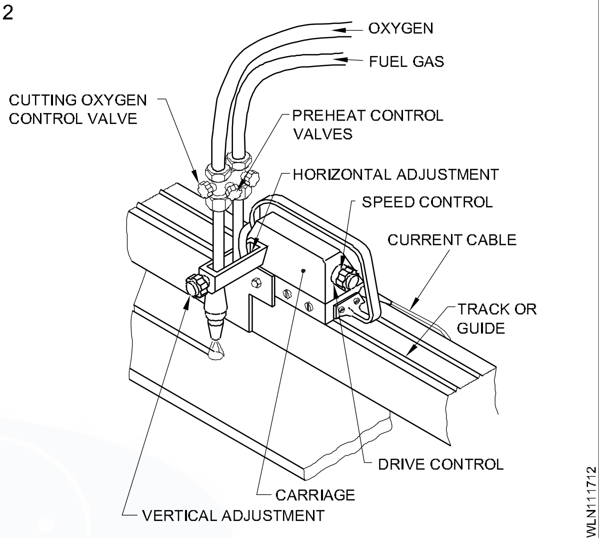
Portable machines

An electrically driven portable cutting machine generally consists of:

- cutting instruments
- carriage (Consisting of a variable speed motor)
- guide (to guide the carriage).

This machine can be used for straight line cutting, bevel cutting, circular cutting and profile cutting. (Fig 2)

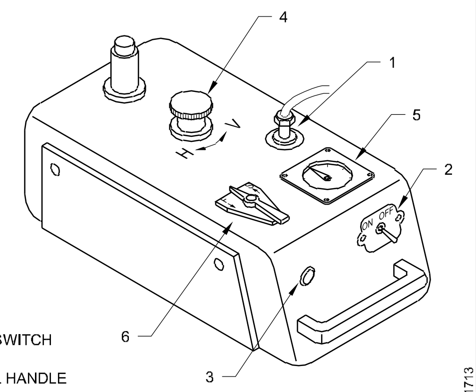
Fig 2



Provision is also made to enable full adjustment of the cutting head to be carried out over the cutting area.

The electrical control unit fitted to the carriage is shown in Fig 3.

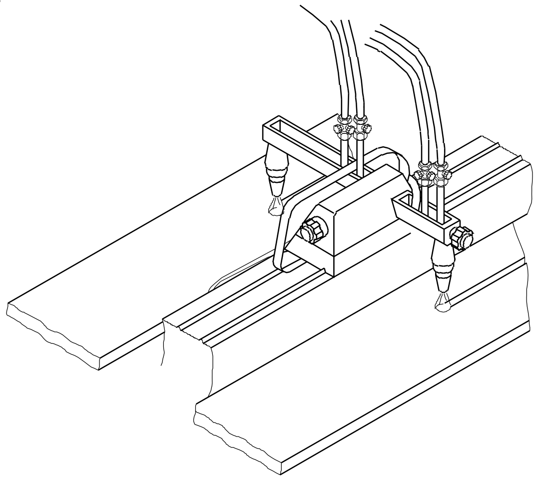
Fig 3



1. ELECTRIC PLUG
2. DRIVER MOTOR SWITCH
3. PILOT LAMP
4. SPEED CONTROL HANDLE
5. SPEED METER
6. CLUTCH LEVER

The speed of an electrically driven machine, when it, is constant, and normally it is able to produce better cuts than a manually driven machine. The speed range of an electrically driven machine is greater than that of the manual type and the adjustment of speed helps to control more accurately. Multiple cutting heads can be mounted to increase the volume of cutting, these cutting heads may be mounted on an adjustable bar extending to either side of the track at 90° to the direction of travel. (Fig 4)

Fig 4



PORTABLE MACHINE WITH MULTIPLE CUTTING HEADS

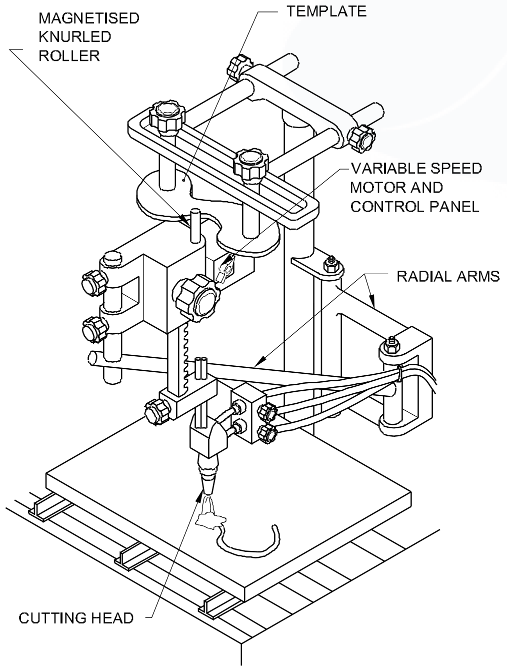
WLN111714

Static machines

These machines are generally used to produce more accurate work than what is possible with manually operated or portable cutters.

These machines can be used with radial arm and cross-carriage arrangements. In general the work is required to be brought to the machine. With this machine straight line cutting, circle and profile cutting can be done. (Fig 5)

Fig 5



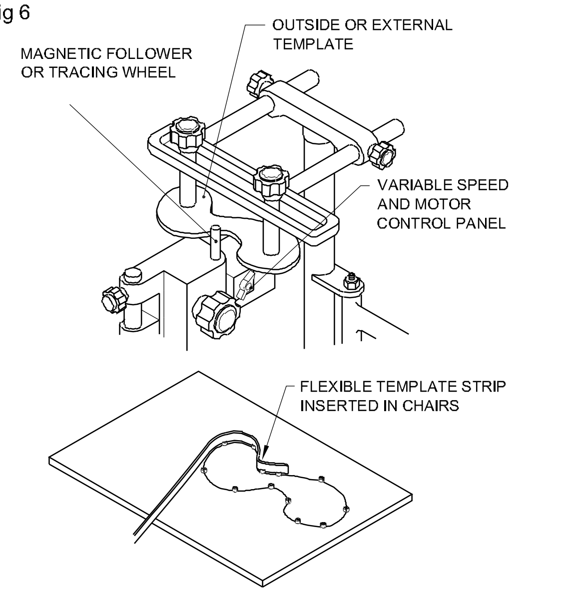
STATIC MACHINE WITH RADIAL ARM CUTTING MACHANISM

WLN111715

Profile cutting by using templates

Profile cutting can be done by static cutting machines as per the shape of the templates. (Fig 6) The templates are mainly used for reproducing the same shapes into a no. of pieces. The templates are made from wood, hardboard, aluminium or steel.

Fig 6



STATIC CUTTING MACHINE AS PER SHAPE OF THE TEMPLATES

WLN111716

Two types of templates are in use depending on their size.

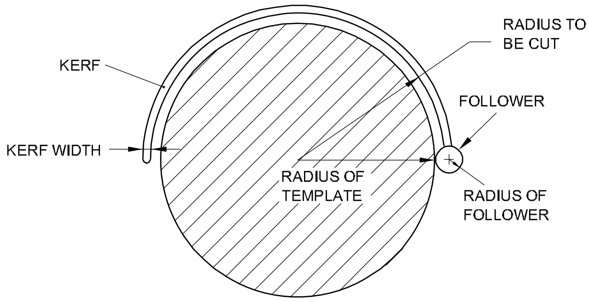
- Outside template
- Inside template

Outside template

The outline of the template will be the shape to be cut, reduced in size by the radius of the follower wheel or roller which is (Knurled) attached with the motor af the machine.

The size of the template is excluding the radius of the tracing wheel (knurled wheel) - half of the kerf width. (Fig 7)

Fig 7



$$\text{RADIUS OF TEMPLATE} = \text{RADIUS OF CIRCLE} - \left(\text{RADIUS OF FOLLOWER} + \frac{\text{KERF WIDTH}}{2}\right)$$

EXTERNAL TEMPLATE

WLN111718

Example

To cut a circle using an external template

Radius of circle	100 mm
Radius tracing wheel	6.5 mm (a)
Half the kerf width	0.8 mm (b)
Difference [(a) - (b)]	5.7 mm
So pre-radius of external template	100-5.7 mm
	= 94.3 mm

NOTE:

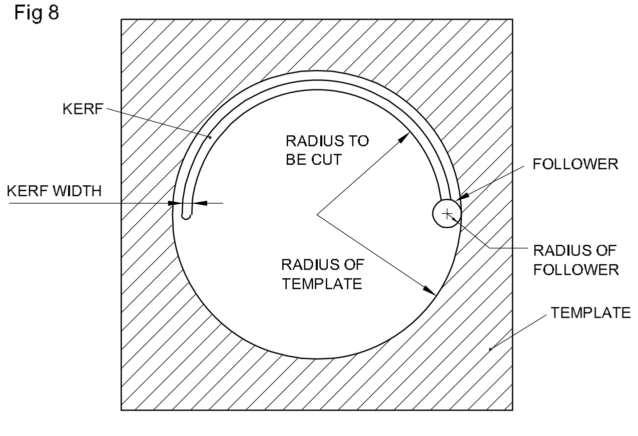
Kerf width is variable according to the:

- nozzle size, type and condition
- plate thickness
- cutting speed
- pressure of cutting oxygen
- preheat flame size.

Internal template or inside template

The shape of the template will be the shape to be cut increased by the radius of the following roller (knurled wheel) + half the kerf width. (Fig 8)

Fig 8



RADIUS OF TEMPLATE = RADIUS TO BE CUT + $\left(\text{RADIUS OF FOLLOWER} + \frac{\text{KERF WIDTH}}{2}\right)$

INTERNAL TEMPLATE

Example

To cut a circle using an internal template:

Radius of circle	-	100mm
Radius of tracing wheel (knurled)	-	6.5 mm (a)
Half the kerf width	-	0.8 mm (b)
Sum of (a) + (b)	=	6.5 + 0.8 mm
	=	7.3 mm
The radius of the external template	=	100 + 7.3 mm
	=	107.3 mm

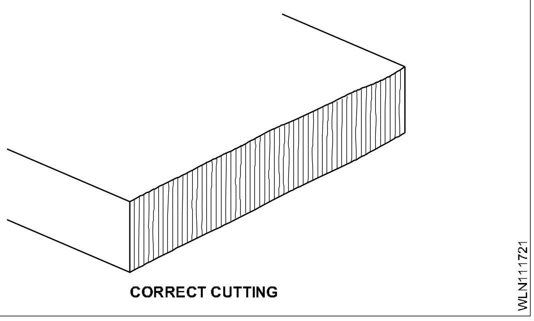
Gas Cutting Defects

Recognition of cutting and gouging defects, their causes, prevention and permissible methods of rectification.

- In a correct cut the top of the cut is both sharp and clean, the drag lines are almost invisible, producing a smooth side. Oxide is easily removed, the cut is sharp and bottom edge is clearly and sharply defined.

Drag lines should be vertical for profiles. A small amount of drag is allowed on straight cuts. (Fig 1)

Fig 1

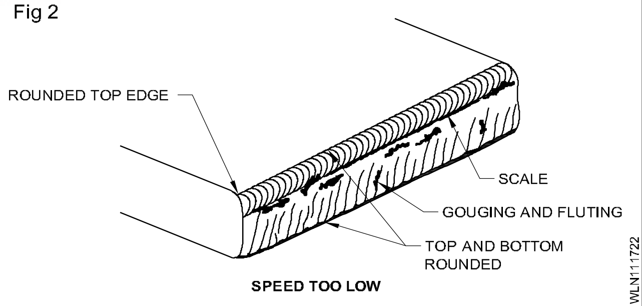


CORRECT CUTTING

- Due to melting, the top edge has become rounded. Gouging is pronounced at the bottom edge, which is also rough. Scale on the cut face is difficult to remove.

To rectify: Traverse at recommended speed. Increase the oxygen pressure. (Fig 2)

Fig 2

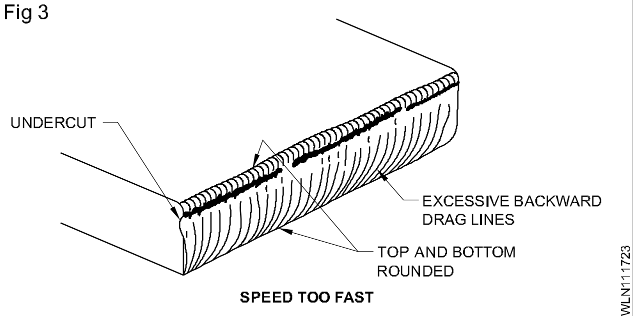


SPEED TOO LOW

- The top edge may not be sharp; there is a possibility of beading.

To rectify: slow down the traverse to the recommended speed. Leave the oxygen pressure as set. (Fig 3)

Fig 3



SPEED TOO FAST

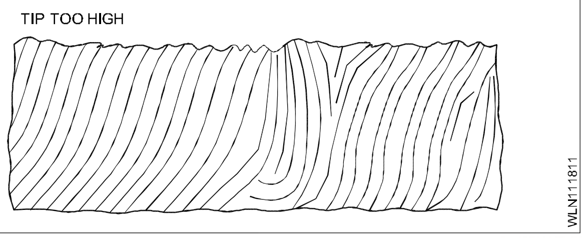
Common defects in gas cutting

Objectives : At the end of this lesson you shall be able to
- **explain the principle of gas cutting**
- **describe the cutting operation and its application.**

Common faults in cutting

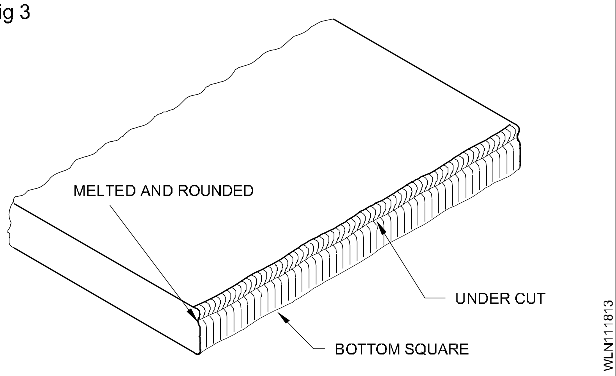
(Fig 1) The tip is too high off the steel. The top edge is heated or rounded, the cut face is not smooth, and often the face is slightly beveled where preheat effectiveness is partially lost due to the tip being held so high. The cutting speed must be reduced because of the danger of losing the cut.

Fig 1



(Fig 2) Extremely slow cutting speed. Pressure marks on the cut face indicate too much oxygen for the cutting conditions. Either the tip is too big, the cutting oxygen pressure is too high, or the speed is too slow as shown by the rounded or beaded top edge. On reducing the cutting oxygen volume to the correct proportions for the thickness of the cut, the pressure marks will recede toward the bottom edge until they finally disappear.

Fig 3



(Fig 3) Tip too close to the steel. The cut shows grooves and deep drag lines, caused an unstable cutting action. Part of the preheat cones burned inside the kerf, where normal gas expansion affected the oxygen cutting stream.

(Fig 4) Too much cutting oxygen. The cut shows pressure marks caused by too much cutting oxygen. When more oxygen is supplied than can be consumed in oxidation, the remainder flow around the slags, creating gouges or pressure marks.

Fig 2

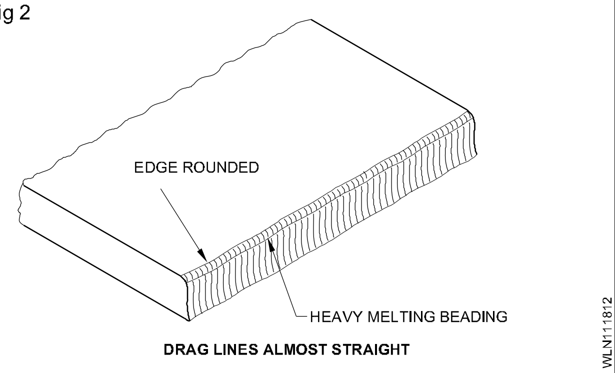
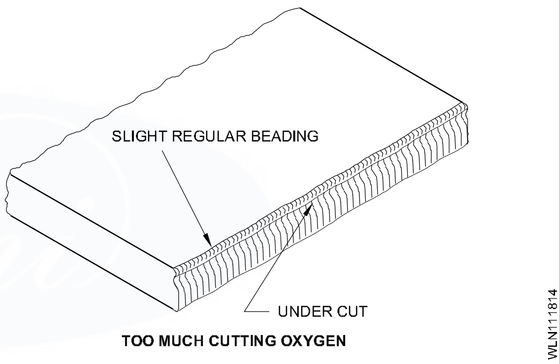
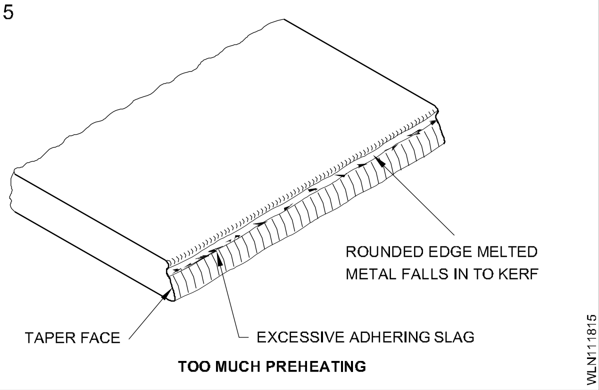


Fig 4



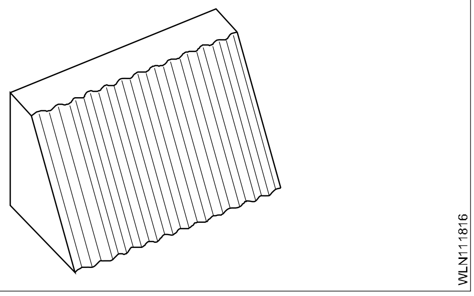
(Fig 5) Too much preheating. The cut shows a rounded top edge caused by too much preheat. Excess preheating does not increase the cutting speed, it only wastes gases.

Fig 5



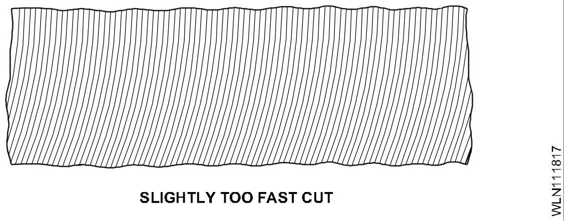
(Fig 6) Poor quality bevel cut. The most common fault is gouging, caused by either excessive speed or inadequate preheat flames. Another fault is a rounded top edge caused by too much preheat, indicating excessive gas consumption.

Fig 6



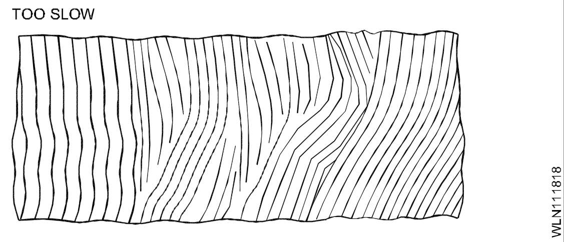
(FIg 7) Slightly too fast a cutting speed. The drag lines on this cut incline backwards, but a 'drop cut' is still attained. The top edge is good; the cut face is smooth and slag-free. This quality is satisfactory for most production work.

Fig 7



(Fig 8) Slightly too slow a cutting speed. The cut is of high quality although there is some surface roughness caused by the vertical drag line. The top edge is usually slightly beaded. This quality is generally acceptable, but faster speeds are more desirable because the labour cost for this cut is too high.

Fig 8



In a good cut, the edges are square, and the lines of cut are vertical. (Fig 9)

Fig 9