SOLDERING

Soldering is defined as the joining process in which joint is made by using filler metal having melting point not more than 400°C. The filler metal used is called solder. It also requires an appropriate flux which is applied at the surfaces to be joined and on the solder & iron. The purpose of applying flux is to prevent the oxidation of metal to be soldered.

Flux may be organic or inorganic substance. The common examples of flux are zinc chloride, Ammonium chloride and muriatic acid. Flux should have some characteristics such as it should melt at soldering temperature and it should be light in weight so that it can be displaced by molten solder material easily.

Solder i.e filler metal is the alloy of metal having low melting point. The most popular solder metals are alloy of tin and lead, silver and antimony, lead and silver and tin and silver. solder is called soft solder if its melting point is comparatively much lower than the metal to be soldered and the process is then called hard soldering.

Procedure of soldering:-

The procedure of soldering is as follows:-

1) The parts to be joined are throughly cleaned by filing, scraping, Etc cleaning is necessary to get a good strong soldered joint.

2) The pieces of the metal to be joined are heated to the required temperature.

3) Applying the flux, usually zinc chloride or other commercial flux in the form of paste.
4) The pieces are then levelled with the end of the solder stick or wire kept in contact with the fluxed surface.
5) Heating the soldering iron bit either electrically or by means of stove.
6) picking up the required quantity of solder and spreading over the surface and gap to be soldered.
7) Applying the flux over the electrically heated soldering iron. the joints are thoroughly cleaned and soldering is carried out with the soldering iron.

ADVANTAGES :-

(1) Soldering is widely used in Electronic applications because a suitable soldering provides electrically conductive strong joint.
2) Soldering can be used to join various metals and of varying thickness.
3) Automated equipments used in soldering give high rate of production.
4) Both similar and dissimilar material can be joined.

Disadvantages :-

(1) Mechanical strength of soldered joint is very low so it cannot be used to carry load.
2) It can not withstand heat due to low melting point of solder.
3) Not suitable for joining parts which require much strength or the parts that are subjected to vibration or heat.

4) Aluminium and stainless steels are difficult to solder because of the strong, thin-oxide film (after cafter cleaning).

5) Butt joint cannot be made because of small facing surfaces.

5)

Applications :—

(1) Electrical components in televisions, Radio, transistor and tape recorder.

2) Electronic components like printed circuit boards.

3) Automobiles parts like radiators and coating and joining the metal etc.

4) Used for joining wires and small parts.

5) Sheet metal work for joining parts that are not subjected to heavy loads and high temperatures.

BRAZING

Brazing is also a process of joining of metal by using filler metal and filling it to the joint like soldering. It is different from soldering in the sense that the filler metal is harder and has high melting point than solder. the melting point of the filler metal used in brazing is higher than that of solder but lower than that of the metal to be joined. It is called spelter. As the brazed joint is formed by solidification of molten filler metal in the very narrow clearance between the Parts to be joined, due to metallurgical bonding and geometric conditions of joint it becomes stronger than the filler metal.

PROCEDURE :-

Brazing is done like soldering :-

First of all, surface of the parts are made throughly clean and free from oxides, oil and dust. In brazing the bond is formed by wetting the metal surface, with molten filler metal, by capillary action which can happen only when the surfaces are perfectly clear. The gap between the parts is adjusted to a narrow limit and flux is applied to them. Metal pieces to be brazed are heated to a temperature above the melting Point of spelter and molten spelter is filled into the gap to be joined and allowed to solidify slowly.

The clearance between the metal pieces to be brazed or width of joint plays important role in making a strong joint and so a good quality joint. A clearance of 0.02 mm. to 0.2 mm gives good result.

Selection of spelter depends on the base metal combination to be brazed. A spelter metal must have characteristics like melting point lower than base metal, lower than base metal, low surface tension in molten state, high fluidity, non-oxidizing tendency at high temperature and chemical inactivity to base metal. Common examples of spelter are alloy of Aluminium and silicon, Copper and zinc, Nickel and silver etc.

Common examples of flux used in brazing Borax are borax, borate, chlorides and Fluorides. Main function of flux are improving wetting action of spelter, protecting formation of metal oxide, low melting point and viscosity so that it can be easily displaced by the spelter from the joints. Flux comes at the top of the joint after solidification of molten spelter and can be wiped off easily.

ADVANTAGES:— ① Brazing can be used to join pieces of any metal and also dissimilar metals.

② Both type of joints, lap joint and butt joint can be made.

Limitations:— Brazing produces weaker joint than welding.

(ii) the joint can not be used in heat effected zone.

(iii) Colour of joint may be different from the colour of base metal.

Applications:— It is used to join tubes, pipes, wires, cables, tool bits of cutting tool, jewellery and in maintenance of low lead bearing structures.

Advantages of Brazing

- Due to the higher melting point of the brazing filler metal, the joint is more stronger than produced by soldering.
- Similar and dissimilar metals can be joined. Difficult-to-weld metals are easily brazed.
- Any thinner sections or complex assemblies can be easily joined.
- Due to low temperature applications as compared to other welding processes heat-affected zones, warping or distortion are minimum.
- The process is quick and economical, and can be easily automated.
- When made properly the strength of the joint may exceed even the strength of the base metal.

Disadvantages of Brazing : (i) It requires tightly mating parts.

(ii) It requires proper cleaning.

(iii) Size of the jobs are limited.

(iv) Joints are not successful at elevated temperatures.

(v) Colour of the filler metal may not match with that of the base metal.

Applications of Brazing : (i) Brazing is used for fastening of pipe fittings, tanks, radiators, heat exchangers, electrical parts etc.

(ii) It can join cast metals to wrought metals, dissimilar metals and also porous metal components.

Comparision of Welding, Soldering and Brazing process

Welding	Soldering	Brazing
1. It is a type of fusion welding used to join metal. It may also be non fusion type.	1. It is a type of fusion welding used to join metals.	1. It is a type of fusion welding used to join metals.
2. It produce stronger joint than soldering and brazing.	2. The joint made is weaker than made by brazing and welding.	2. The joint made is weaker than the welding but stronger than soldering.
3. Filler metal used has a very high melting point.	3. Filler metal used in called solder and have lowest melting point.	3. Filler metal used is called spelter and have melting point more than solder but less than filler metal used in welding.
4. Joint is formed by filling the gap with melton filler metal and then by solidifying it. Some of bare metal also melt and mixed with filler metal.	4. The joint is formed by applying melton solder at the interface of pieces to be joined and allow it solidifies.	4. The joint is made by welding the surfaces to be joined with spelter. Wetting takes place due to capillary action of melton spelter.
5. It is widely used in making steel structure and also have numerous applications.	5. It has limited applications mainly used in making electrical contacts of wires.	5. It has more applications than soldering.

Difference between TIG & MIG Welding :

	TIG welding	MIG welding
1.	Uses the gases for shielding.	Uses the gases for shielding.
2.	Non-consumable electrodes of tungsten are used.	Consumable electrode wires are used.
3.	Electrodes are made of tungsten or tungsten alloys.	Base welding rod is made of desired composition.
4.	Electrodes only generate an arc and do not melt.	Electrodes generate an arc and also melt.
5.	Easier for thin plates and small parts.	Widely used for thick plates (above 4 mm).
6.	Welding torch is air or water cooled.	Welding torch is water cooled.
7.	Used for joining dissimilar metals.	Used for joining similar metals.

Difference between Gas & Arc Welding :

	Gas welding	Arc welding
1.	The heat of welding is obtained by the combustion of fuel gas.	The welding heat is obtained from an electric arc between electrode and work.
2.	The highest flame temperature that can be reached is 3200°C.	The temperature produced by an electric arc is about 5500°C.
3.	Gas welding is classified into three types : oxy-acetylene, oxy-hydrogen and air- acetylene welding.	Arc welding is of six types : carbon, metal, submerged, inert gas arc welding, atomic hydrogen welding and stud welding.
4.	Heat transfer is slow, hence the welding speed is low.	Welding speed is better than that of gas welding.
5.	There is a possibility of explosion if the equipments are not properly handled.	Arc welding is safer than the gas welding.

Difference between AC and DC Welding (Arc) :

A.C. arc welding	D.C arc welding
1. Transformer is power source.	1. Motor generator or AC, DC rectifier set
2. AC across the arc.	2. DC across the arc
3. Uniform heat distribution across the arc.	3. Heat distribution 2/3 at positive pole and $\frac{1}{3}$ at negative pole.
4. The arc is unstable.	4. Arc is quite stable.
5. Output depends on voltage supplied.	5. Not affected by normal neutron in power supply.
6. Cheap in cost.	6. Costly.
7. No moving parts in transformer.	7. Number of moving parts are needed to convert AC to DC.
8. Not suitable for light coated electrodes and for light sheet gauge work.	8. Suitable for all types of work and uses all types of electrodes.
9. Only ferrous metals can be welded as polarity does not exist.	9. By changing the polarity both ferrous and non-ferrous metals can be welded.