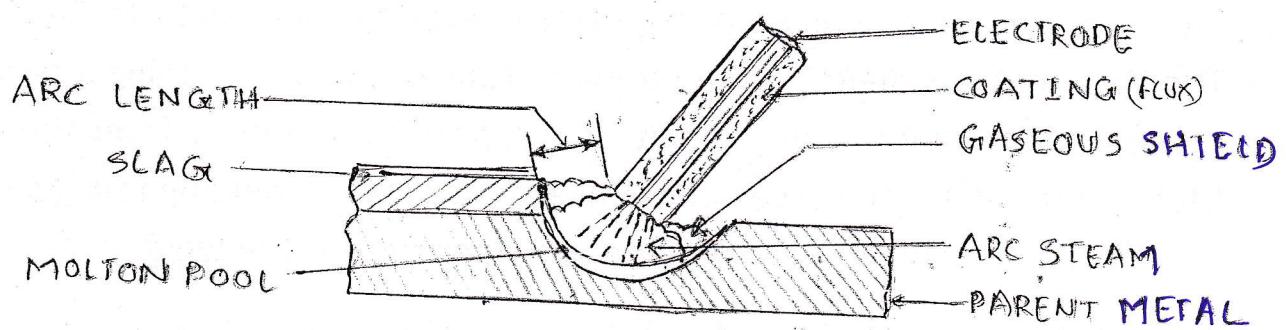


ARC WELDING

ARC WELDING



DIRECTION OF WELDING

ELECTRIC ARC WELDING

INTRODUCTION:

It is the fusion welding process in which welding heat is obtained from an electric arc between the electrode and the work. The electrode is first allowed to touch the work to form an electric circuit and then separated by a small distance (4 to 6 mm.) so that current continues to flow through gaseous medium.

The temperature produced by an electric arc is about 6000° to 7000° C. The base metal is melted by the temperature of the arc, forming a pool of molten metal which is forced out of the pool by the blast from the arc. Metal of the electrode (used in metal arc welding) or welding rod (used in carbon arc welding) also gets melted and deposited at the weld.

~~DATA~~
A small depression is formed in the base which is called arc crater. The molten metal is deposited around the edge of arc crater. The distance between centre of the arc from the tip of the electrode and the bottom of the arc crater is called arc length. It should be 3-4 mm.

Either alternating current (A.C.) or direct current (D.C.) is used for arc welding, DC being most commonly preferred in most of the cases.

EQUIPMENT FOR ARC WELDING:

- | | |
|--------------------------------|-----------------------------------|
| 1) DC generator or transformer | 6) Welding helmet and Face shield |
| 2) Electrodes | 7) Hand gloves |
| 3) Electrode holder | 8) Aprons |
| 4) Cables and connections | 9) Chipping Hammer |
| 5) Earthing clamps | 10) Wire brush |

1) **DC Generator or welding Transformer:** For DC welding, generator set is used. The generator set is driven either by electric motor or by I.C. engine where no electricity is available.

For A.C. welding, a step down Transformer is required. It takes the electric supply from main line at 400-440 volts and reduces it to 80-100 volts.

Current regulator is essential in both the cases, to select proper quantity of current. Necessary voltage for striking the arc is 80-100 volts (i.e. open circuit voltage) but 30-40 volts is sufficient to maintain the arc. The current required for manual operation in metal arc welding ranges from 30 to 500 A.

2) **Electrodes:** The electrodes used are of three types: - bare, fluxed (lightly coated) and heavy coated. The use of bare electrodes is limited for welding of wrought iron and mild steel!

Fluxed electrodes have a light coating of flux on the rods to increase arc stability. They are used for welding non-essential jobs.

Heavy coated electrodes are most commonly used for welding alloys and non ferrous metals.

The electrode coating has following functions:

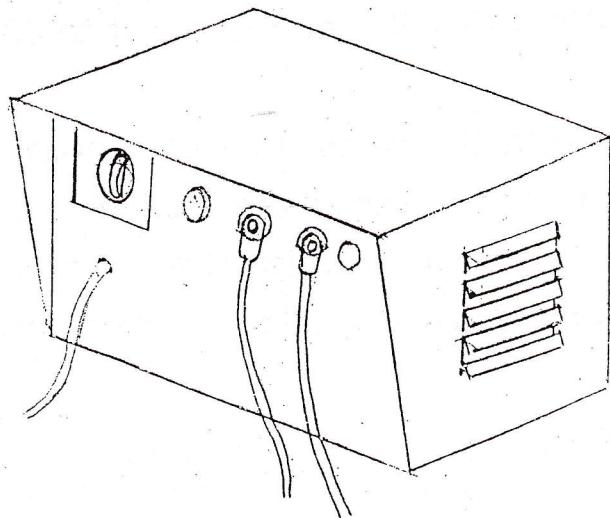
1. To form slag with metal impurities, thus refining the metal also to retard the cooling of the weld.
2. To form a gaseous shield around the molten metal, excluding oxygen.
3. To act as a flux so that impurities may be removed.
4. To replace certain constituents which may be lost from the weld metal.
5. To add alloying elements.
6. To stabilise the arc.

WELDING EQUIPMENTS

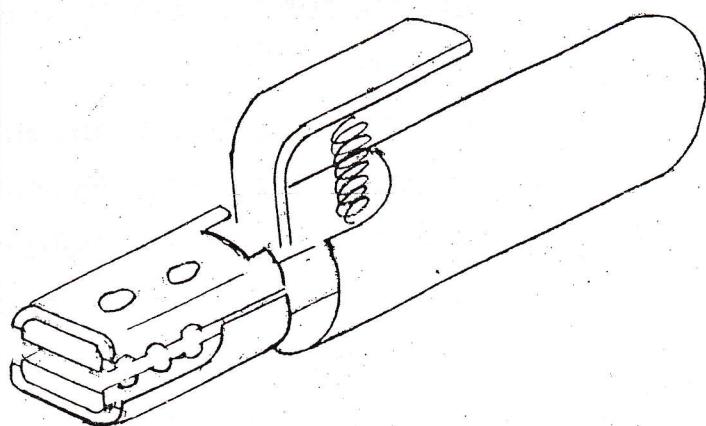
50

35

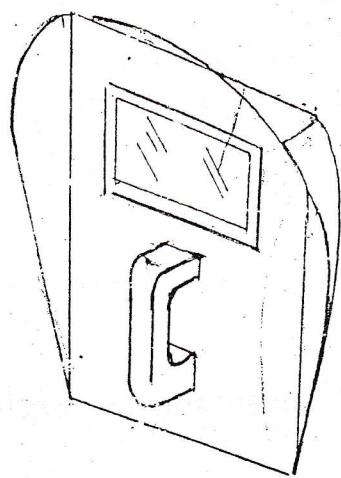
WELDING TRANSFORMER



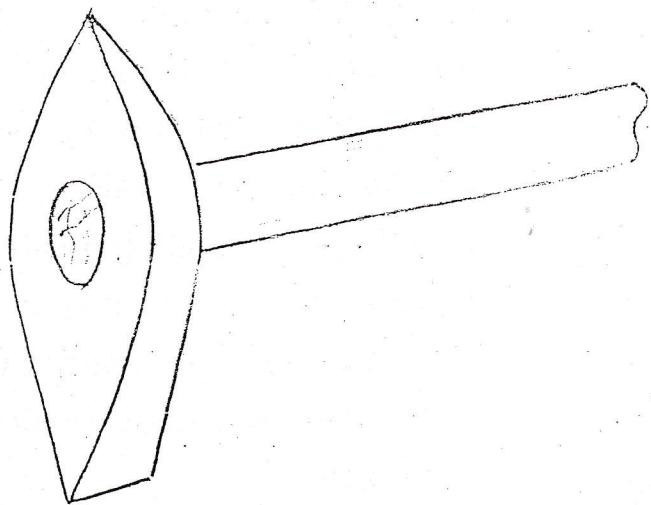
ELECTRODE HOLDER



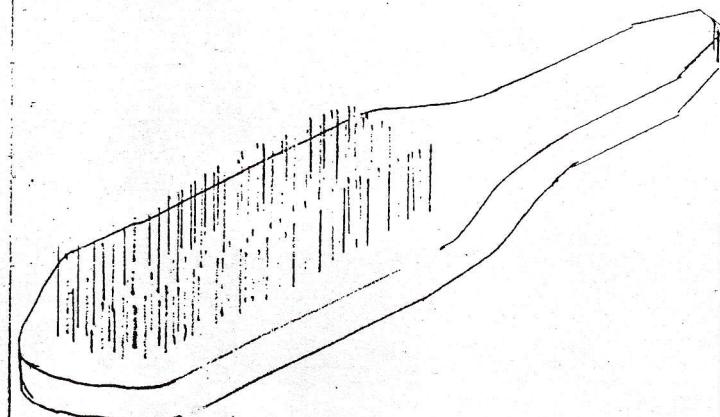
FACE SCREEN



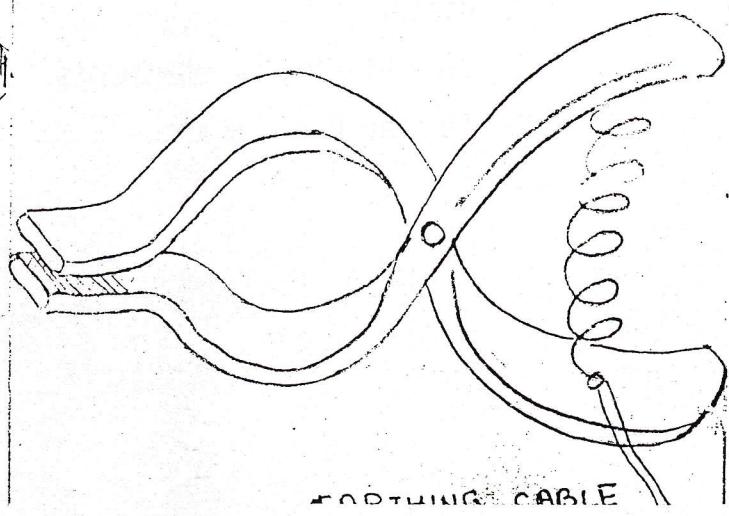
CHIPPING HAMMER



WIRE BRUSH



EARTHING CLAMP



- 3) **Electrode Holder:** Well insulated electrode holder is used to grip the electrode with spring or by pressure of lever held in the operators hand.
- 4) **Cables and Cable Connections:** Cables carry the current to desired place and cable connectors are essential for connection.
- 5) **Earthing Clamps:** These are used to form the electric circuit.
- 6) **Welding Helmet and Face Shield:** The face and eyes must be protected from the rays of the arc which contain ultra violet and infra red rays.
- 7) **Hand Gloves:** These are used to protect the hands of the operator from the arc rays, spatter of molten metal, sparks etc. They also provide protection while handling the work.
- 8) **Aprons:** Protective aprons are used by operator for providing protection from sparks and globules of molten metal thrown out from the arc.
- 9) **Chipping hammer:** It is required for removing the slag from the weld.
- 10) **Wire Brush:** It is used for cleaning the weld after chipping.

Maintenance of Generator –

- 1) Brush pressure should be set according to maker's instructions.
- 2) Worn brushes should be replaced only with those of the correct type.
- 3) The commutators and brush gears of generators should be given particular attention, the commutators being skimmed when grooves have formed.

Care of Welding transformer -

- 1) Occasionally they should be blown out with dry compressed air.
- 2) Check nuts of the frame and case periodically.
- 3) All contacts should be kept clean and connections secure.
- 4) Insulation should be examined regularly and repaired if necessary.
- 5) Oil in transformers and regulators should be checked for level.

Safety precautions –

Precautions required in respect of danger when electric arc welding is being undertaken are from:

- 1) Electric shock
- 2) Radiations from the arc
- 3) The scattering of hot particles or globules of metal.
- 4) Flying pieces of sharp slag when being chipped away after welding.

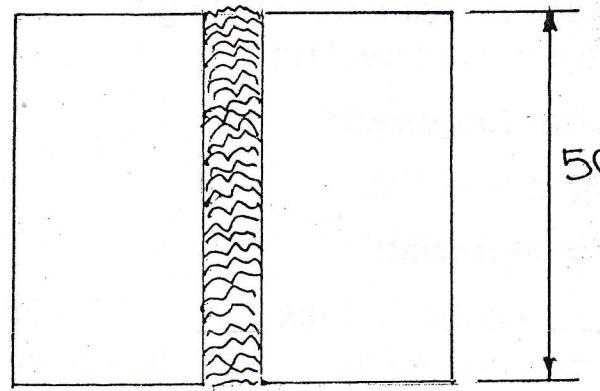
AIM OF THE EXPERIMENT:

To learn welding skills and integrate them by manufacturing two welding joints, ^V joint and corner joint.
BUTT

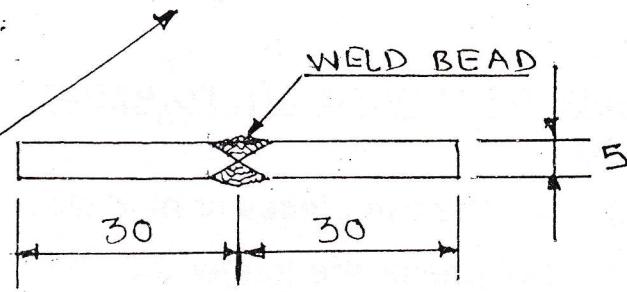
Tools and equipments required:

- | | |
|--------------------------|-----------------------------------|
| 1) Bench vice | 7) Earthing clamp |
| 2) Flat file | 8) Welding helmet and face shield |
| 3) Welding transformer | 9) Hand gloves |
| 4) Electrode | 10) Apron |
| 5) Electrode holder | 11) Chipping Hammer |
| 6) Cables and connectors | 12) Wire brush. |

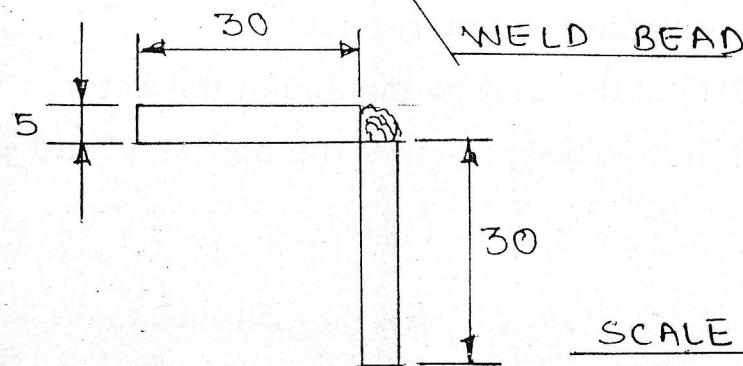
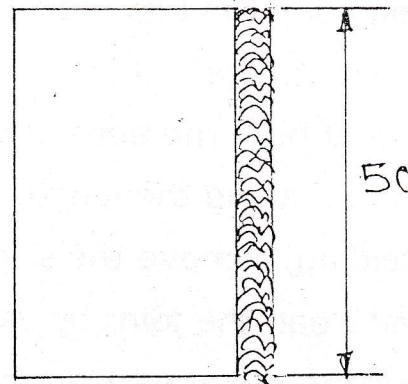
DOUBLE "V" BUTT JOINT



TO BE WELD -
IN HORIZONTAL -
POSITION.



CORNER JOINT



SCALE - 1:1
ALL THE DIMENSIONS ARE IN M

Operations Involved:

- 1) Edge preparation by filing.
- 2) Electric arc welding.

Material Required:

Mild steel flat.

Size of Material:

- 1) For double 'v' butt joint :- 50 x 30 x 5mm (2 Nos.).
- 2) For corner joint :- 50 x 30 x 5mm (2 Nos.).

STEPWISE PROCEDURE TO REPAIR A DOUBLE 'V' BUTT JOINT:

- 1) Take the two pieces of mild steel of size 50 x 30 x 5mm.
- 2) Make one of the longer side smooth, even and sideways perpendicular and another side angular of the two metal pieces by filing process.
- 3) After filing the longer sides, join those two pieces together by electric arc welding.
- 4) While joining keep the two metal pieces together in the same horizontal plane.
- 5) First, tack-weld both the ends of the pieces and then, do the full welding, along the length on both sides.
- 6) After full welding, remove the slag with the chipping hammer and clean the joint by using wire brush.
- 7) Remove also the metal particles stuck on the surfaces by chipping hammer.
- 8) Cool the joint by dipping in the water.
- 9) In this way, prepare the double 'v' butt joint.

STEPWISE PROCEDURE TO PREPARE THE CORNER JOINT:

- 1) Take the two pieces of mild steel of size 50 x 30 x 5 mm.
- 2) Make the longer sides smooth, even and sideways perpendicular by filing process.
- 3) After filing longer sides, join two pieces together at right angles by tack welding on both the ends.
- 4) Keep joined pieces vertical in a fixture to maintain the right angle and do the full welding on the joint from the bottom to top.
- 5) After full welding, remove the slag from the weld bead with the chipping hammer. See whether the welding is done properly all over the joint.
- 6) Cool the job by dipping in water.
- 7) Thus, prepare the corner joint.

ELECTRIC ARC WELDING PROCEDURE:

- 1) Set the current of welding transformer according to the thickness of the job material and diameter of the electrode.
- 2) Connect the earthing cable and electrode holder cable firmly to welding transformer.
- 3) To complete electrical circuit, connect earthing plate or clamp with the job material.
- 4) Select the dia of electrode according to thickness of the job material.
- 5) Fix electrode into the electrode holder.
- 6) Switch on the welding transformer.
- 7) For welding, first produce the arc.
- 8) To produce the arc, tap or strike the tip of electrode on the job where the welding is to be done.
- 9) After producing the arc, keep the electrode in the angle of 60° or 70° with the job surface and keep the tip of electrode 3–4 mm. above job surface.
- 10) Do the welding from one end to another end.