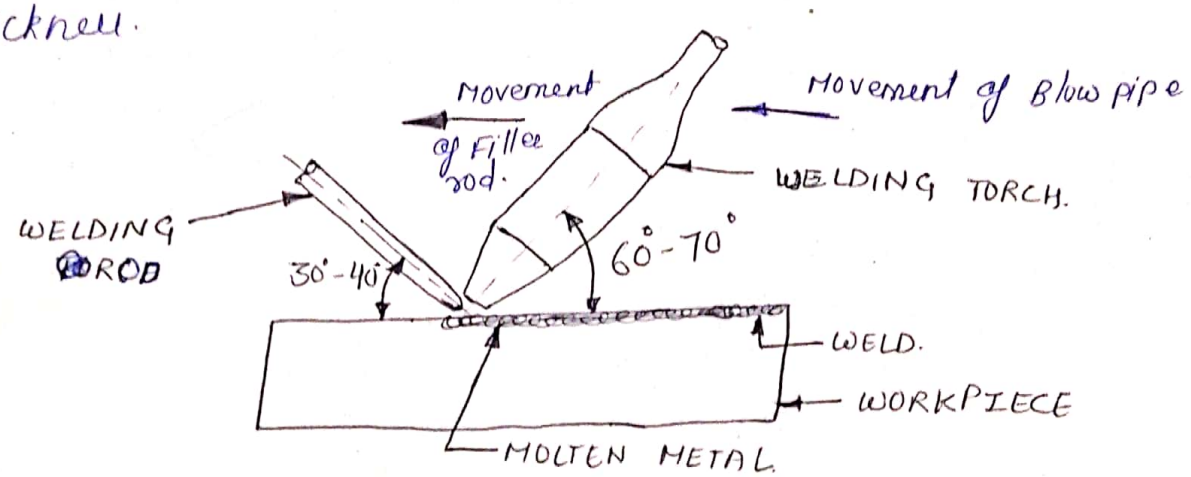
WELDING TECHNIQUES:-

The commonly used welding techniques are:-

1. Leftward or Forehand welding.
2. Rightward or Backward welding
3. Vertical welding.

Leftward or Forehand welding :- (forward welding)

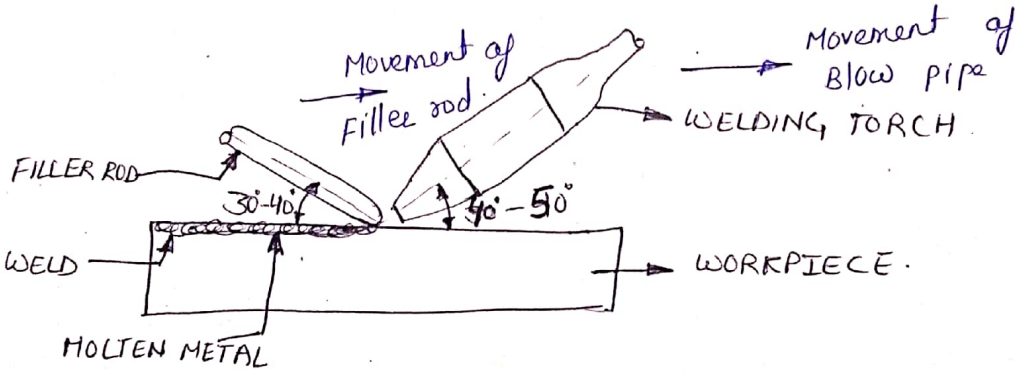
It is also known as forehand welding the weld is made working from right to left. In this process the torch is held in the right hand at an angle 60-70° and the welding rod in the left hand at an angle 30° to 40° from the workpiece. The flame is given circular, rotational or side to side motion to obtain uniform fusion theory. act. this method is more efficient for welding materials upto 6mm thickness.



LEFTWARD OR FOREHEAD WELDING.

RIGHTWARD WELDING :-

Rightward or backward welding is carried out from left to right. It has no lateral movement. In this process, the torch is held in the right hand at an angle of 40° to 50° and the filler rod in the left hand at an angle of 30° to 40°. the cone of the flame in rightward welding is deeper than the flame in leftward welding. this process is more suitable for welding plates above 6mm thickness. This method is very widely used for welding in steel plates.



RIGHTWARD OR BACKWARD WELDING

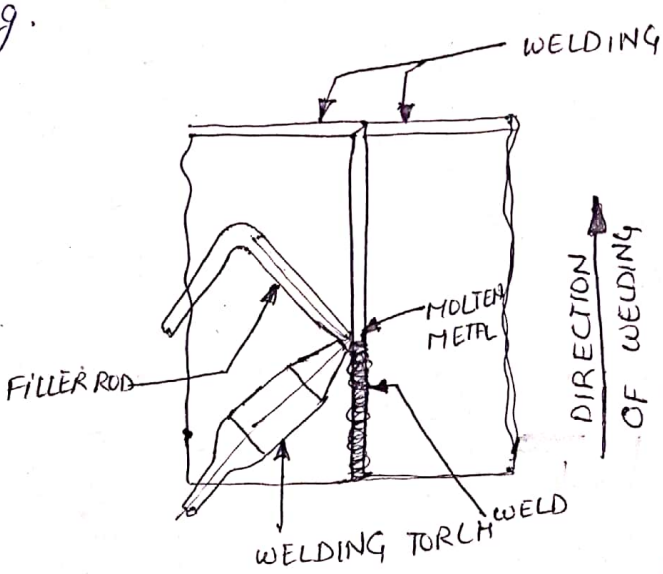
Advantages of Rightward Welding over leftward welding :-

1. The consumption of filler rod is less.
2. It is a quicker method.
3. The weld thus produced is stronger and tougher.
4. Expansion and contraction of material is lesser.
5. the molten pool is better visible thus it gives a better control on weld.
6. Less consumption of gas.

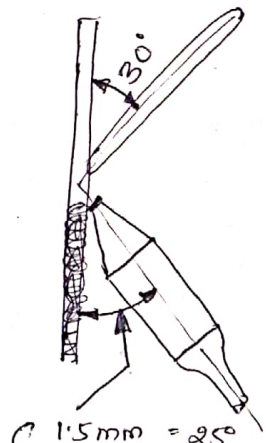
VERTICAL WELDING:-

This process is used when Plates are lying in the vertical position. In this process welding starts at the bottom of the plates and proceeds upwards. The welding Torch is held in the right hand and filler rod in the left hand. the filler rod moves ahead of the blowpipe. this process is useful and economical for welding plates upto 6mm thickness specially the tanks.

It does not require plate edge preparation even for thickness upto about 15mm. & the amount of filler rod material is smaller than with horizontal welding.



VERTICAL WELDING



1.5mm = 25°
3.2mm = 50°
5mm = 90°

Plate thickness — inclination of blow piper

Flux:-

when metals are heated, the oxygen from air combines with them and form oxides. these oxides Produce poor quality and low strength welds. In some cases it makes the welding impossible. thus in order to prevent oxidation and other unwanted chemical reactions during welding, fluxes are used. They are capable of dissolving oxides and make the welding process easier.

Requirements of good flux materials are:-

1. A flux should have a lower melting point than the base metal.
2. It must not cause any corrosive action on the finished weld.
3. It must make the welding process easier and serve to release trapped gases and form slag to remove impurities like sand, scale and dirt.
4. The molten flux should easily spread over the area next to welding spot so that it may clean the surface ahead.
5. It must be capable of forming a protective glaze on the weld and surround surfaces.

The fluxes ultimately provides a reliable joint b/w the parent and filler metals. In case of Carbon steels, Calcium oxide dissolved in liquid is commonly used for gas welding. In case of welding Copper and Copper base alloys, boric acid ($H_3B_3O_3$), Borax ($N_2B_4O_7$) Di sodium Hydrogen phosphate (Na_2HPO_4) etc are used. For welding aluminium and its alloys, sodium chloride is commonly used. For Cast iron welding, Borax and sodium carbonate are commonly used.

Functions of Flux :-

In addition to formation of a gaseous shield, the different functions of flux are :-

1) It takes away the impurities present on the surface to be weld.
2) It forms slag over the weld that reduces blow holes, porosity and chances of crack formation.
3) It enables the use of alternating current.
4) It prevents overheating of the electrode.
5) It provides strength and flexibility to the coating.
6) It increases the rate of melting and therefore welding operation can be performed faster.
7) It increases the fluidity.
8) Many fluxes contain stabilising materials like titanium oxides and potassium compounds that help in maintaining the arc.
9) It gives easy striking to the arc.
10) It reduces or prevent undercutting.

Electrode :—

A material in the form of wire or rod through which current is conducted b/w the Electrode holder and the arc. Electrode, the filler rod can be classified into two categories :-

(i) **Non Consumable Electrodes :—**

These are made of Carbon, graphite or tungsten which do not consume during welding proces.

(ii) **Consumable Electrodes :—**

These are made of different metals depending on the chemical composition of metal to be welded. These Electrodes are of two types :—

(a) **Plain or Bare Electrodes :—**

These are made of various metals and alloys which do not have any coating of flux. The globules of metal pass from the Electrode to work, they are exposed to atmospheric air. This causes the formation of some non-metallic Constituents which are trapped in the rapidly solidifying weld metal and thereby decrease the strength and ductility of the metal.

(b) **Coated Electrodes :—** when the core of the bare metallic wire is provided with a covering or coating of some flexing material, It is known as coated Electrode

These electrodes form a molten pool in the joint area which must be protected from being oxidised. On solidification, the presence of these oxides makes the joint weaker and less efficient. thus rapid loss of heat is also prevented.

WELDED JOINT :-

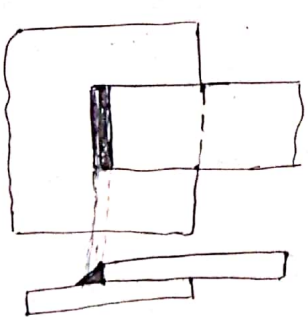
The relative positions of the two pieces being joined determine the type of joint. the following are the five basic types of joints commonly used in fusion welding.

(1) Lap JOINT :-

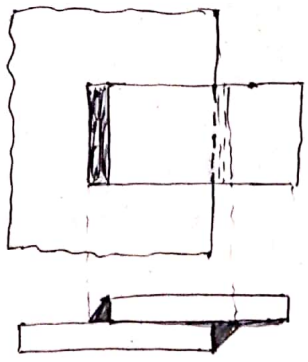
The lap joint is obtained by over lapping the plates and then welding the edges of the plates. these joints are employed on plates having thickness less than 3mm.

the lap joints are :-

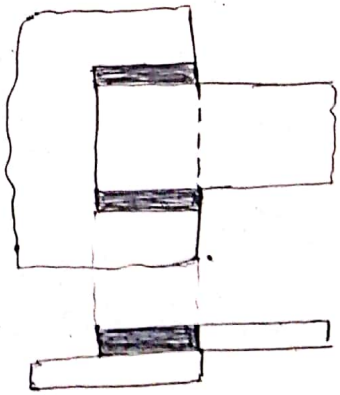
(a) Single transverse
(b) Double Transverse.
(c) Parallel Lap joint.



Single Transverse.



Double Transverse



Parallel

A single transverse lap joint has the disadvantage that the edge of the plate which is not welded can buckle or warp out of shape.

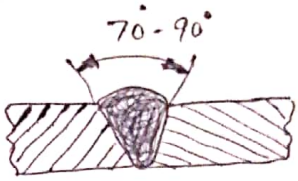
2. BUTT JOINT :-

The butt joint is obtained by welding the ends or edges of the two plates which are approximately in the same plane with each other. In butt welds, the plate edges do not require bevelling if the thickness of plate is less than 5mm. On the other hand, if the plate thickness is 5mm to 12.5 mm, the edges should be bevelled to V or U groove and plate having thickness above 12.5 mm should have a U or V groove on both sides. Various types of butt joints are :-

(a)

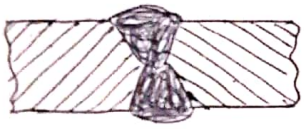
SQUARE

(b)



single V

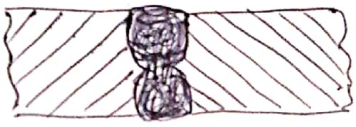
(c)



DOUBLE V

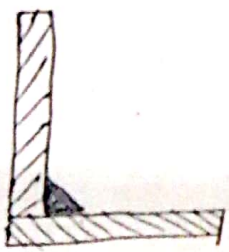
(d)

SINGLE U



DOUBLE U

3 CORNER JOINT :-

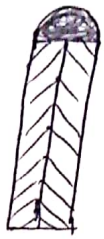


Corner joint

The corner joint is obtained by joining the edges of two plates whose surfaces are at an angle of approximately 90° to each other. It is used for both light and heavy gauge sheet metal.

4. EDGE JOINT :-

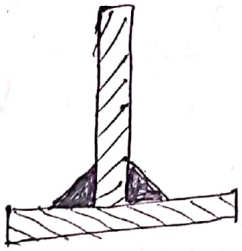
The Edge joint is obtained by joining two parallel plates. It is economical for plates having thickness less than 6mm.



EDGE JOINT

5. T- JOINT :-

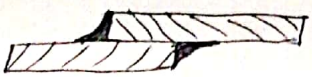
T- Joint is obtained by joining two plates whose surfaces are approximately at right angles to each other. It is widely used to weld stiffeners in air craft and other thin walled structures. these joints are suitable upto 3mm thickness.



T- JOINT

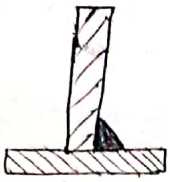
FILLET WELDED JOINTS :-

Lap joints, Corner joints and T- joints are the filleted welded connections which are generally used. The rounding of a corner is known as filleting. The Cross- section of the fillet is approximately triangular. Flush fillet, Convex fillet and Concave fillet are the three types of fillet welds.



Flush fillet

Convex fillet



concave fillet

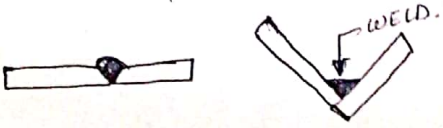
EDGE PREPARATION :-

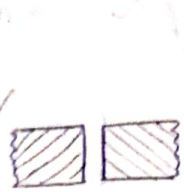
It is a prepared contour on the edge of the workpiece to be joined. the edge preparation is very essential in order to obtain sound welded joints It consists of bevelling the edges and carefully cleaning the faces to be welded from dust, sand grit and oil etc. the edge preparation used in fusion welding for various types of butt welded joints.

1. The square butt welded joints are used when the thickness of the plates is from 3 mm to 5 mm. It does not require bevelling of the edges. the edges should be space 3mm apart.
2. The single V butt welded joints are used when the thickness of the plates is between 8mm to 16mm. the edges of the plates are bevelled to form and include angle of about 70° to 90° depending upon the method to be used.
3. The double-V butt welded joints are used when the thickness of the plates is more than 16 mm and where welding can be performed on both sides of the plate. the both edges of each plate are bevelled to form a double V.

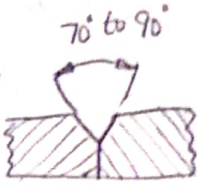
WELDING POSITIONS :- the welding positions are :-

1. Flat Position :- In this position, the filler metal is deposited from the upper side of the joint with the face of the weld horizontal.

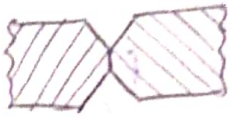




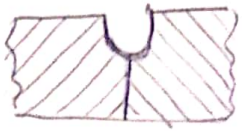
(a) square



(b) single V



(c) Double V



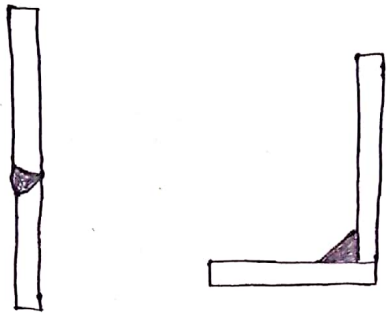
(d) Single U

Double U

4) The single and double U butt welded joints are used when the thickness of the plate is more than 20mm. These joints are more satisfactory and require less filler rod.

2. HORIZONTAL POSITION :—

In this position, the weld is deposited upon the side of a horizonal and against a vertical surface.



Horizontal position

3. VERTICAL POSITION :—

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

Vertical position.

4. Overhead position :—

In this position, the weld is deposited from the under side of the joint and the face of the weld is horizontal.

OVERHEAD POSITION