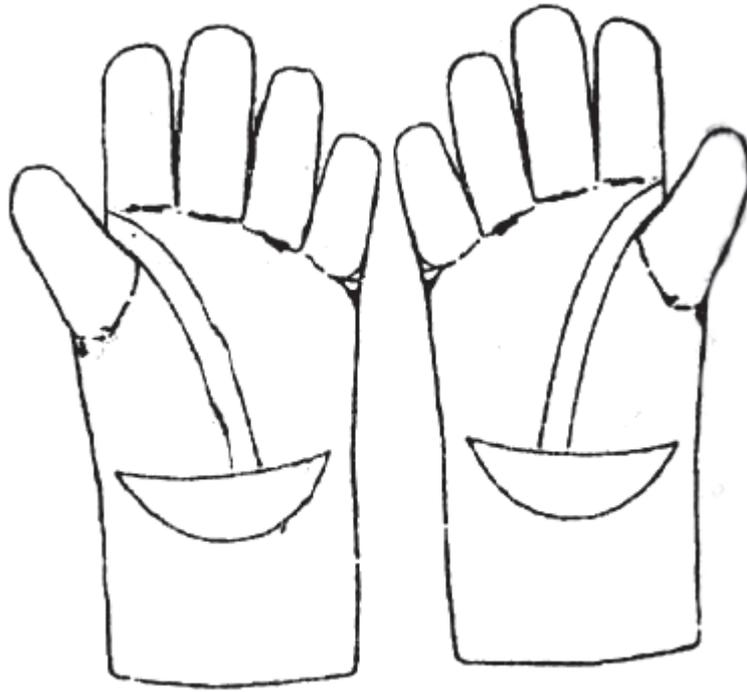


WELDING

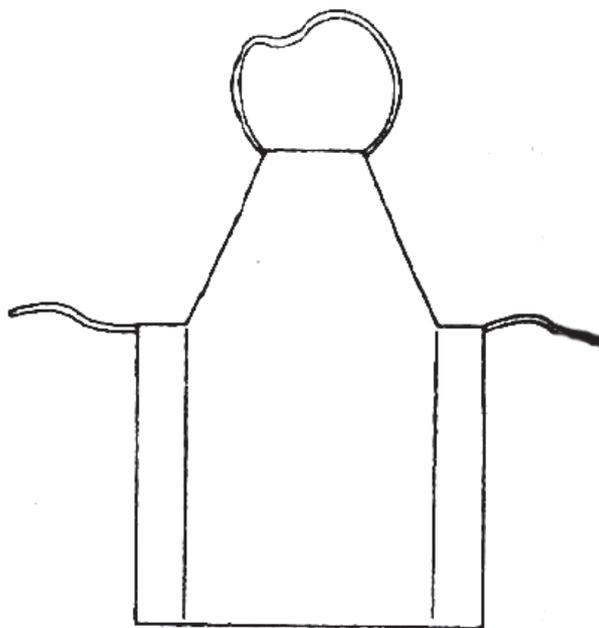
INTRODUCTION

The welding is a process of joining two similar or dissimilar metals by fusion, with or without the application of pressure and with or without the application of filler metal. The fusion of metal takes place by means of heat. The heat obtained from blacksmith fire, electric arc, electrical resistance, or by chemical reaction.

Hand Gloves



Leather Apron



SAFETY PRECAUTIONS

1. Workshop Safety
2. Personnel Safety
3. Equipment Safety
4. General Safety

(1) Workshop Safety

- (a) Welding shop must be away from the storage of petrol, oil, or any inflammable materials
- (b). Welding shop must be ventilated.
- (c). Natural light, water and transport must be available.
- (d). Fire fighting equipments must be instant in the shop.
- (e). Lay out the electric and gas welding machine.
- (f). Always keep a first aid box with accessories and containing eye drops, iodine, burnol with some cotton and bandage.

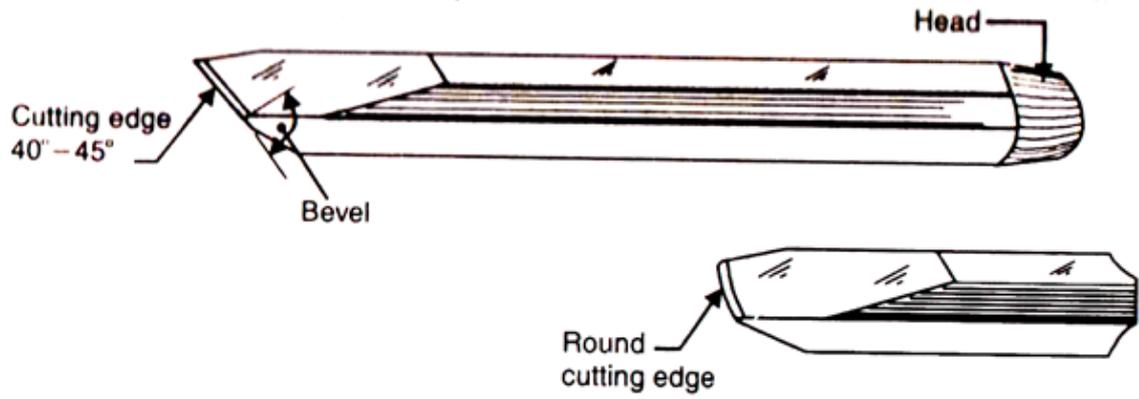
(2). Personnel Safety

- (a). Must be protective clothings for the body.
- (b). Must be wear goggles, helmet, Apron, hand gloves and leg guard.
- (c). Must be used wirebrush, chipping screen, etc.

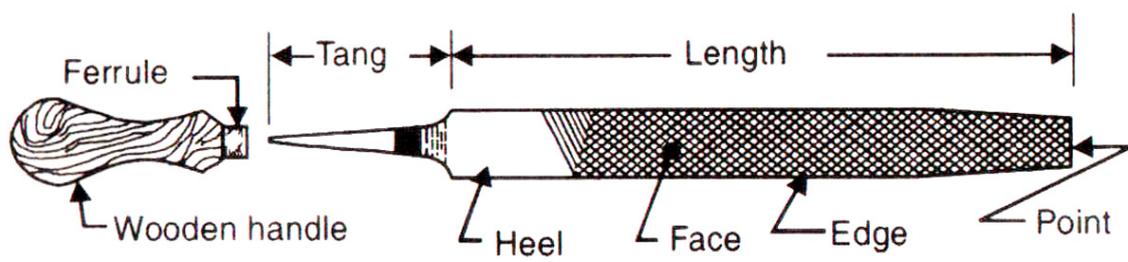
(3). Equipment Safety

- (a). Follow the manufactures instructions while seating the electric welding and gas welding equipments.
- (b). Store the oxy acetelene cylinder must be made seperately.
- (c). Welding equipments must be free from, oil or grease.
- (d). Dont try with faulty equipments.
- (e). Always have periodically inspect of machine.
- (f) Never repair regulators, blow pipes as this are specialised job and must be to the maintenance repair.

Flat Chisel



Flat File



(4). General Safety

- (a). Arc welding ooth should be pointed with black colour as it has the property of observing the harmful rays produced by the arc.
- (b). Always use hammer and file with handle.
- (c). Always use chipping goggles while grinding or chipping.
- (d). Always store the scrap metals in a bin provided for the purpose.

ELECTRIC WELDING ACCESSORIES

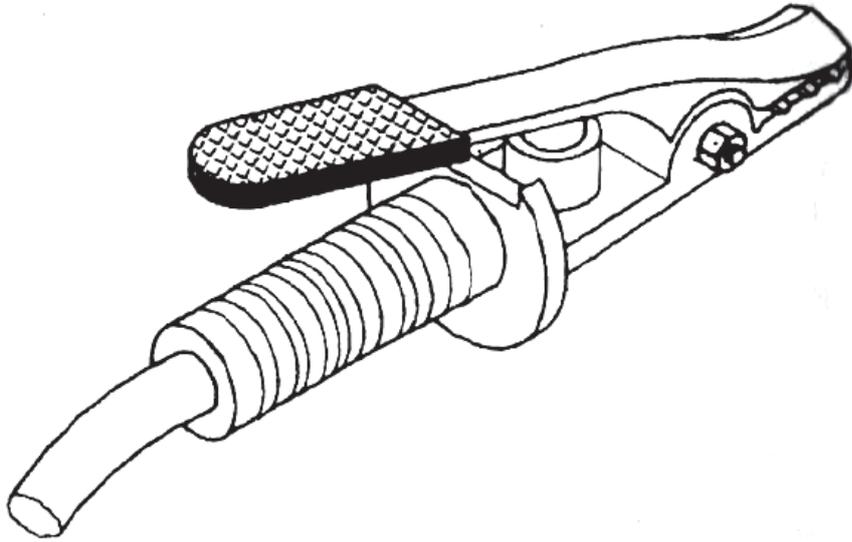
The following accessories are used for electric arc welding.

1. AC or DC welding machine
2. Electrode
3. Electrode holder
4. Cable and Cable connector
5. Chipping Hammer
6. Earth Clamp
7. Wire Brush
8. Face Shield
9. Safety Goggles
10. Hand gloves
11. Apron
12. Sledge Hammer
13. Punch
14. Tongs

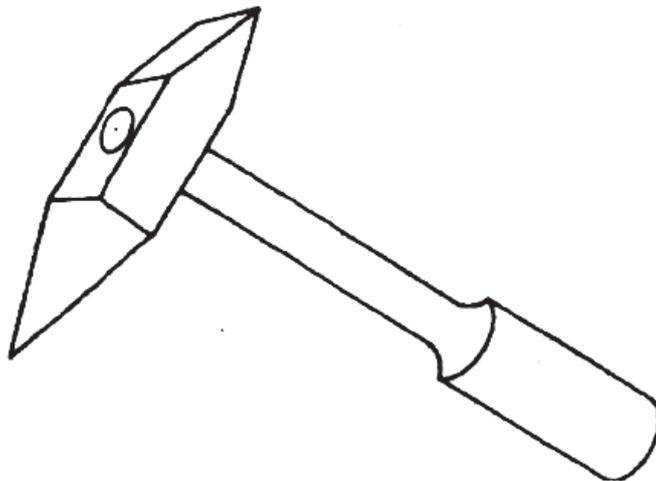
Electrode:

Welding electrodes are used for providing extra metal to the weld. This extra metal is obtained by melting the end of this rod. The size of electrode depends upon the core wire diameter of it, various sizes of electrode and their melting or welding ampere is shown below.

Electrode Holder



Chipping Hammer



| Size of electrode | Welding ampere |
|--------------------------|-----------------------|
| 1.6 mm | 25 Amp - 40 Amp |
| 2 mm | 40 Amp - 60 Amp |
| 2.5mm | 60 Amp - 90 Amp |
| 3.15mm | 90 Amp - 130 Amp |
| 4mm | 130 Amp – 180 Amp |
| 5mm | 180 Amp – 220 Amp |
| 6mm | 220 Amp – 280 Amp |

Electrode holder: Electrode holder is used to hold the electrodes when welding operation is one.

Cable: It is used to connect the electric system

Chipping hammer: It is used to remove slag from welded material.

Earth clamp: It used to connect the electric system on the work.

Wire brush: It used to clean the work

Face shield: It used to protect the light and heat when welding is done.

Tongs: It is used to pick the work in hot stage

Apron: It is used to protect the body from welding rays and heat. Apron is made by leather or asbestos

Electric Arc:

An electric arc is nothing but more continuous spark between two terminals is called arc.

Arc Length:

The distance between the tip of the electrode and surface of base metal is called arc length. It may be classified in to three, they are:

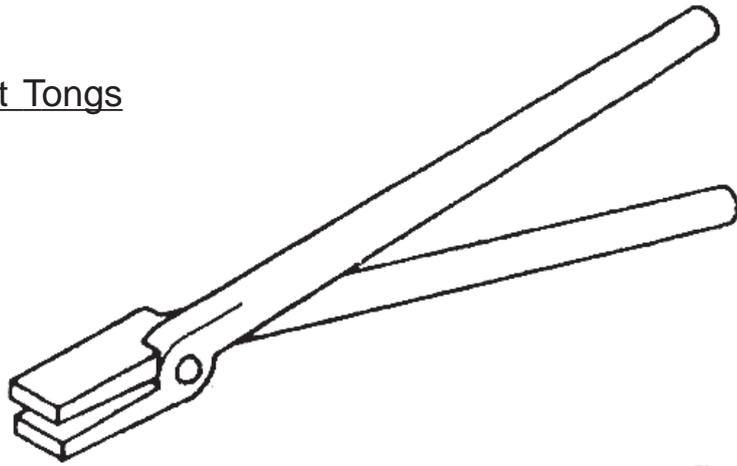
1. Long Arc

The distance between the tip of electrode and surface of base metal is greater than the diameter of core wire of electrode.

2. Short Arc

The length of the arc is less than the diameter of core wire of electrode.

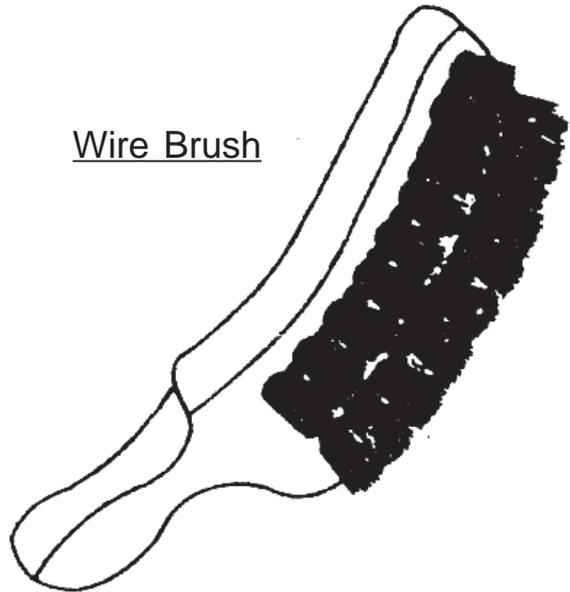
Flat Tongs



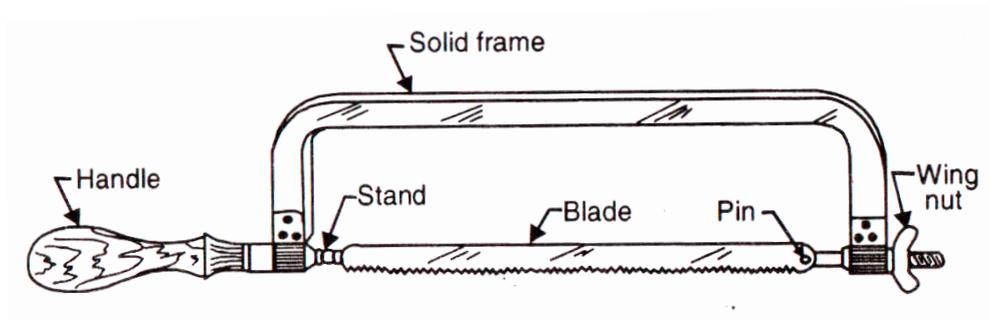
Ball Peen Hammer



Wire Brush



Hacksaw with Blade



3. Medium Arc

The length of the arc is equalant to the diameter of the core wire of electrode.
Ordinary working in down hand position we keep normal arc.

COMPARISON BETWEEN AC AND DC ARC WELDING MACHINES

| AC Arc welding Machine | DC Arc welding Machine |
|--|---|
| AC welding plant has no rotating parts | DC welding plant has rotating parts like motor and generator |
| Maintenance cost of the transformer is low | Maintenance cost of DC plant is high The initial cost of Dc welding set is high |
| The transformer initial cost is low Distribution of heat is equal and there is no change in polarity. | Heat distribution is different in both poles , 2/3 of the heat obtained positive pole and 1/3 at negative pole |
| The problem of arc blow does not arise as it is very easy to controlling AC welding. | The problem of arc blow is ever and easily control. |
| All type of electrode can't be used in AC: only coated electrode can be used effectively. | Bare and coated electrode can be used in DC welding generator. |
| Usually ferrous metals are welded by AC and non ferrous can't be welded. | All types of metals can be welded by DC welding generator. |

WELDING POSITIONS

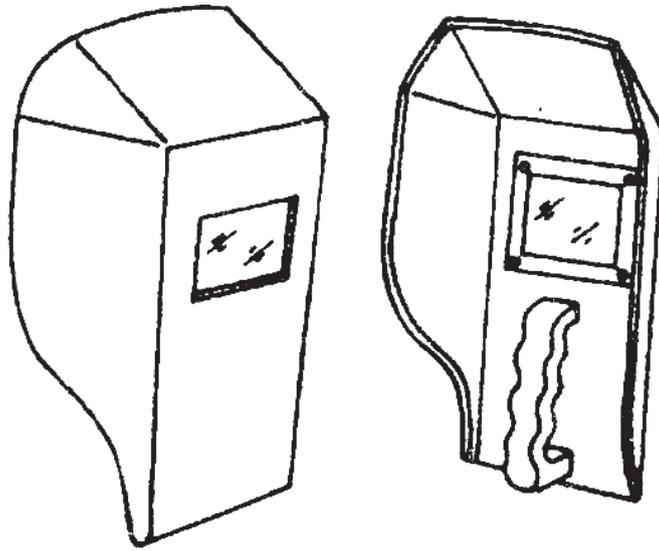
FLAT POSITION

In this position the filler metal is deposited from the upper side of the joint with the face of weld.

HORIZONTAL POSITION

In this position the filler metal is deposited upon the side of a horizontal and against a vertical surface.

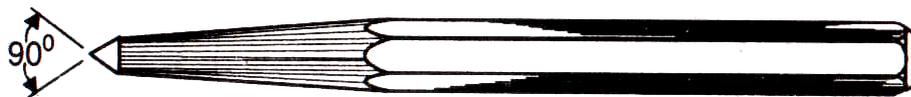
Face Shield



Scriber



Centre Punch



VERTICAL POSITION

In this position the line of weld is in a vertical plane and the weld is deposited on vertical surface.

OVER HEAD POSITION

In this position the weld is deposited from the underside of the joint and the face of the weld is in horizontal.

MELTING POINT OF VARIOUS METALS.

| Metals | Melting points in O°C |
|-------------------|-----------------------|
| Iron | 1535 |
| High Carbon steel | 1500 |
| Low Carbon Steel | 1350 |
| Gray iron | 1200 |
| Copper | 1083 |
| Brass | 900 |
| Aluminium | 657 |
| Zinc | 419 |

POLARITY

Polarity is the direction in which the current flows when using direct current.

Straight Polarity

When the electrode is connected with negative pole of D.C welding plant is called straight polarity

Reverse Polarity

When an electrode is connected with positive pole of D.C. generator is called reverse polarity.

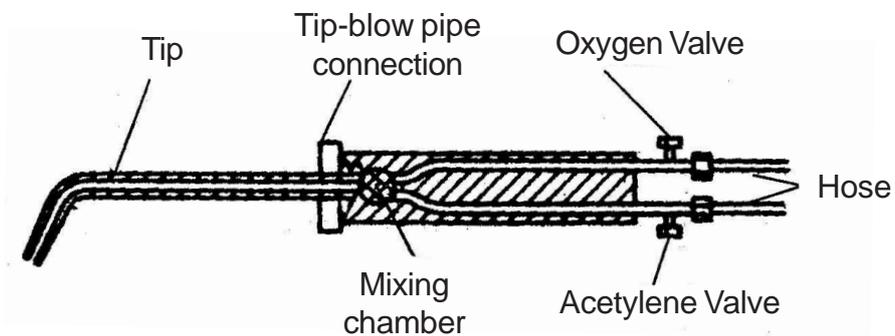
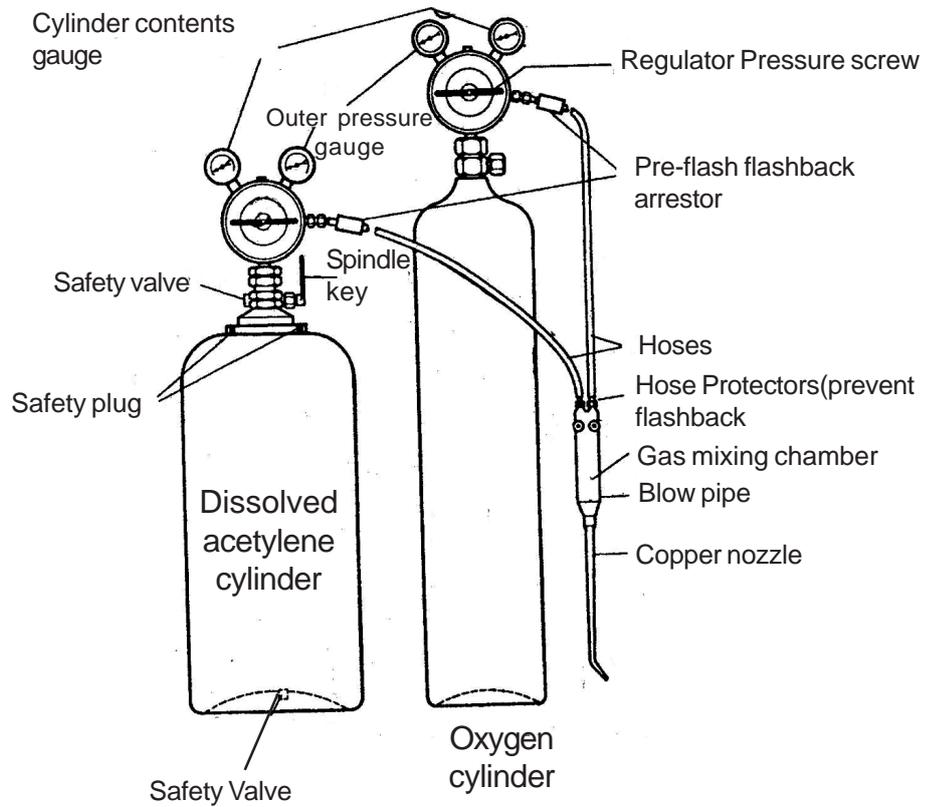
DISTORSION

To metals the uneven expansion or contraction while welding is called distortion.

There are three types of distortion.

1. Angular distortion
2. Longitudinal distortion.
3. Transverse distortion.

Oxy-Acetylene Welding System



Welding torch (Blow pipe)

JOINT DESIGN

The basic types of joints used in

1. Butt joint
2. Lap Joint
3. Edge joint
4. T-fillet joint
5. Corner joint

OXY ACETYLENE GAS WELDING PROCESS

Gas welding is a group of welding process where in heat is produced by heating with a gas flame or flames with or without the application of pressure and with or without the application of pressure and with or without the use of filler material.

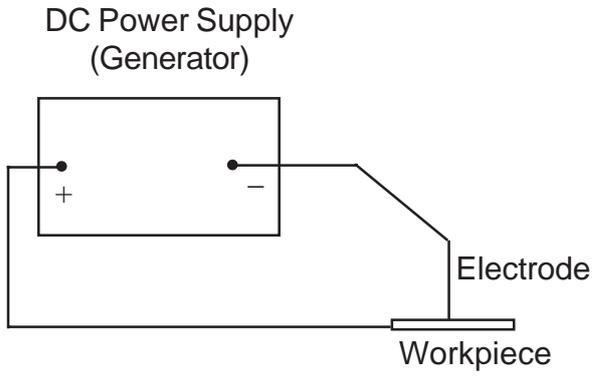
OXY ACETYLENE GAS WELDING EQUIPMENT

1. One cylinder of oxygen gas (O_2)
2. One cylinder of acetylene gas (C_2H_2)
3. One Oxygen regulator
4. One Acetylene regulator.
5. One Oxygen rubber hose.
6. One Acetylene rubber hose.
7. One welding torch with tip.
8. One pair of welding goggles.
9. One cylinder key
10. One spark lighter.

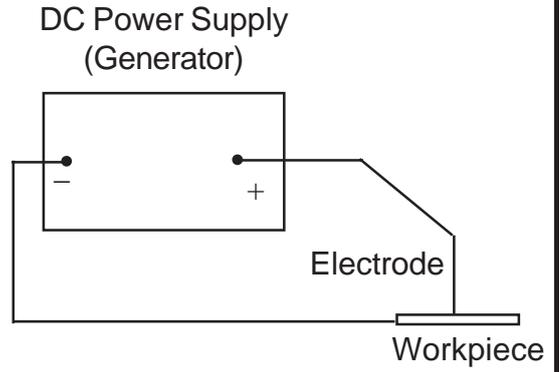
COMMON GAS USED IN WELDING.

1. Oxe Acetylene :- Its temperature is $3100^{\circ}C$ to $3300^{\circ}C$
2. Oxy-coal gas : - Its temperature is $2200^{\circ}C$
3. Oxy-propane:- Its temperature is $2480^{\circ}C$.
4. Natyral gas with Oxygen :- Its temperature is $2800^{\circ}C$ to $3000^{\circ}C$
5. Oxy-butane :- Its temperature is $2800^{\circ}C$ to $3000^{\circ}C$
6. Oxy hydrogen :- Its temperature is $2800^{\circ}C$ and used for under water cutting and lights alloy welding.

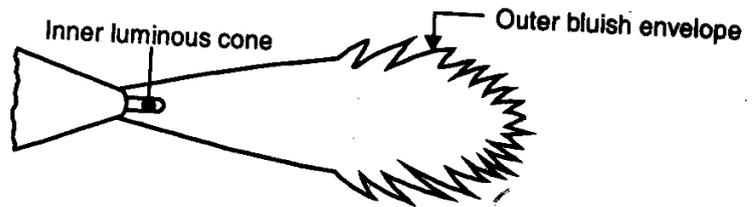
Straight Polarity



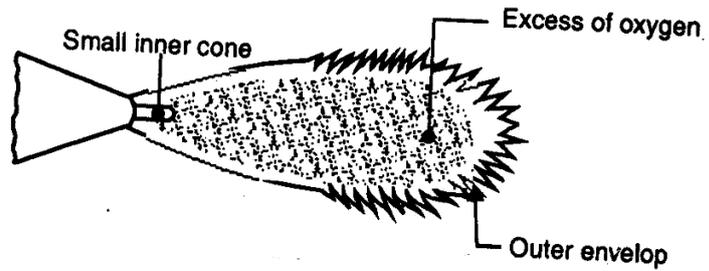
Reverse Polarity



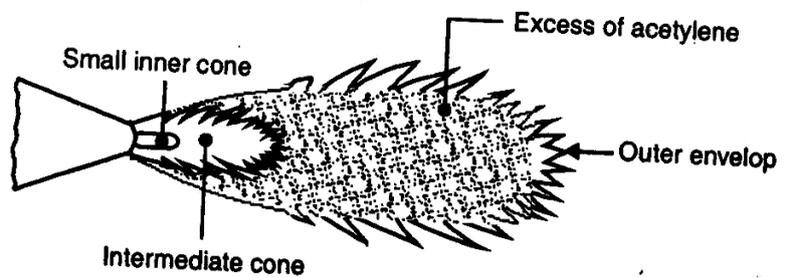
Neutral Flame



Oxidising Flame



Reducing or
Carburising Flame



TYPES OF FLAME

There are three types of oxy acetylene flames. They are Neutral flame, Carburising flame and oxydising flame.

Neutral Flame.

In this flame, the ratio of oxygen and acetylene are equal in volume. Its temperature is 3200 to 3300°C

Carburising flame

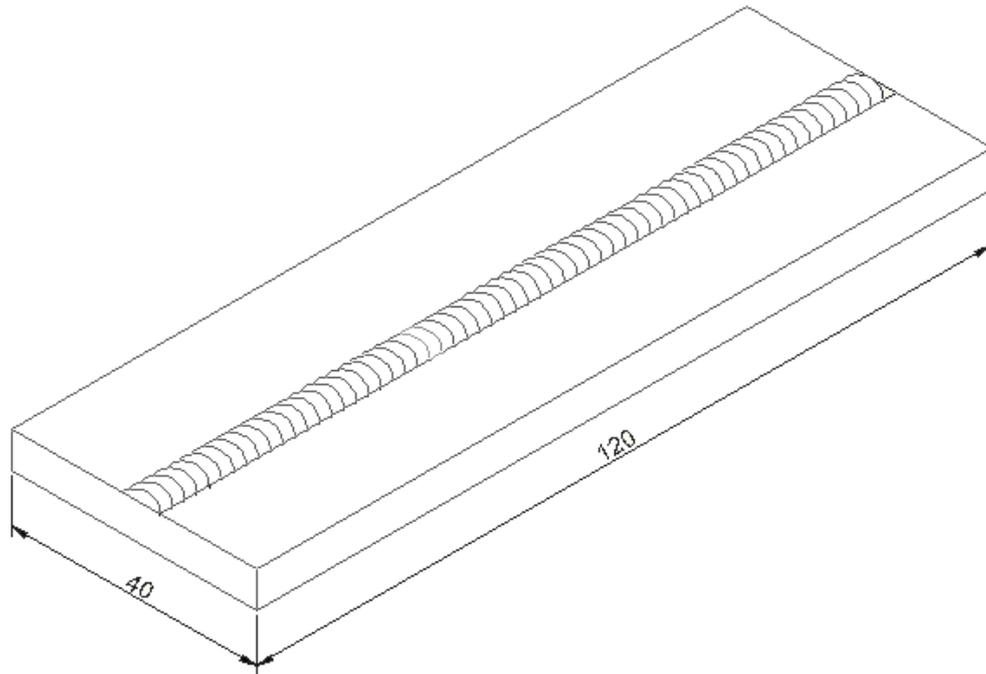
In this flame the ratio of acetylene gas is greater, then the ratio of oxygen gas. The flame temperature is 3100°C

Oxydising flame

In this flame the ratio of oxygen gas is greater than the volume of acetylene gas. The flame temperature is upto 3000°C

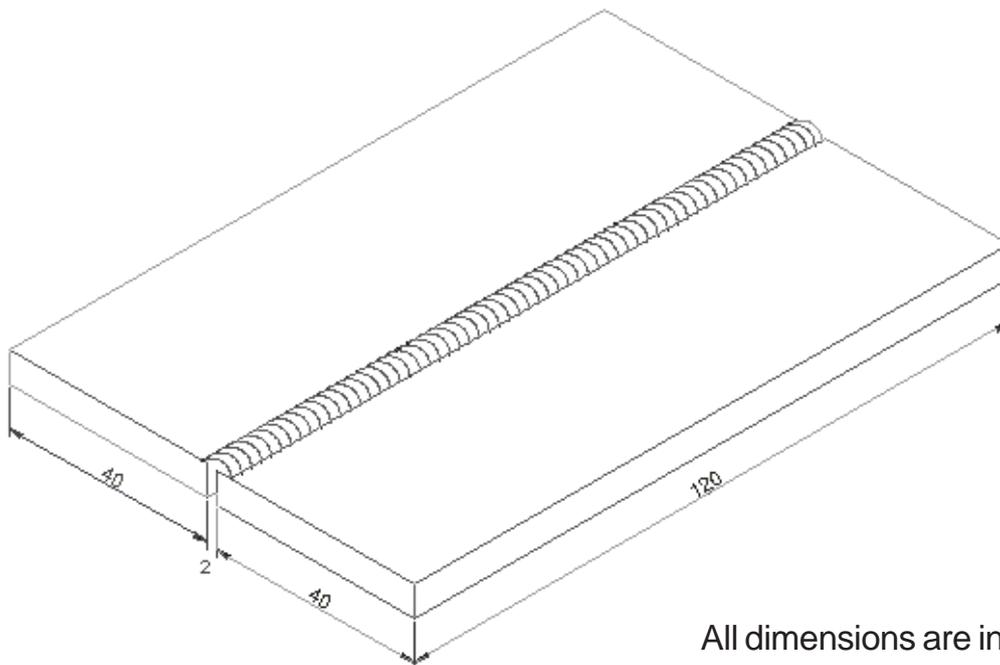


STRAIGHT LINE WELDING



All dimensions are in 'mm'

BUTT JOINT



All dimensions are in 'mm'

MODELS FOR PRACTICE

Ex.No. 1

Date

Straight line Joint

Aim :

Material required :

Tools Required :

Procedure :

Ex.No. 2

Date

Butt Joint

Aim :

Material required :

Tools Required :

Procedure :