

## 26.1 BRAZING

Brazing is a process of joining two pieces of metals in which a non-ferrous alloy is introduced in a liquid state between the workpieces to be joined and allowed to solidify. The melting point of the filler metal is above  $450^{\circ}\text{C}$  but lower than the melting temperature of the parent metal.

The filler metal is distributed between the closely fitted surfaces of the joint by capillary action.

Fluxes are also added into the brazed joint to remove any of the oxide present or prevent the formation of oxide. The capillary attraction between the base metal and the filler material is higher than that between the base metal and the flux. So the filler material easily replaces the flux. The method of application of the flux is by spraying, brushing or with the help of a pressurized application.

The fluxes generally used are combinations of borax, boric acid, chlorides, fluorides and other wetting agents.

### 26.1.1 Brazing Equipment

The brazing equipment mainly comprises of a blow pipe and brazing hearth. The heat for brazing is obtained by the following means :

1. Coal gas and a mouth blow pipe for very small work using fine work.
2. Coal gas and compressed air using the normal blow pipe.
3. Oxy-acetylene torch.
4. Oxy-hydrogen torch.
5. Electrical resistance as on a spot welder.
6. Coal gas and oxygen.



### **26.1.2 Brazing Procedure**

1. Clean and Prepare the surface to be brazed. Cleaning may be done by solvents, acid pickling and by mechanical means. It is also essential that the joint is designed properly and clearance between the workparts should be controlled critically.
2. Fluxing both the base metal and filler metal surface by spraying, brushing or by mechanical means.
3. Aligning the base metal parts to be joined.
4. Heating the joint. Heat sources that are used for brazing are : a molten bath of brazing filler metal, oxy-acetylene torch, electrical resistance heating or induction heating.
5. Applying filler metal to the joint.
6. Allow cooling of the brazed joint.
7. Remove flux residue from the completed joint.

### **26.1.3 Filler Metals**

- ❖ Aluminium silicon
- ❖ Copper phosphorus
- ❖ Copper zinc
- ❖ Silver brazing
- ❖ Magnesium
- ❖ Nickel etc.

### **26.1.4 Advantages of Brazing**

- ❖ Distortion is less in brazed joints because of lower temperatures used.
- ❖ The joint can be quickly finished without much skill.
- ❖ Brazing can join cast metals to wrought metals.
- ❖ Sheet metal assemblies can be joined.
- ❖ Brazing has the ability to preserve metal coating.

### **26.1.5 Disadvantages of Brazing**

- ❖ It requires tightly mating parts.
- ❖ It requires proper cleaning.
- ❖ Size of the jobs are limited.
- ❖ Joints are not successful at elevated temperatures.
- ❖ Colour of the filler metal may not match with that of the base metal.

### **26.1.6 Applications of Brazing**

- ❖ Brazing is used for fastening of pipe fittings, tanks, carbide tips on tools, radiators, heat exchangers, electrical parts etc.
- ❖ It can join cast metals to wrought metals, dissimilar metals and also porous metal components.
- ❖ Used to join Band saws, parts of bicycle such as frame and rims.



## 26.3 SOLDERING

Soldering is a process of joining two pieces of metals in which a fusible alloy or metal is introduced in a liquid state between the workpieces to be joined and allowed to solidify. The melting point of the filler metal is below  $450^{\circ}\text{C}$ . The filler metal is called the solder. Composition of some of the solders is as follows :

**Soft Solder.** Lead 37% and tin 63%.

**Medium Solder.** Lead and tin each 50%.

**Electrician Solder.** Lead 58% and tin 42%.

**Plumber's Solder.** Lead 70% and tin 30%.

Flux will be added to remove the oxides from the joint. Fluxes are normally available in the form of powder, paste, liquid or in the form of core in the solder metal. Fluxes are :

**Inorganic Fluxes.** (Corrosive fluxes)

Inorganic fluxes consist of zinc and ammonium chloride.

**Organic Fluxes.** (Mild fluxes)

The constituents of these fluxes are lactic acid, stearic acid, benzoic acid, glutamic acid etc.

**Rosin** (Non-corrosive fluxes). This consists of gum extruded from pine trees.

### 26.3.1 Soldering Procedure

1. Select the right solder, flux, joint design and clearance.
2. Clean and prepare the surfaces to be joined. Both mechanical and chemical methods are employed. Surfaces must be free from rust, grease, oil and dirt by scraping with dull knife or emery paper.
3. Aligning the components.
4. Then coat the surfaces with flux.
5. Take a blob of solder on the bit of the hot soldering Iron and allow it to run down till filling the recess of the joints for light work. For heavy work the hot iron should be held against the soldering stick and molten solder be allowed to fill the longer length of the joint.
6. Wipe off excess of solder with a piece of felt or cotton waste.
7. Wash the joint thoroughly with warm water to remove the traces of acid flux.

### 26.3.2 Soldering Methods

Various methods are used to produce the joint

- ❖ Soldering iron method
- ❖ Torch method
- ❖ Spray method
- ❖ Induction method
- ❖ Dip and wave method
- ❖ Resistance method



- ❖ Ultrasonic method
- ❖ Condensation method.

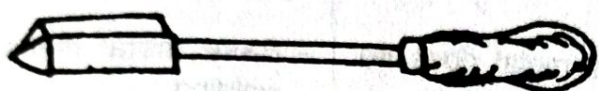
Out of the above methods, soldering Iron method is commonly used :

### Soldering Iron

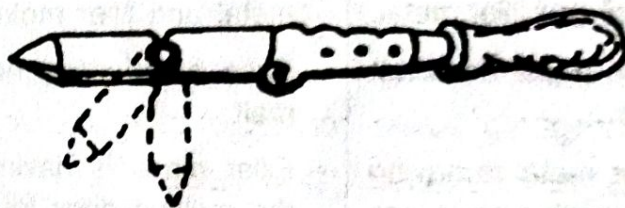
It is a tool used during a soldering operation to heat the solder and the parts to be joined. These are mainly of two types :

#### 1. Heated by either Solid or Gaseous Fuel :

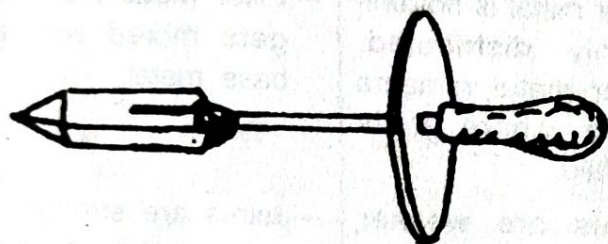
This type of soldering Iron consists of copper point or bit. The purpose of this bit is to absorb heat while in the fire or muffle and to give this out when applied to the job. The heat must be enough to melt the solder as well as heat the adjoining area. Various types of soldering bits are shown in figure below.



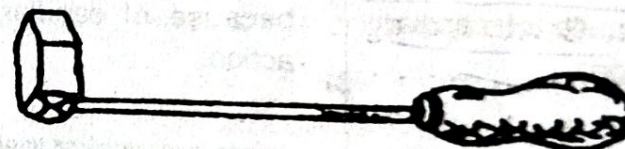
(a) Simple bit



(b) Folding bit



(c) Bit for vertical soldering



(d) Hatchet bit

**Fig. 26.1. Types of Soldering Bits.**

#### 2. Heated Electrically :

When small assemblies have to be soft soldered, an electrically heated soldering iron proves better and efficient.

### 26.3.3 Application of Soldering

The soldering in practice, is done for the following work :

1. Connections in wireless sets (radio), T.V. sets etc.
2. Wiring joints in electrical connections, battery and other terminals.
3. Radiator brass tubes for motor car.
4. Copper tabing carrying liquid fuel, gas or air used on engines.
5. Brass halved bearings are joined with solder when relined with white metal and bored on lathe.
6. It is sometimes used to repair utensils.