MECHANICAL ENGINEERING DEPARTMENT

Subject_:- Basic Workshop Practice - I **Course code -FEL105**

Course Education Objectives:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labor.
3. To get exposure to interdisciplinary engineering domain.

Course Outcomes:

At the end of the course Learners will be able to…		**PO**	**Bloom Level**
FEL101.1	Develop the necessary skill required to handle/use different fitting tools.	PO1,PO5, PO9,PO11	Application
FEL101.2	Develop skill required for hardware maintenance.	PO1,PO5, PO9,PO11	Application
FEL101.3	Able to prepare the edges of jobs and do simple arc welding	PO1,PO5, PO9,PO11	Application

MARKS DISTRIBUTION

Fitting Job 1 & 2	Hardware and Networking	Welding Job	Journal-Report	Attendance	Total
20	15	5	5	5	50

CO1:- At the end of the course Learners will be able to develop the necessary skill required to handle/use different fitting tools.

FITTING

INTRODUCTION:

Machine tools are capable of producing work at a faster rate, but there are occasions when components are processed at a bench. Sometimes it becomes necessary to replace or repair a component that must fit accurately with one another or reassemble. This involves a certain amount of hand fitting. The assembly machine tools, jigs, gauges etc., involves certain amount of bench work.

FITTING TOOLS: Holding tools:-

Bench vice

V-block with clamp

C-clamp

Bench vice:-

It is a work holding device, when vice handle is turned in a clockwise direction the sliding jaw forces the work against the fixed jaw, the greater the force applied to the handle, the tighter is the work held.

V-block with clamp:-

It is a rectangular (or) square block with v-groove on one or both sides, opposite to each other. It holds cylindrical work pieces.

C-clamp:-

This is used to hold work against an angle plate or v-block.

MARKING AND MEASURING TOOLS:

1. Surface plate
2. Try square
3. Angle plate
4. Scriber
5. Universal scribing block
6. Odd leg caliper
7. Divider
8. Calipers
9. Dot punch
10. Vernier caliper

Surface plate:-

It is used for testing flatness of work piece, for marking out small works.

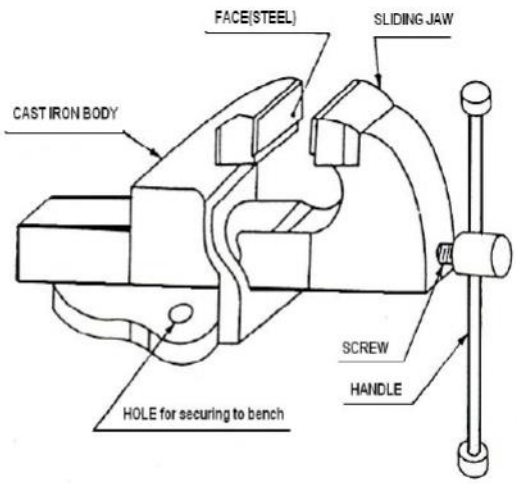


Fig: 1 Bench wise

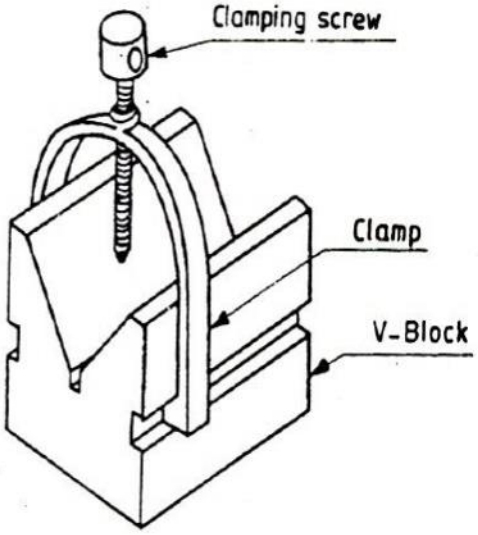


Fig: 2 V- Block

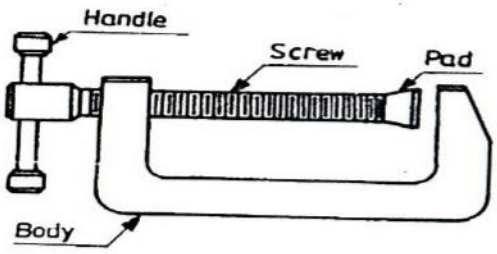


Fig: 3 C – Clamp

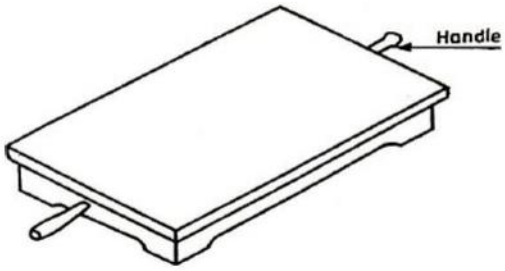


Fig: 4 Surface plate

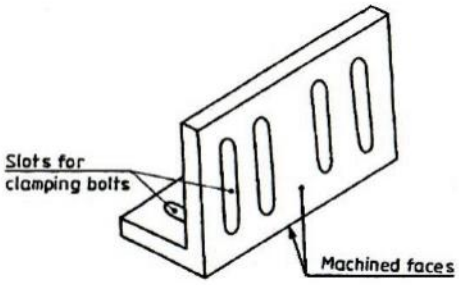


Fig: 5 Angle plate

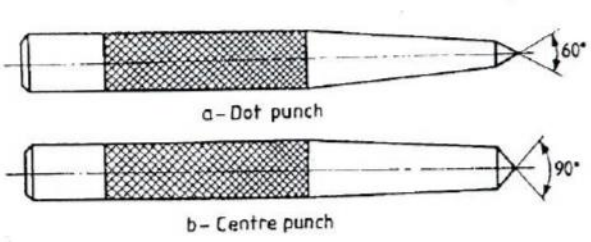


Fig: 6 Dot punch

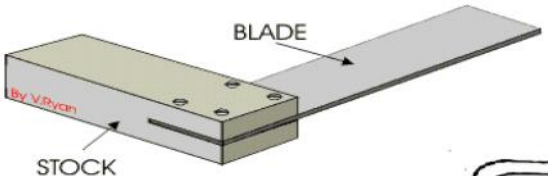


Fig: 6 try square

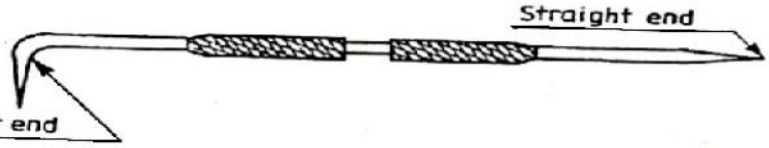


Fig: 7 scriber

Combination cutting pliers: -

This is made of tool steel and is used for cutting as well as for ripping work.

Taps and die holders: -

Tap and wrenches are used for cutting internal threads in a drilled hole.

Dies and die holders:-

They are used for making external threads. Dies are made either solid (or) split type.

TYPES OF FILES:

Hand file:-

It is a rectangular in section tapered in thickness but parallel in width.

Flat file:-

Rectangular in section and tapered for 1/3rd length in width and thickness.

Square file:-

Square in section and tapered for 1/3rd length on all sides.

Half round file:-

It has one flat face, connecting by a curved (surface) face & tapered for 1/3rd length.

Round file:-

Circular in cross section and tapered for 1/3rd length, it has double cut teeth.

MISCELLANEOUS TOOLS: Ball peen hammer:-

It has a flat face, which is used for general work and a ball end is used for riveting.

Screw driver:-

It is designed to turn the screws. The blade is made of steel and is available in different lengths and diameters.

Spanners:-

It is a tool for turning nuts and bolts. It is usually made of forged steel.

FITTING OPERATIONS:

Chipping:-

Removing metal with a chisel is called chipping and is normally used where machining is not possible.

Fitting:-

1. Pinning of files:-

Soft metals cause this; the pins are removed with a file card.

2. Checking flatness and square ness:-

To check flatness across thickness of plate.

MARKING AND MEASURING:

Measurements are taken either from a center line, for visibility of the non-ferrous metals and oxide coated steels are used.

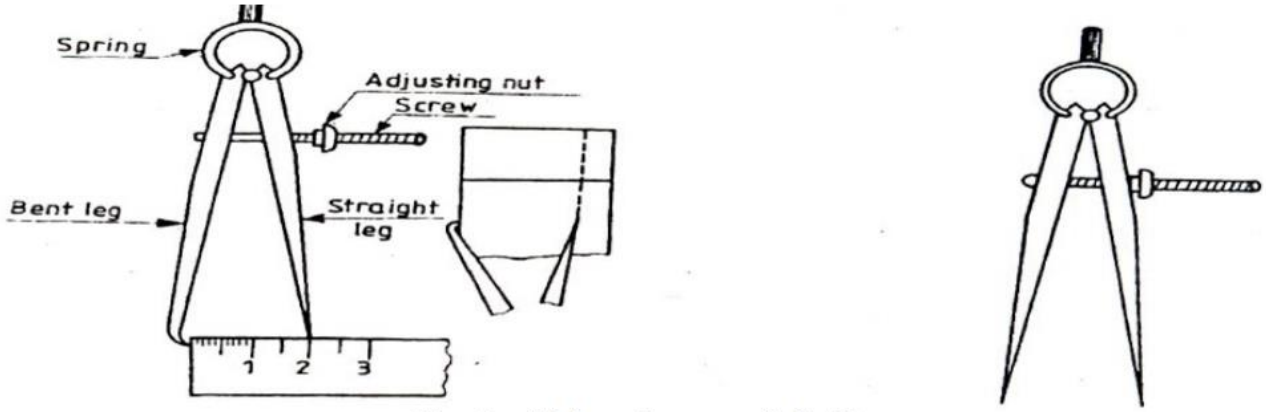


Fig: 8 odd leg clamp and divider

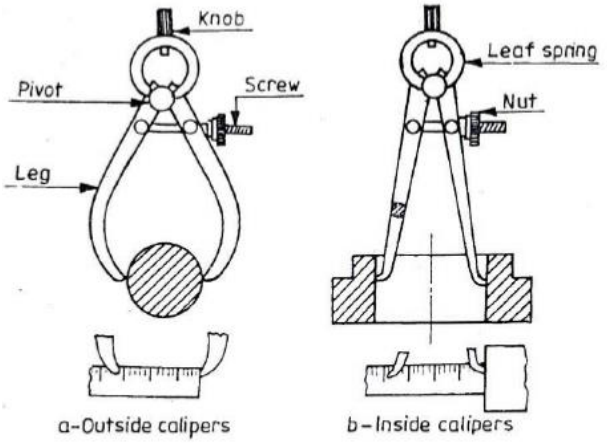


Fig: 9 calipers

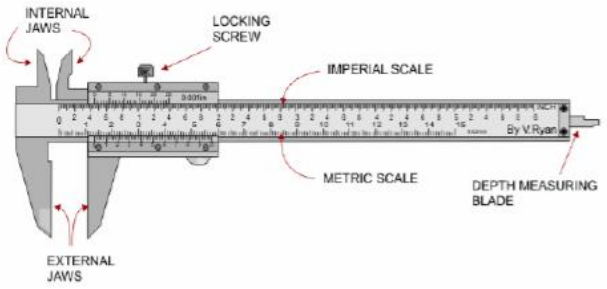


Fig: 10 Vernier caliper

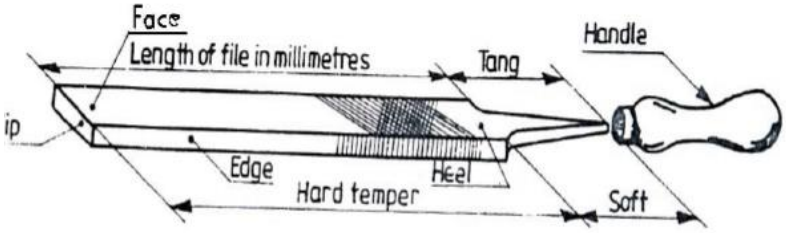


Fig: 11 Parts of hand file

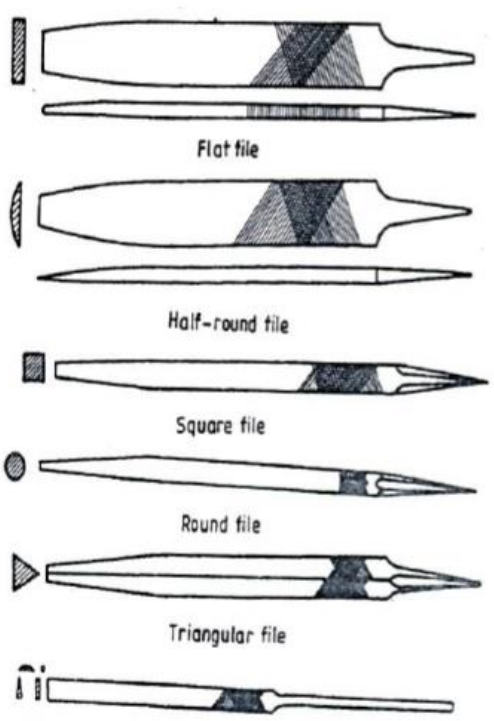


Fig: 12 Types of files

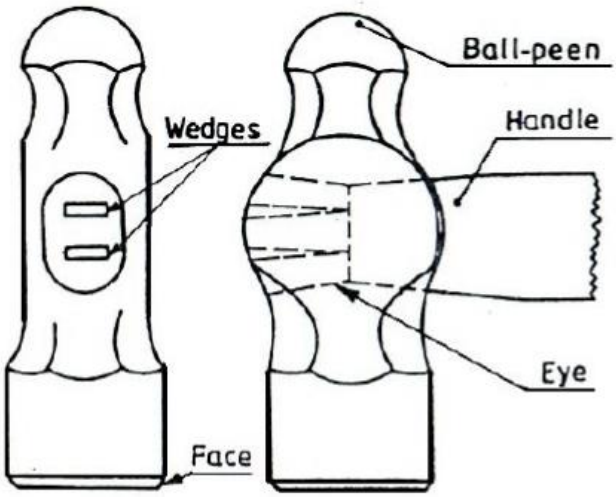


Fig: 13 ball peen hammer

FITTING SECTION

EXPERIMENT:-1 & 2,

FITTING JOB NO:-1&2 , **DATE:-**

Aim: - To make a T-fitting from the given two M.S pieces.

Tools required: -

1. Bench vice
2. Steel rule
3. Try square
4. Ball peen hammer
5. Scriber
6. Hack saw with blade
7. Dot punch and Centre punch
8. Surface plate
9. Venire height gauge
10. Rough and smooth flat files
11. Flat chisel and triangular file

Material required: - Mild steel (M.S) plate of size 48 x 50 x5,

Sequence of Operations: -

1. Filing
2. Checking flatness and square ness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

Procedure: -

1. The burrs in the pieces are removed and the dimensions are checked with a steel rule.

2. The pieces are clamped one after the other and the outer mating edges are filed by using rough and smooth files.

3. The flatness, straightness and squareness i.e. right angle between adjacent sides are checked with help of Try-square.

4. Chalk is then applied on the surfaces of the two pieces.

5. The given dimensions of the T-fitting are marked with help of vernier height gauge carefully.

6. Using the dot punch, dots are punched along the above scribed lines.

7. Using the hack saw, the unwanted portions are removed.

8. Using file, the unwanted material in the piece Y is removed.

9. The cut edges are filed by the half round file.

10. The corners of the stepped surfaces are filed by using a square or triangular file to get the sharp corners.

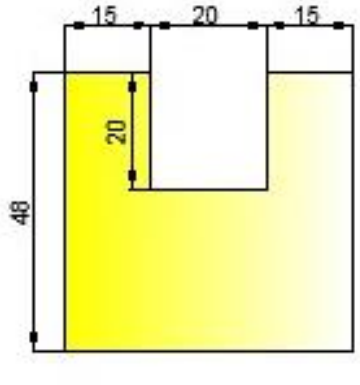
11. The pieces (X and Y) are fitted together and the mating is checked for the correctness of the fit.

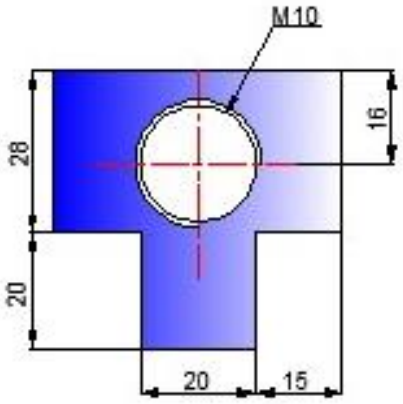
Safety precautions: -

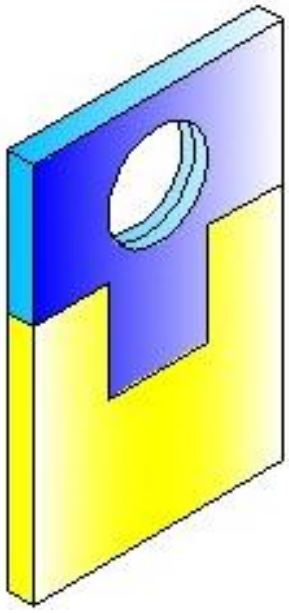
1. Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.
2. Apply pressure in forward direction during hack sawing.
3. Don't rub steel rule on the job.
4. Fix blade in hacksaw frame with correct tension.
5. During hack sawing the coolant like water or lubricating oil is to be used.
6. Use precision instruments like vernier calipers and vernier height gauge carefully.
7. Files are to be cleaned properly after using.

Result: - T-fit is made as per the required dimensions.

T-FITTING





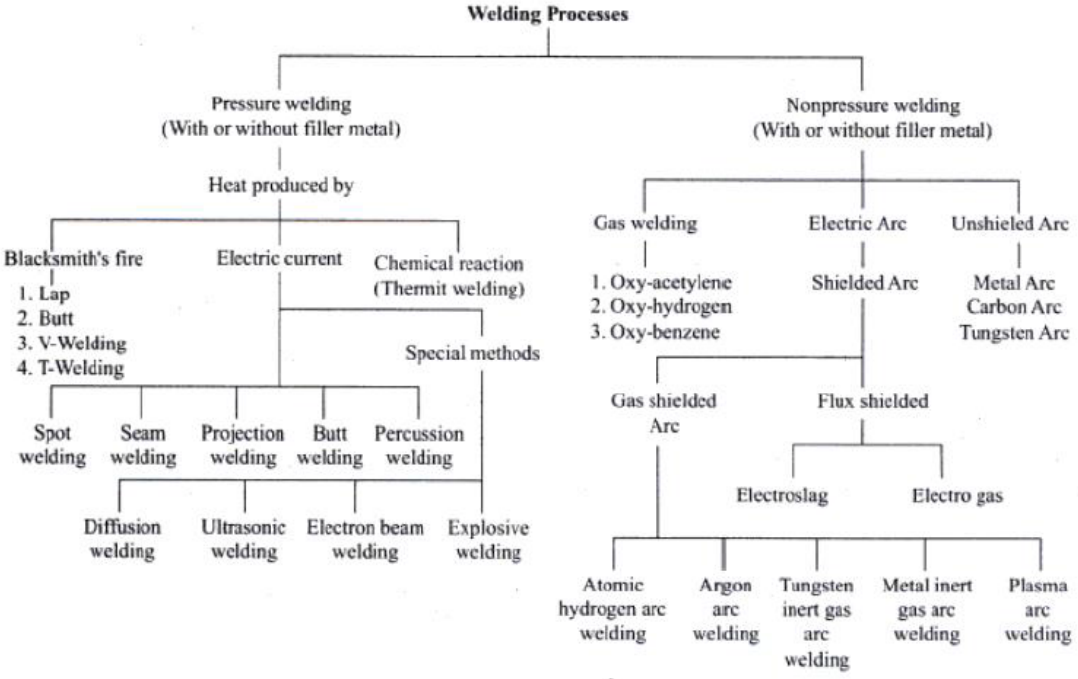


CO2:- At the end of the course Learners will be able to Able to prepare the edges of jobs and do simple arc welding

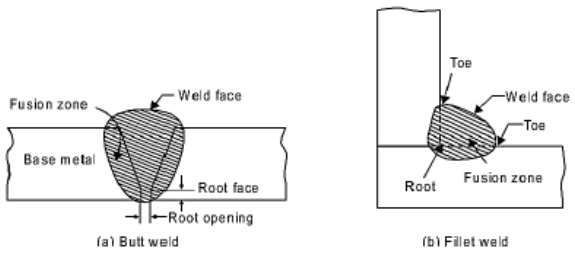
WELDING

Welding is a process for joining two similar or dissimilar metals by fusion. It joins different metals/alloys, with or without the application of pressure and with or without the use of filler metal. The fusion of metal takes place by means of heat. The heat may be generated either from combustion of gases, electric arc, electric resistance or by chemical reaction.

Welding provides a permanent joint but it normally affects the metallurgy of the components. It is therefore usually accompanied by post weld heat treatment for most of the critical components. The welding is widely used as a fabrication and repairing process in industries. Some of the typical applications of welding include the fabrication of ships, pressure vessels, automobile bodies, off-shore platform, bridges, welded pipes, sealing of nuclear fuel and explosives, etc.



Most of the metals and alloys can be welded by one type of welding process or the other. However, some are easier to weld than others. To compare this ease in welding term 'weldability' is often used. The weldability may be defined as property of a metal which indicates the ease with which it can be welded with other similar or dissimilar metals.



Terminology of welding process

Elements of welding process used with common welding joints such as base metal, fusion zone, weld face, root face, root opening toe and root are depicted in Figure.

Electric arc welding:-

Arc welding is the welding process, in which heat is generated by an electric arc struck between an electrode and the work piece. Electric arc is luminous electrical discharge between two electrodes through ionized gas.

Any arc welding method is based on an electric circuit consisting of the following parts:

a. Power supply (AC or DC);
b. Welding electrode;
c. Work piece;
d. Welding leads (electric cables) connecting the electrode and work piece to the power supply.

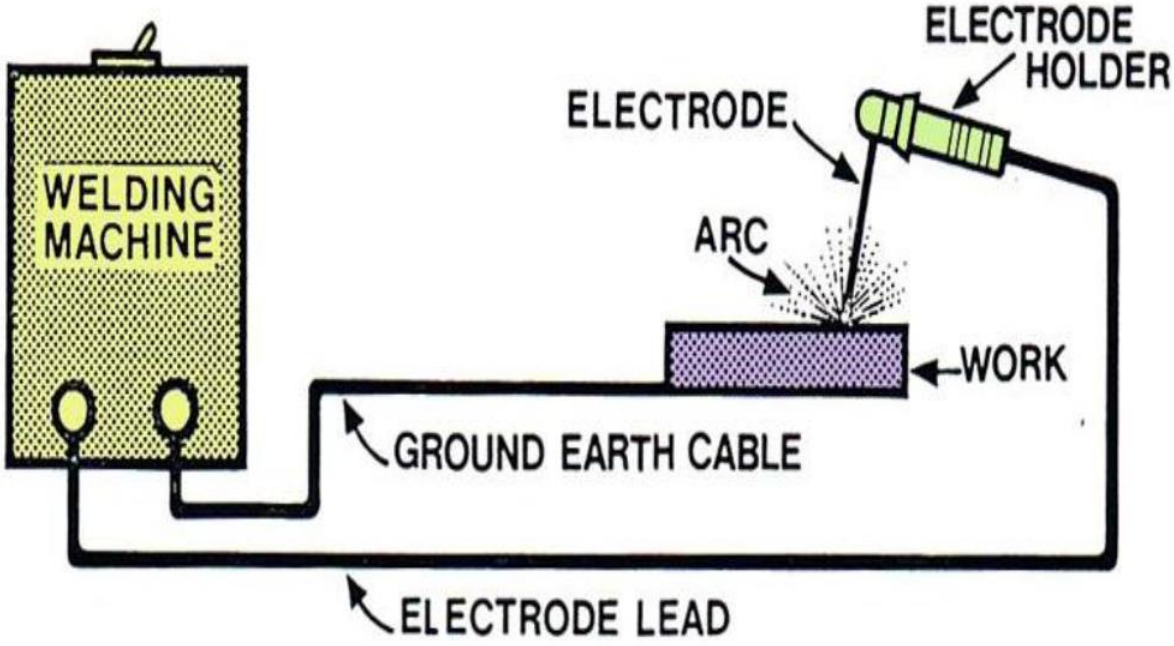


Fig:1 Arc welding set up

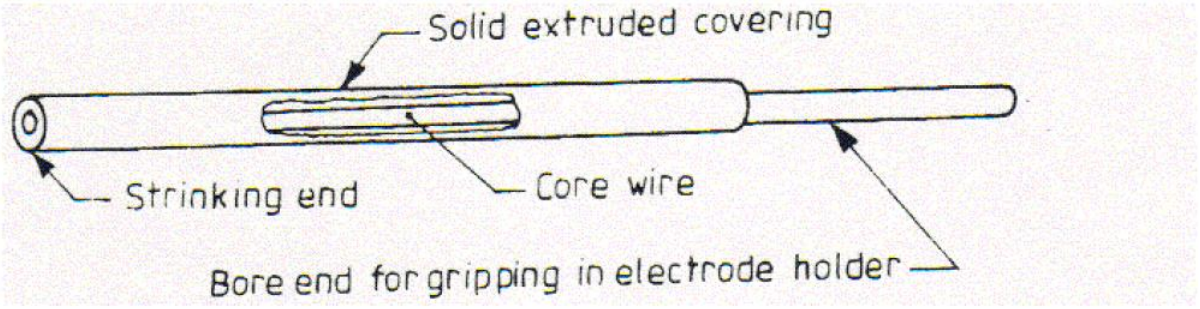


Fig :2 parts of an electrode

Electric arc between the electrode and work piece closes the electric circuit. The arc temperature may reach 10000°F (5500°C), which is sufficient for fusion the work piece edges and joining them. When a long joint is required the arc is moved along the joint line. The front edge of the weld pool melts the welded surfaces when the rear edge of the weld pool solidifies forming the joint.

Transformers, motor generators and rectifiers' sets are used as arc welding machines. These machines supply high electric currents at low voltage and an electrode is used to produce the necessary arc. The electrode serves as the filler rod and the arc melts the surface so that, the metals to be joined are actually fixed together.

Sizes of welding machines are rated according to their approximate amperage capacity at 60% duty cycle, such as 150,200,250,300,400,500 and 600 amperes. This amperage is the rated current output at the working terminal.

Transformers

The transformers type of welding machine produces A.C current and is considered to be theleast expensive. It takes power directly from power supply line and transforms it to the voltage required for welding. Transformers are available in single phase and three phases in the market.

Motor generators

These are D.C generators sets, in which electric motor and alternator are mounted on the same shaft to produce D.C power as pert the requirement for welding. These are designed to produce D.C current in either straight or reversed polarity. The polarity selected for welding depends upon the kind of electrode used and the material to be welded.

Rectifiers

These are essentially transformers, containing an electrical device which changes A.C into D.C by virtue of which the operator can use both types of power (A.C or D.C, but only one at a time).In addition to the welding machine, certain accessories are needed for carrying out the welding work.

Welding cables

Two welding cables are required, one from machine to the electrode holder and the other, from the machine to the ground clamp. Flexible cables are usually preferred because of the case of usingand coiling the cables. Cables are specified by their current carrying capacity, say 300 A, 400 A, etc.

Electrodes

Filler rods are used in arc welding are called electrodes. These are made of metallic wire called core wire, having approximately the same composition as the metal to be welded. These are coated uniformly with a protective coating called flux. While fluxing an electrode; about 20mm of length is left at one end for holding it with the electrode holder. It helps in transmitting full current from electrode holder to the front end of the electrode coating. Flux acts as an insulator of electricity. In general, electrodes are classified into five main groups; mild steel, carbon steel, special alloy steel, cast iron and non-ferrous. The greatest range of arc welding is done with electrodes in the mild steel group. Various constituents like titanium oxide, potassium oxide, cellulose, iron or manganese, Ferro silicates, carbonates, gums, clays, asbestos, etc., are used as coatings on electrodes. While welding, the coating or flux vaporizes and provides a gaseous shield to prevent atmospheric attack. The size of electrode is measured and designated by the diameter of the core wire in SWG andlength, apart from the brand and code names; indicating the purpose for which there are most suitable

Fig :3 Electrode holder

Fig :4 Ground Clamp

Fig :5Wire brush

Fig :6Chipping hammer

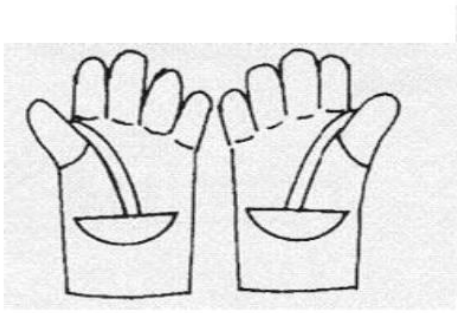


Fig :7Hand gloves

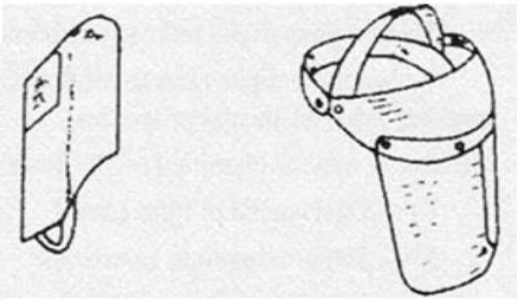


Fig :8Face shield

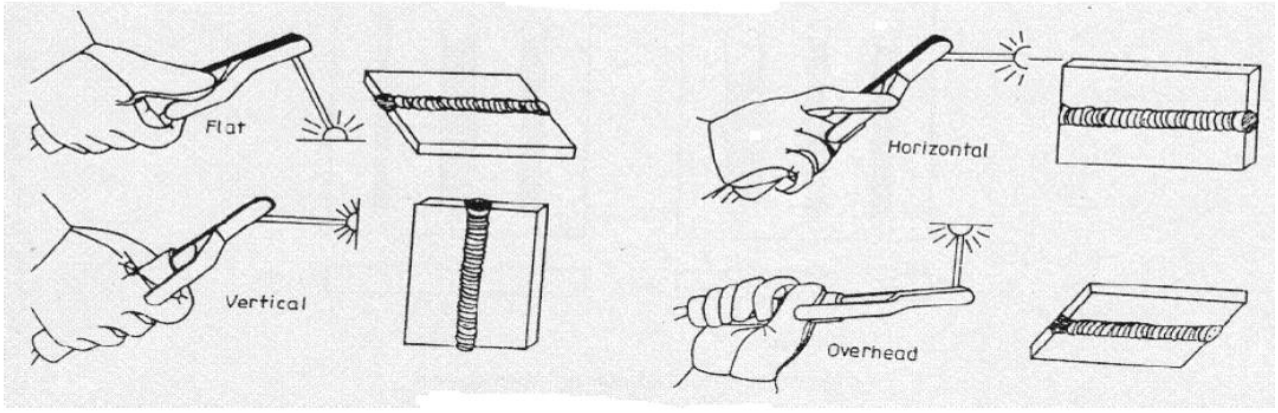


Fig :9Weld positions

WELDING TOOLS

Electrode holder

The electrode holder is connected to the end of the welding cable and holds the electrode. Itshould be light, strong and easy to handle and should not become hot while in operation. Figure shows one type of electrode holder. The jaws of the holder are insulated, offering protection from electric shock.

Ground clamp

It is connected to the end of the ground cable and is clamped to the work or welding table to complete the electric circuit. It should be strong and durable and give a low resistance connection.

Wire brush and chipping hammer

A wire brush is used for cleaning and preparing the work for welding. A chipping hammer is used for removing slag formation on welds. One end of the head is sharpened like a cold chisel and the other, to a blunt, round point. It is generally made of tool steel. Molten metal dispersed around the welding heads, in the form of small drops, is known as spatter. When a flux coated electrode is used in welding process, then a layer of flux material is formed over the welding bead which contains the impurities of weld material. This layer is known as slag. Removing the spatter and slag formed on and around the welding beads on the metal surface is known as chipping.

Welding table and cabin

It is made of steel plate and pipes. It is used for positioning the parts to be welded properly.

Welding cabin is made-up by any suitable thermal resistance material, which can isolate the surrounding by the heat and light emitted during the welding process. A suitable draught should also be provided for exhausting the gas produced during welding.

Face shield

A face shield is used to protect the eyes and face from the rays of the arc and from spatter or flying particles of hot metal. It is available either in hand or helmet type. The hand type is convenient to use wherever the work can be done with one hand. The helmet type though not comfortable to wear, leaves both hands free for the work.

Shields are made of light weight non-reflecting fiber and fitted with dark glasses to filter out the Harmful rays of the arc. In some designs, a cover glass is fitted in front of the dark lens to protect it from spatter.

Hand gloves

These are used to protect the hands from electric shocks and hot spatters

TECHNIQUES OF WELDING

Preparation of work

Before welding, the work pieces must be thoroughly cleaned of rust, scale and other foreign material. The piece for metal generally welded without beveling the edges, however, thick work pieceshould be beveled or veed out to ensure adequate penetration and fusion of all parts of the weld. But, in either case, the parts to be welded must be separated slightly to allow better penetration of the weld. Before commencing the welding process, the following must be considered

a) Ensure that the welding cables are connected to proper power source.

b) Set the electrode, as per the thickness of the plate to be welded.

c) Set the welding current, as per the size of the electrode to be used.

WELDING POSITIONS

Depending upon the location of the welding joints, appropriate position of the electrode and hand movement is selected. The figure shows different welding positions.

Flat position welding

In this position, the welding is performed from the upper side of the joint, and the face of the weld is approximately horizontal. Flat welding is the preferred term; however, the same position is sometimes called down hand.

Horizontal position welding

In this position, welding is performed on the upper side of an approximately horizontal surface and against an approximately vertical surface.

Vertical position welding

In this position, the axis of the weld is approximately vertical as shown in figure.

Overhead position welding

In this welding position, the welding is performed from the underside of a joint

EXPERIMENT NO: 03

LAP JOINT

Aim: To make a Lap joint, using the given two M.S pieces and by arc welding.

Material Supplied:

Mild steel plate of size 100X50X5 mm – 2 No's

Welding Electrodes: M.S electrodes 3.1 mm X350 mm

Welding Equipment: Air cooled transformer

Voltage-80 to 600 V,3-ϕ supply, Current up to 350Amps

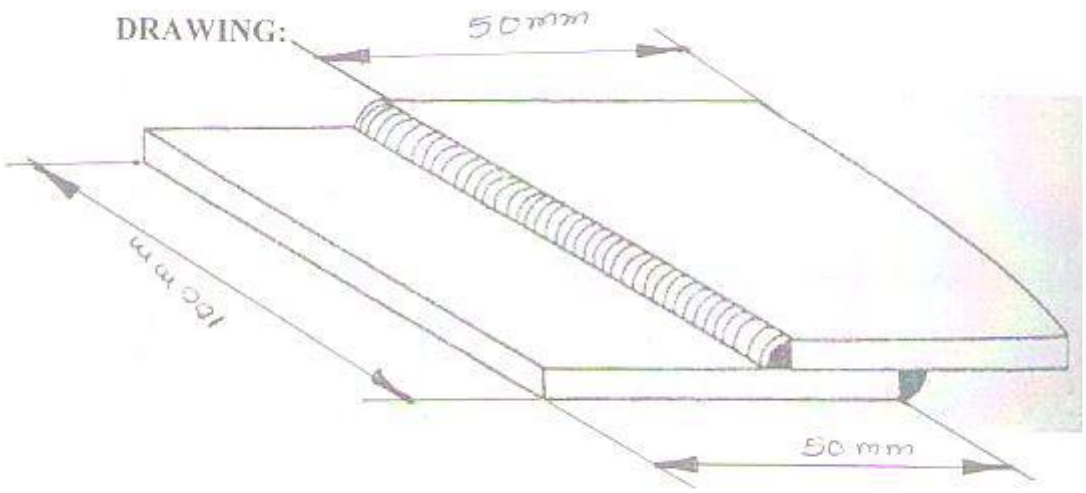
Tools and Accessories required:

1. Rough and smooth files.
2. Protractor
3. Arc welding machine (transformer type)
4. Mild steel electrode and electrode holder
5. Ground clamp
6. Tongs
7. Face shield
8. Apron
9. Chipping hammer.

Sequence of operations:

1. Marking
2. Cutting
3. Edge preparation (Removal of rust, scale etc.) by filling
4. Try square leveling
5. Tacking
6. Welding
7. Cooling
8. Chipping
9. Cleaning

DRAWING:



Procedure:

1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. The two pieces are positioned on the welding table such that, the two pieces overlapped one over the other as shown in drawing.
3. The electrode is fitted in the electrode holder and the welding current is ser to be a proper value.
4. The ground clamp is fastened to the welding table.
5. Wearing the apron and using the face shield, the arc is struck and the work pieces are tack-welded at both the ends and at the centre of the joint.
6. The alignment of the lap joint is checked and the tack-welded pieces are required.
7. The scale formation on the welds is removed by using the chipping hammer.
8. Filling is done to remove any spanner around the weld.

Result:

The Lap joint is thus made, using the tools and equipment as mentioned.