SRM UNIVERSITY
[Under section 3 of UGC Act 1956]

WELDING

DEPARTMENT OF MECHANICAL ENGINEERING

SUB CODE -18MES103L

SUB.NAME-BASIC CIVIL & MECHANICAL ENGINEERING WORKS

MAKE A LAP JOINT OF TWO METAL PLATES OVERLAPPING ON ONE ANOTHER PLATE USING ARC WELDING PROCESS

WELDING

- Welding is a materials joining process which produces coalescence of materials by heating them to suitable temperatures with or without the application of pressure or by the application of pressure alone, and with or without the use of filler material.

- Welding is used for making permanent joints.
- It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building.

TYPES

- **Plastic Welding or Pressure Welding**

  The piece of metal to be joined are heated to a plastic state and forced together by external pressure

  (Ex) Resistance welding

- **Fusion Welding or Non-Pressure Welding**

  The material at the joint is heated to a molten state and allowed to solidify

  (Ex) Gas welding, Arc welding

Classification of welding processes:

(i). **Arc welding**

- Carbon arc
- Metal arc
- Metal inert gas
- Tungsten inert gas
- Plasma arc
- Submerged arc
- Electro-slag

(ii). **Gas Welding**

- Oxy-acetylen
- e
- Air-acetylene
- Oxy-hydrogen

(iii). **Resistance Welding**

- Butt
- Spot
- Seam
- Projection
- Percussion

(iv)Thermit Welding

(v)Solid State Welding

Friction
Ultrasonic
Diffusion
Explosive

(vi) Newer Welding

Electron-beam
Laser

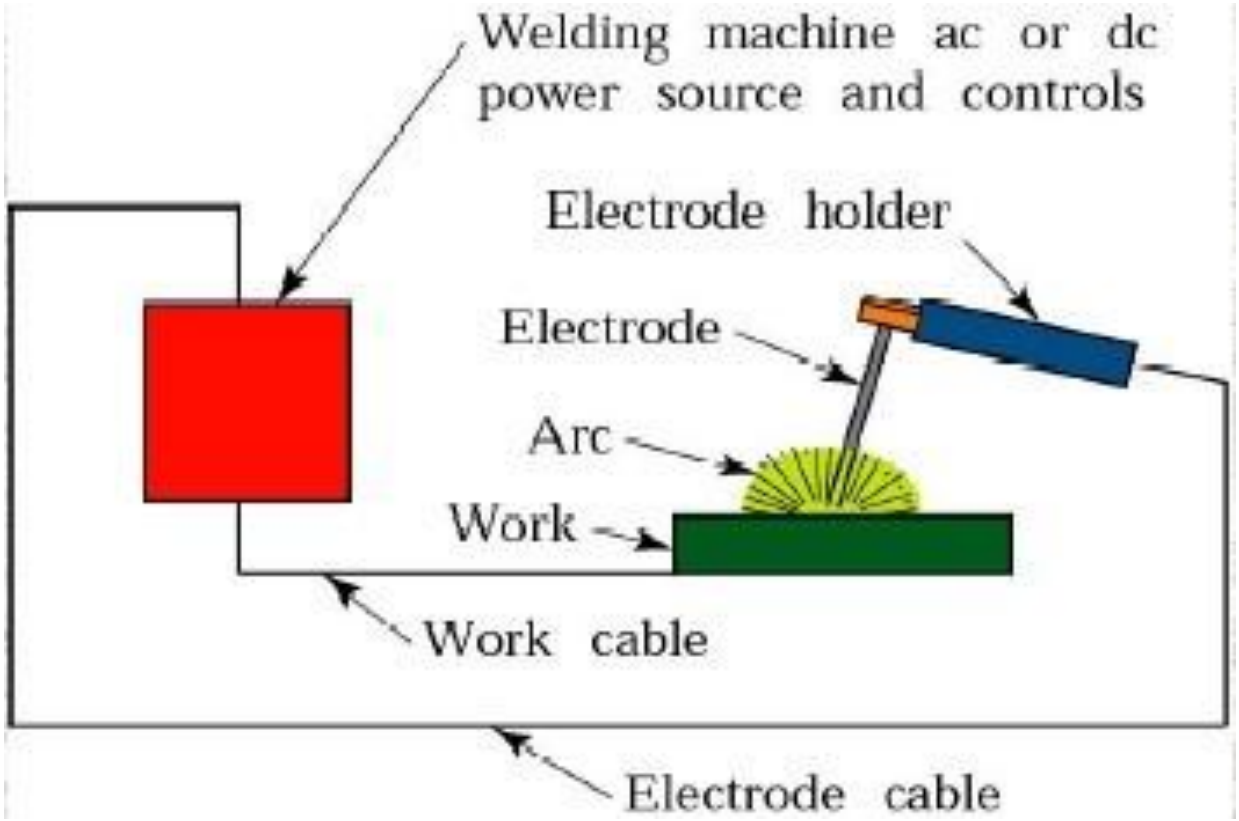
(vii) Related Process

Oxy-acetylene cutting Arc cutting
Hard facing
Brazing
Soldering

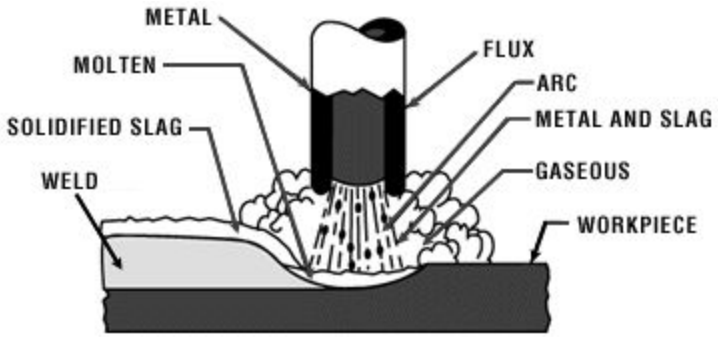
Arc welding

- **Equipments:**
- A welding generator (D.C.) or Transformer (A.C.)
- Two cables- one for work and one for electrode
- Electrode holder
- Electrode
- Protective shield
- Gloves
- Wire brush
- Chipping hammer
- Goggles

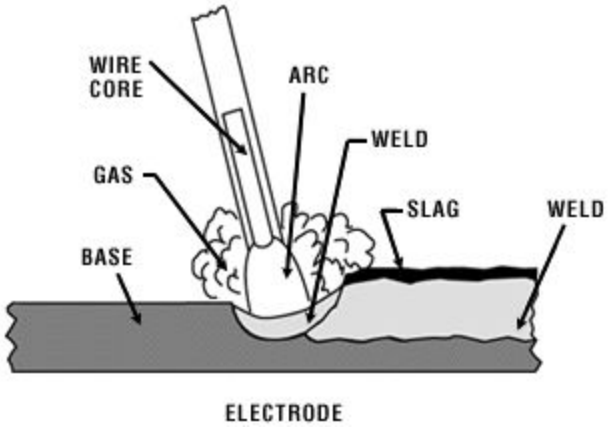
Arc Welding Equipments



Metal arc welding



STICK WELDING PROCESS



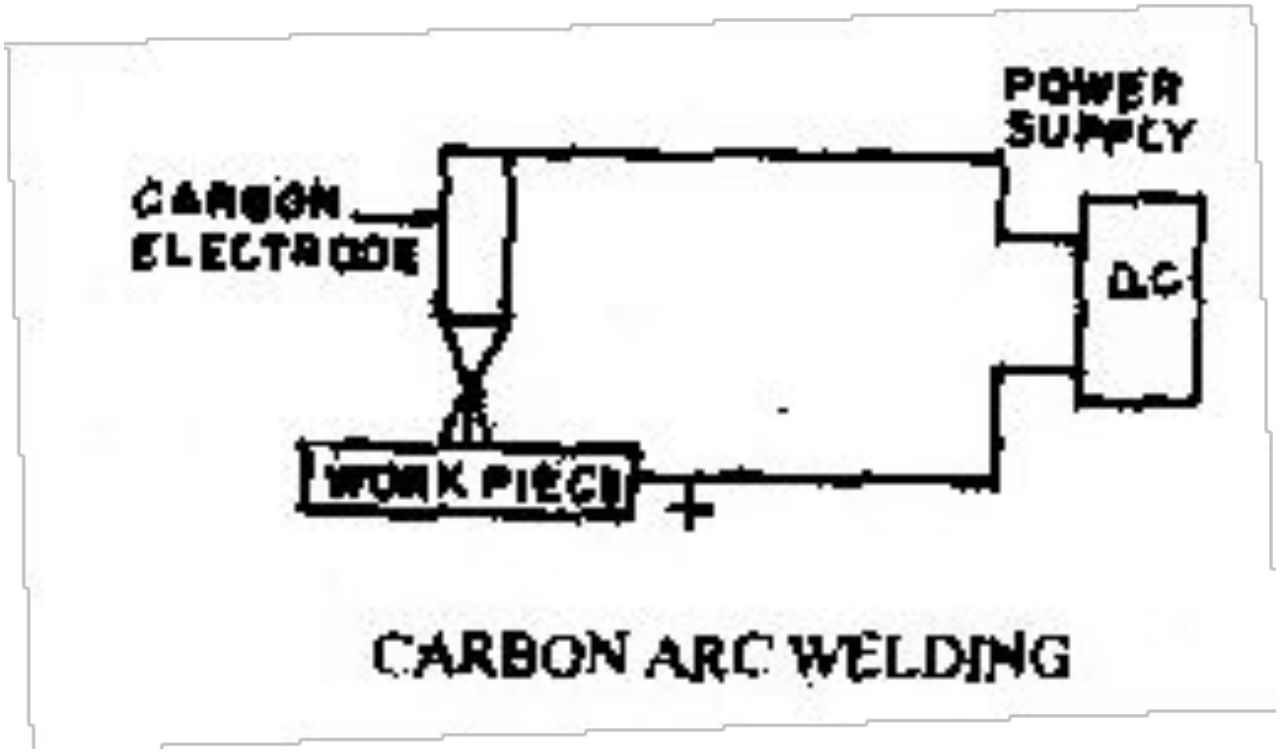
Arc Welding

Uses an electric arc to coalesce metals

Arc welding is the most common method of welding metals

Electricity travels from electrode to base metal to ground

Carbon Arc Welding



CARBON ARC WELDING

Arc welding

Advantages

- Most efficient way to join metals
- Lowest-cost joining method
- Affords lighter weight through better utilization of materials
- Joins all commercial metals
- Provides design flexibility

Limitations

- Manually applied, therefore high labor cost.
- Need high energy causing danger
- Not convenient for disassembly.
- Defects are hard to detect at joints.

Comparison of A.C. and D.C. arc welding

Alternating Current (from Transformer)

More efficiency
Power consumption less

Cost of equipment is less

Higher voltage – hence not safe
Not suitable for welding non ferrous metals

Not preferred for welding thin sections

Any terminal can be connected to the work or electrode

Comparison of A.C. and D.C. arc welding

Direct Current (from Generator)

Less efficiency
Power consumption more
Cost of equipment is more
Low voltage – safer operation
suitable for both ferrous non ferrous metals
preferred for welding thin sections
Positive terminal connected to the work
Negative terminal connected to the electrode

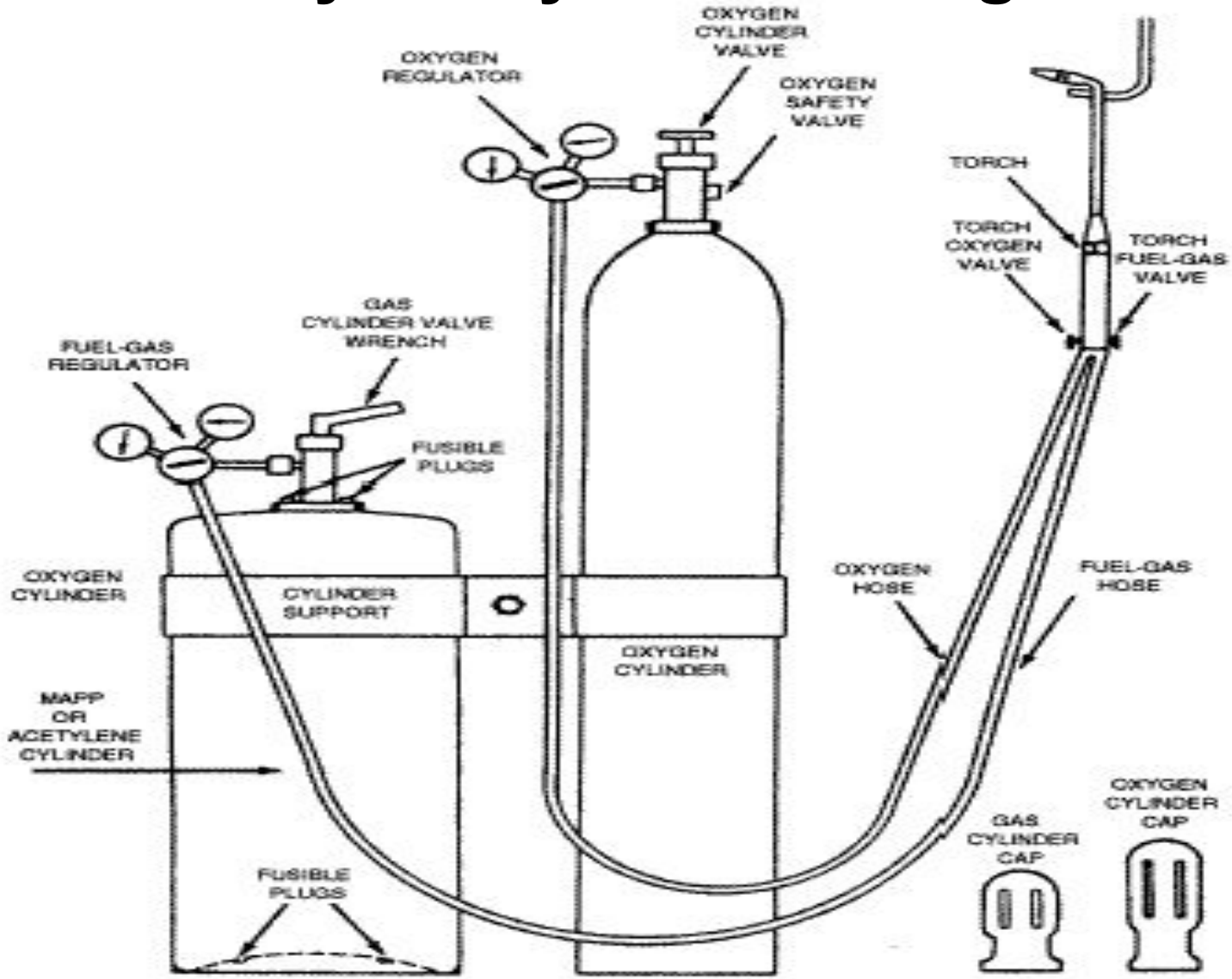
GAS WELDING

- Sound weld is obtained by selecting proper size of flame, filler material and method of moving torch
- The temperature generated during the process is 3300^0c
- When the metal is fused, oxygen from the atmosphere and the torch combines with molten metal and forms oxides, results defective weld
- Fluxes are added to the welded metal to remove oxides
- Common fluxes used are made of sodium, potassium. Lithium and borax.
- Flux can be applied as paste, powder,liquid.solid coating or gas.

GAS WELDING EQUIPMENT...

1. Gas Cylinders
   Pressure
   - Oxygen – 125 kg/cm2
   - Acetylene – 16 kg/cm2
2. Regulators
   - Working pressure of oxygen 1 kg/cm2
   - Working pressure of acetylene 0.15 kg/cm2
   - Working pressure varies depends upon the thickness of the work pieces welded.
3. Pressure Gauges
4. Hoses
5. Welding torch
6. Check valve
7. Non return valve

Oxy-Acetylene welding

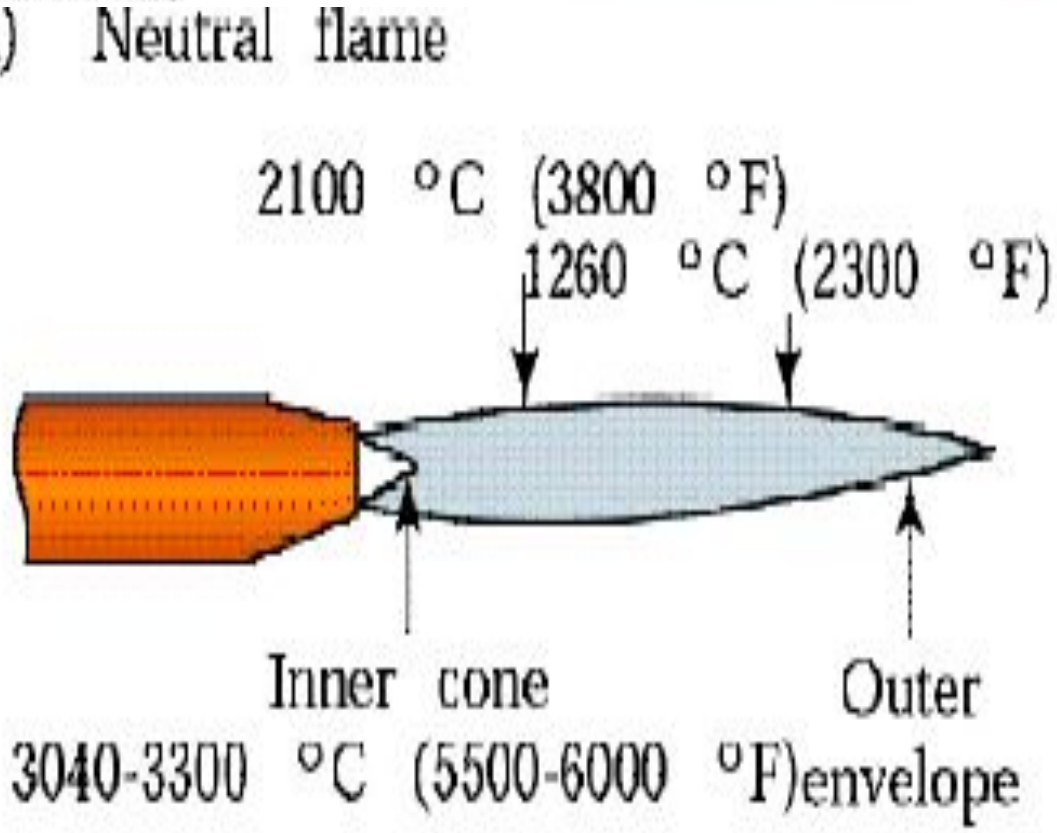


TYPES OF FLAMES…

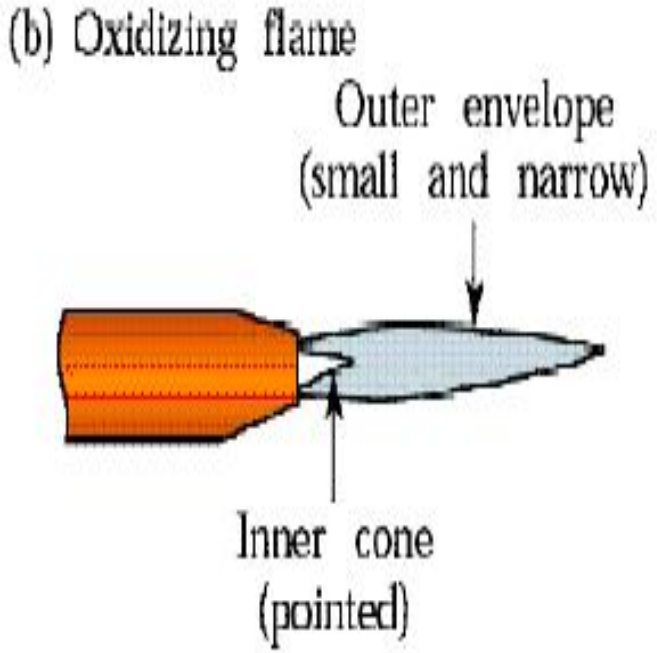
- Oxygen is turned on, flame immediately changes into a long white inner area (Feather) surrounded by a transparent blue envelope is called **Carburizing flame** (3000^0c)

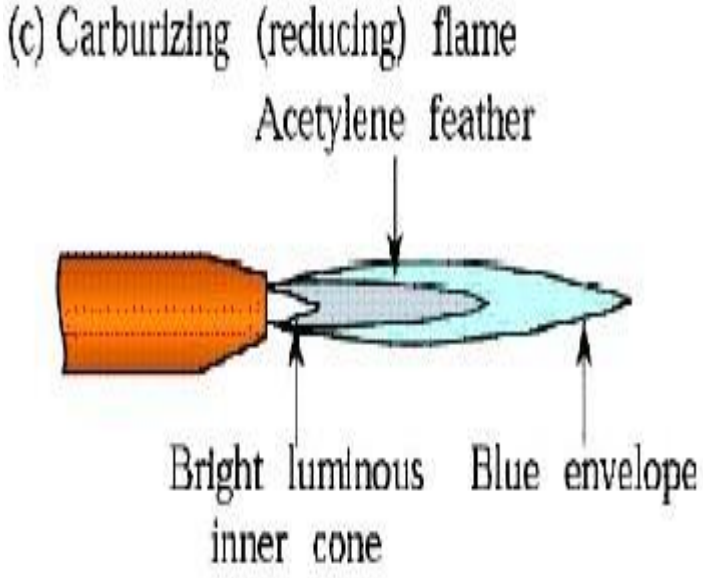
- Addition of little more oxygen give a bright whitish cone surrounded by the transparent blue envelope is called **Neutral flame** (It has a balance of fuel gas and oxygen) (3200^0c)
- Used for welding steels, aluminium, copper and cast iron

- If more oxygen is added, the cone becomes darker and more pointed, while the envelope becomes shorter and more fierce is called **Oxidizing flame**
- Has the highest temperature about 3400^0c
- Used for welding brass and brazing operation



Three basic types of oxyacetylene flames used in oxyfuel-gas welding and cutting operations: (a) neutral flame; (b) oxidizing flame; (c) carburizing, or reducing flame.





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GAS CUTTING

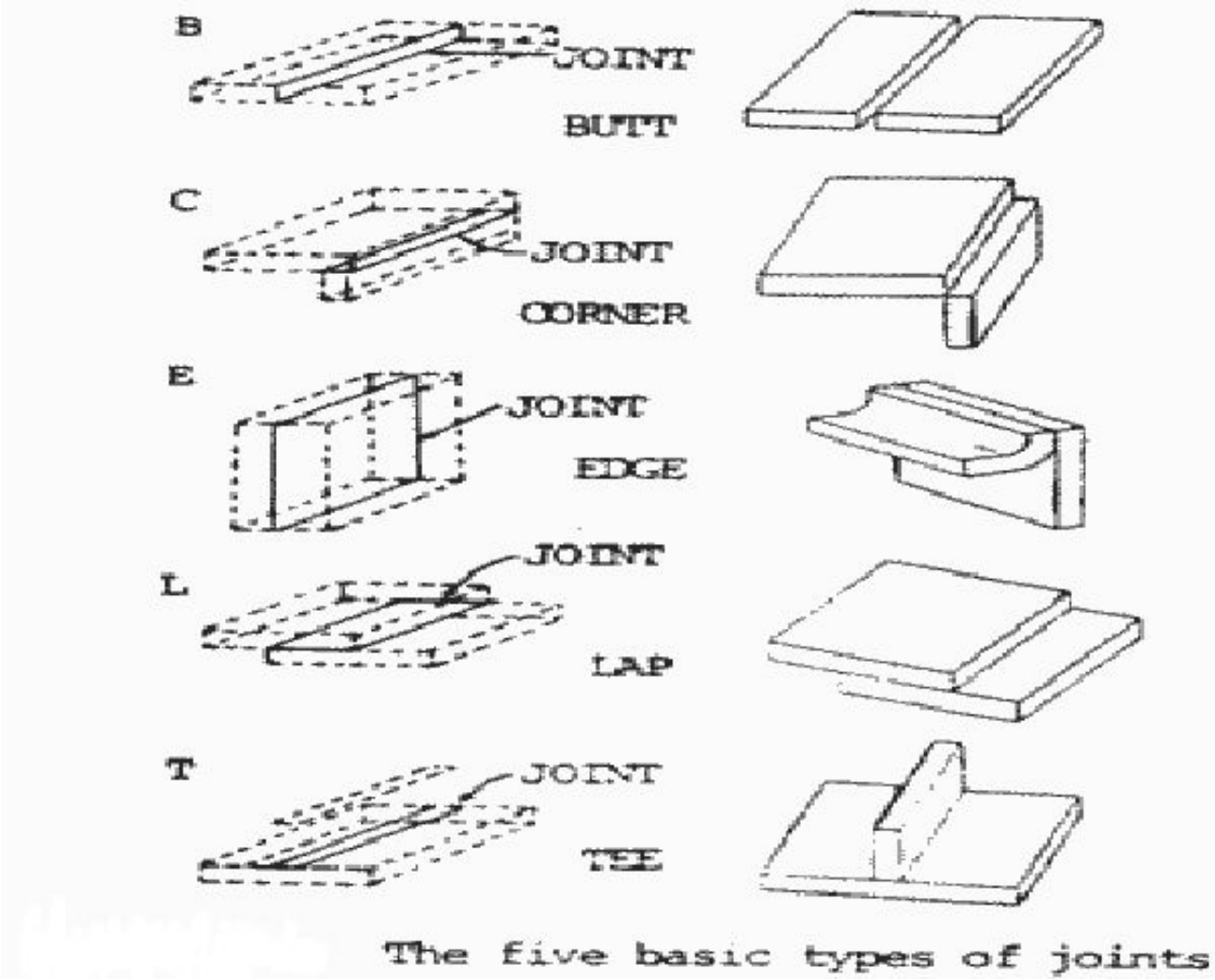
- Ferrous metal is heated in to red hot condition and a jet of pure oxygen is projected onto the surface, which rapidly oxidizes
- Oxides having lower melting point than the metal, melt and are blown away by the force of the jet, to make a cut
- Fast and efficient method of cutting steel to a high degree of accuracy
- Torch is different from welding
- Cutting torch has preheat orifice and one central orifice for oxygen jet
- **PIERCING** and **GOUGING** are two important operations
- **Piercing**, used to cut a hole at the centre of the plate or away from the edge of the plate
  Gouging, to cut a groove into the steel surface

GAS CUTTING…

Automatic Gas Cutting

Manual Gas Cutting

Weld joints



The five basic types of joints

Brazing and Soldering

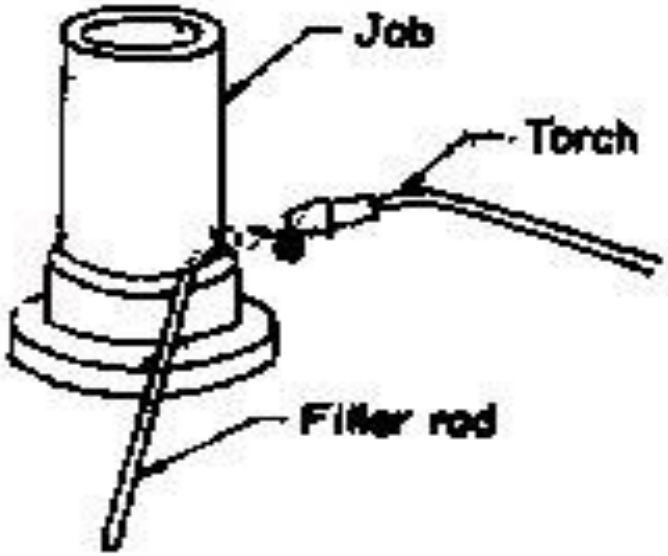
- **Brazing**

It is a low temperature joining process. It is performed at temperatures above 840º F and it generally affords strengths comparable to those of the metal which it joins. It is low temperature in that it is done below the melting point of the base metal. It is achieved by diffusion without fusion (melting) of the base

Brazing can be classified as

Torch brazing
Dip brazing
Furnace brazing
Induction brazing

Brazing



BRAZING

Advantages & Disadvantages

Advantages

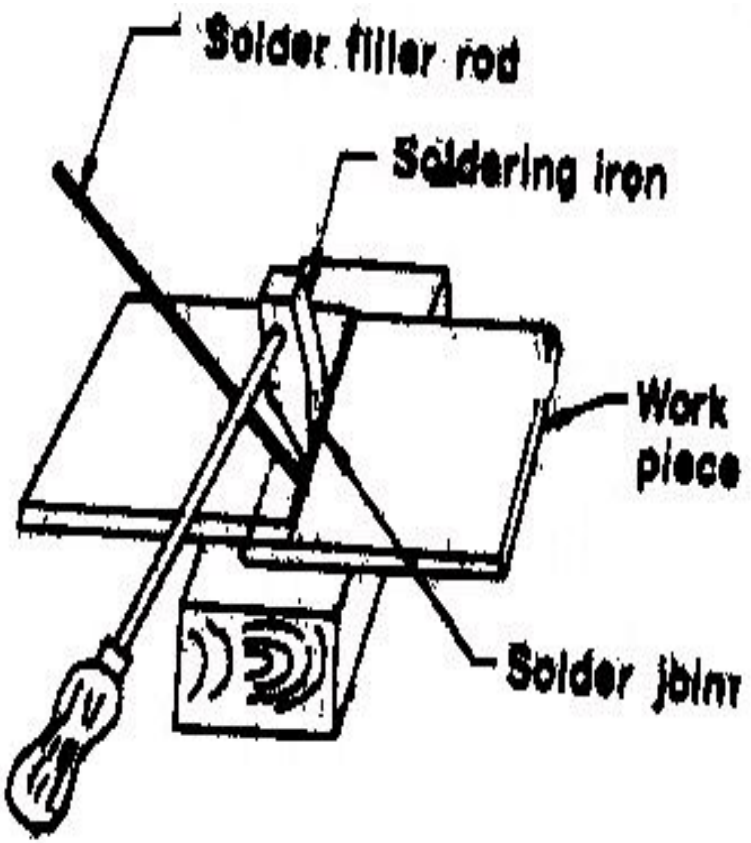
- Dissimilar metals which canot be welded can be joined by brazing
- Very thin metals can be joined
- Metals with different thickness can be joined easily
- In brazing thermal stresses are not produced in the work piece. Hence there is no distortion
- Using this process, carbides tips are brazed on the steel tool holders

Disadvantages

- Brazed joints have lesser strength compared to welding
- Joint preparation cost is more
- Can be used for thin sheet metal sections

Soldering

- It is a low temperature joining process. It is performed at temperatures below 840ºF for joining.
- Soldering is used for,
  - Sealing, as in automotive radiators or tin cans
  - Electrical Connections
  - Joining thermally sensitive components
  - Joining dissimilar metals



EXPERIMENT 11. LAP JOINT

Aim:

To make a lap joint on the given work pieces using arc welding.

Apparatus required:

Work pieces, Welding electrodes, Welding machine, Tongs, Wire brush, chipping hammer, Gloves and Goggles.

Procedure:

1. The given work pieces are cleaned with the wire brush to remove the rust, scale and other impurities.

2. Edges are prepared suitably to the given dimension and positioned one over another for the lap joint.

3. Depending upon the thickness of the parent metal, the amperage and correct voltage is selected.

4.With goggles covering the eyes and gloves on hands, an arc is struck on the work piece and tacks are made at the extreme ends.

5.Welding process is progressed along the seam at a constant speed and keeping uniform distance between the electrode and the work piece.

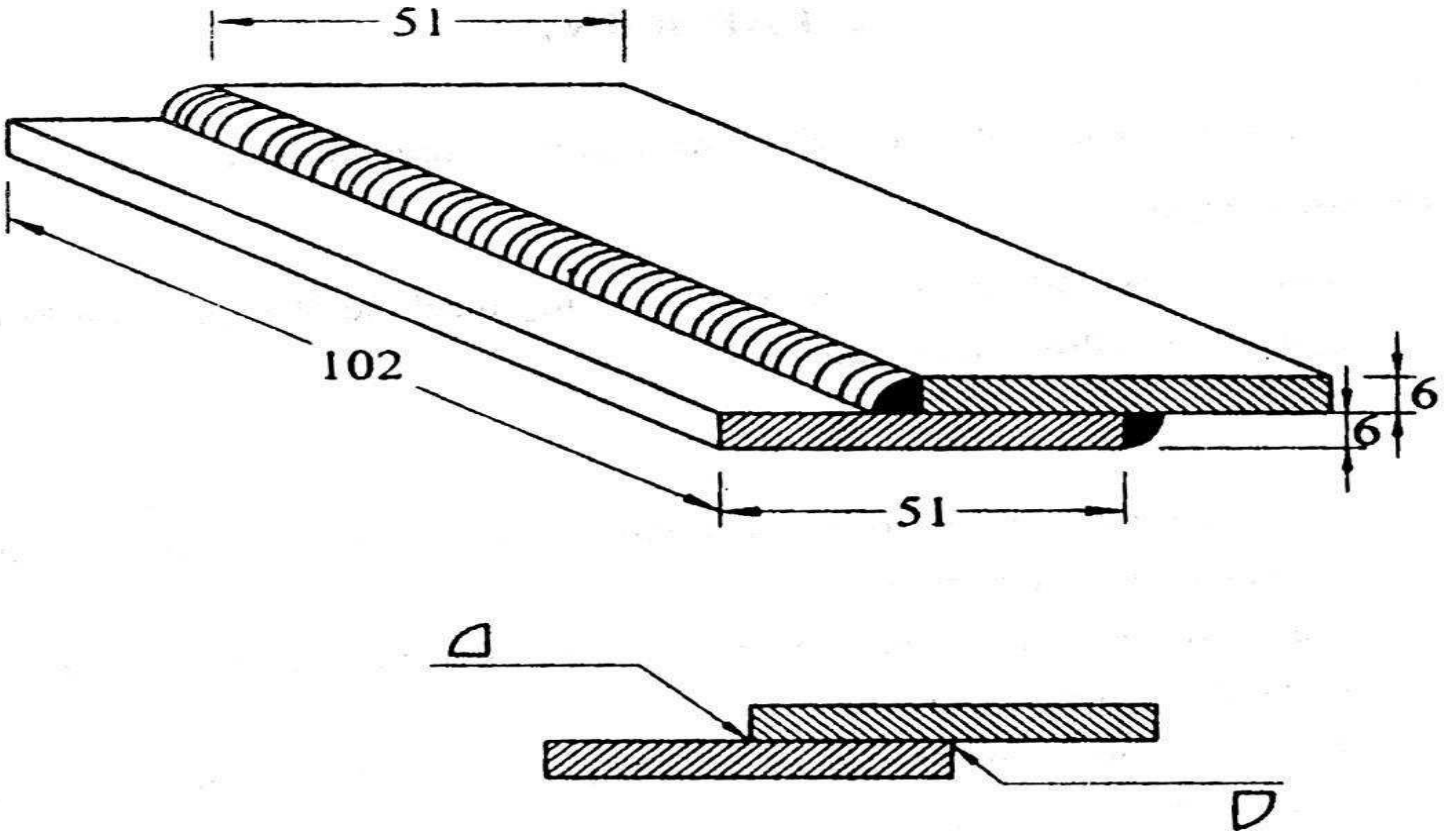
6. Using chipping hammer the flux in the form of slag is chipped off and then cleaned.

7. After welding, the work pieces should be handles only using the tongs.

Result:

Thus the required lap joint is obtained as per the given dimensions

LAP JOINT



Result:

Thus the required butt joint is obtained as per the given dimensions.