GOVT. CO-ED POLYTECHNIC RAIPUR

LAB MANUAL

SUBJECT- WORKSHOP PRACTICE (PRACTICAL)

SUBJECT CODE- 2000293(037)

YEAR/SEMESTER- 1ST/2ND

EXPERIMENT-1

Aim:- To study different types of measuring tools used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.

Procedure:- Describe in brief the following measuring tools with neat sketch mentioning their sizes & usage.

- Vernier caliper
- Micrometer (inside & outside)
- Vernier height gauge
- Vernier depth gauge
- Standard wire gauge
- Combination set
- Screw thread gauge
- Depth micrometer
- Radius gauge
- Caliper
- Try square
- Sine bar
- Bevel protector
- Dial indicator

Least count:- Least count of vernier caliper, micrometer, & vernier height gauge to be calculated.

Precautions:-

1. Measuring tools should not be mishandled.
2. Proper upkeep of measuring tool is necessary must be cleaned.
3. Tools before & after use kept in store
4. Tools should be calibrated after certain interval & accuracy determined.

CARPENTARY

INTRODUCTION:

Wood work or carpentry deals with making joints for a variety of applications like door frames, cabinet making furniture, packing etc.

WORK HOLDING TOOLS:

Carpentry vice:- It is a work holding device. When handle vice is turned in a clockwise direction, the sliding jar forces the work against the fixed sawn. The greater the force applied to the handle, the tighter to the work held.

Bar 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:

Try square:- It is used for marking and testing the square ness of planed surfaces. It consists of a steel blade, fitted in a cast iron stock. It is also used for flatness. The size of a try square used for varies from 150 mm to 300 mm, according to the length of the blade. It is less accurate when compared to the try square used in fitting shop.

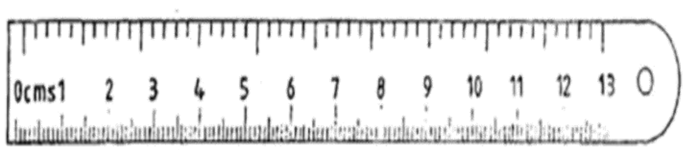


Fig: 1 steel rule

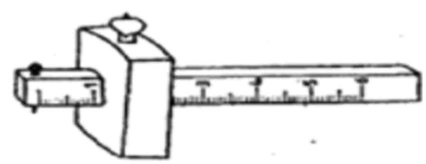


Fig: 2 marking Gauge

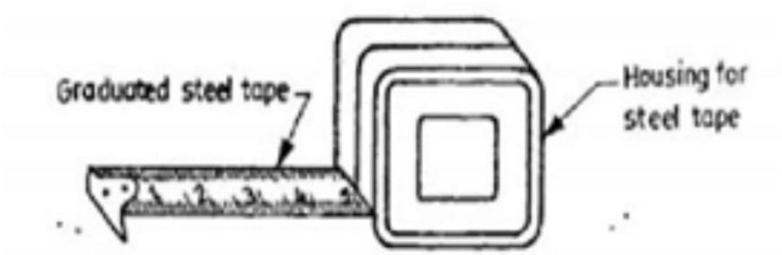


Fig: 3 steel tape

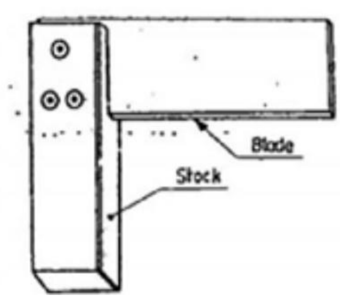
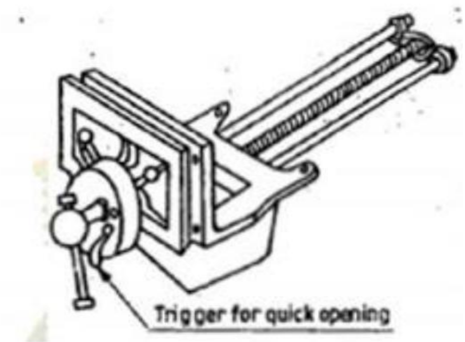


Fig: 4 Try square



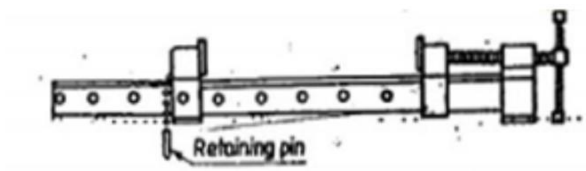
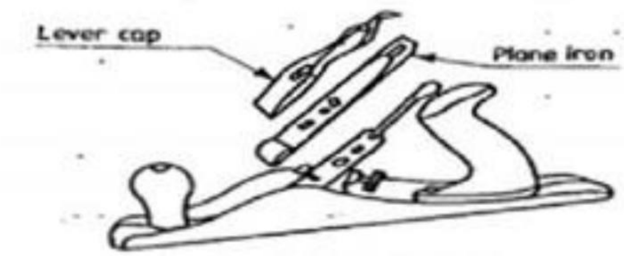


Fig: 5 carpenter vice Fig: 6 Bar clamp



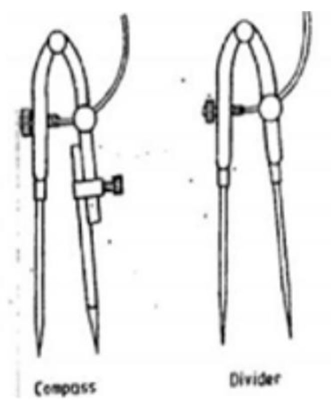


Fig: 7 metal jack plane Fig: 8 compass and divider

Marking gauge:-

It is a tool used to mark lines parallel to the edges of wooden pieces. It consists of a square wooden stem with a riding wooden stock on it. A marking pin, made of steel is fitted on the stem. A mortise gauge consists of two pins. In these it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.

Compass and dividers:-

This is used for marking circles, arcs, laying out perpendicular lines on the planed surface of the wood

CUTTING TOOLS:

Hack saw:-

It is used to cross cut the grains of the stock. The teeth are so set that the saw kerfs will be wider than the blade thickness. Hard blades are used to cut hard metals. Flexible blades are having the teeth of hardened and rest of the blade is soft and flexible.

Chisels:-

These are used for removing surplus wood. Chisels are annealed, hardened and tempered to produce a tough shank and a hard cutting edge.

Rip saw:-

It is used for cutting the stock along the grains. The cutting edge of this saw makes a sleeper angle about 60o whereas that saw makes an angle of 45o with the surface of the stock.

Tenon saw:-

It is used for cutting tenons and in fine cabinet works. The blade of this saw is very thin and so it is used stiffed with back strip. Hence, this is sometimes called back saw. The teeth shapes similar to cross cut saw.

DRILLING AND BORING TOOLS:

Auger bit:-

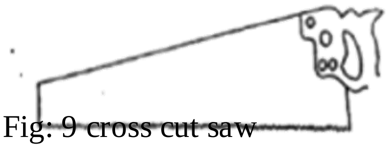
It is the most common tool used for boring holes with hard pressure.

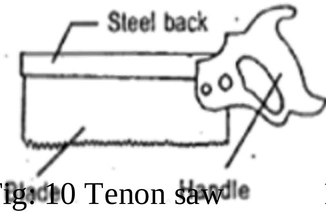
Gimlet:-

This is a hand tool used for boring holes with hand pressure.

Hand drill:-

Carpenters brace is used to make relatively large size holes, whereas hand drill is used for drilling small holes. A straight shank drill is used with these tools. It is small light in weight and may be conveniently used than the brace. The drill is clamped in the chuck.





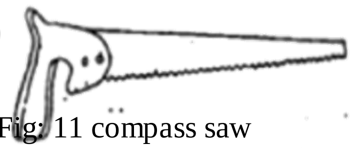
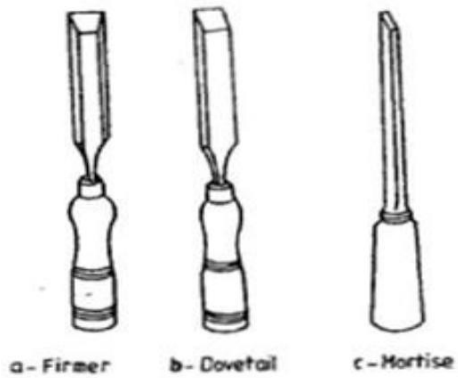


Fig: 9 cross cut saw Fig: 10 Tenon saw Fig: 11 compass saw



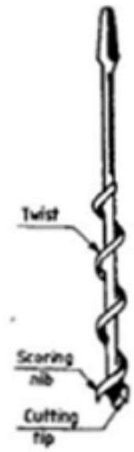


Fig: 12 Chisels Fig: 13 Carpenter’s brace Fig: 14 Auger bit

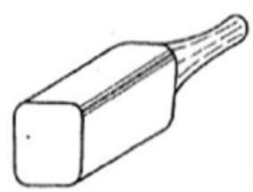
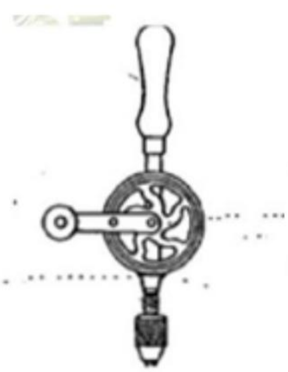


Fig: 15 Gimlet Fig: 16 wood rasp file Fig:17 Mallet



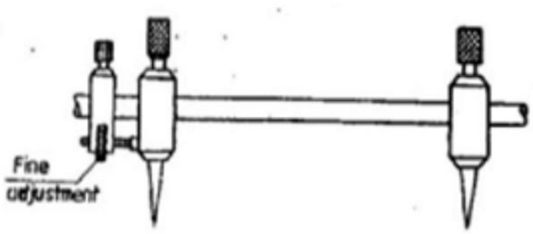


Fig: 18 Hand drill Fig: 19 Trammel Fig: 20 Claw hammer

EXPERIMENT NO: 2

Aim: - To make a T- lap joint

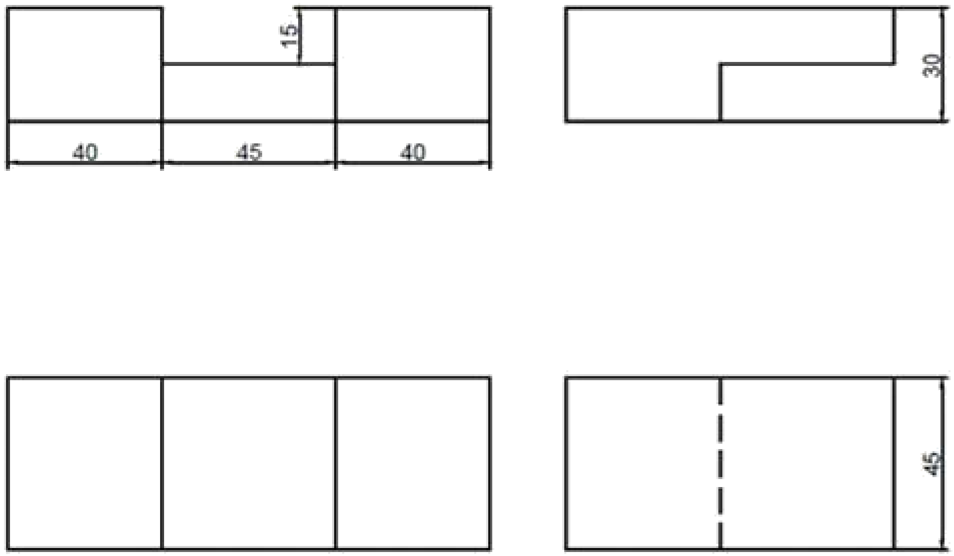
Tools required: -

1. Carpenter's vice
2. Steel Rule
3. Try square
4. Jack plane
5. Scriber
6. Cross cut saw
7. Marking gauge
8. Firmer chisel
9. Mallet
10. Wood rasp file and smooth file

Material required: - Wooden pieces of size 50 x 35 x 250 mm–2 Nos.

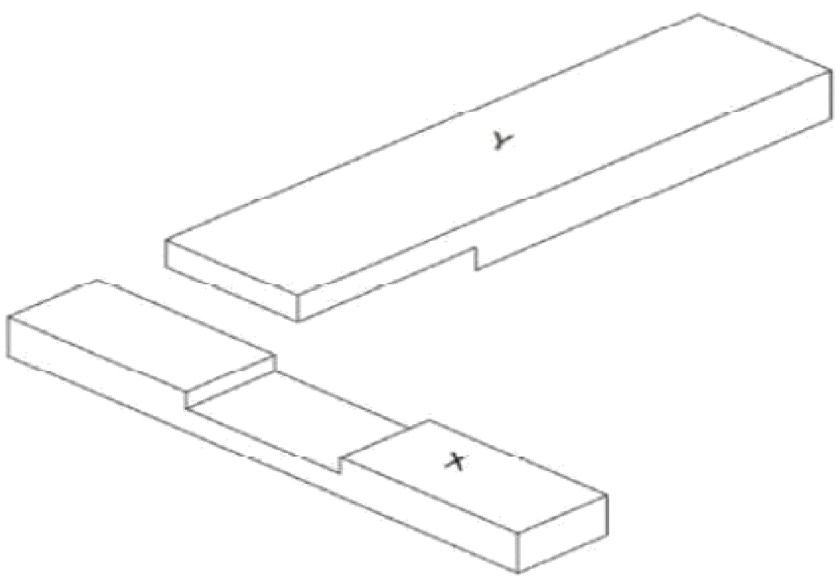
Sequence of operations: -

1. Measuring and Marking
2. Planning
3. Check for squareness
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing



T-LAP JOINT

ALL DIMENTIONS ARE IN MM



T-LAP JOINT

Procedure: -

1. The given reaper is checked for dimensions.
2. They are planed with jack plane and checked for straightness.
3. The two surfaces are checked for squareness with a try square.
4. Marking gauge is set and lines are marked at 30 and 45 mm to mark the thickness and width of the model respectively.
5. The excess material is first chiseled with firmer and then planned to correct size.
6. The mating dimensions of the parts X and Y are then marked using steel rule and marking gauge.
7. Using the crosscut saw, the portions to be removed are cut in both the pieces, followed by chiseling.
8. The ends of both the parts are chiseled to the exact lengths.
9. The fine finishing is given to the parts, if required so that, proper fitting is obtained.
10. The parts are fitted to obtain a slightly tight joint.

Safety precautions: -

1. Loose cloths are to be avoided.
2. Tools to be placed at their proper placed.
3. Hands should not be placed in front of sharp edged tools.
4. Use only sharp tools.
5. Care should be taken, when thumb is used as a guide in cross cutting and ripping.
6. Handle while chiseling, sawing and planning with care.

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

EXPERIMENT NO:3

Aim: - To make a Dovetail lap joint from the given reaper of size 50 x35 x250 mm.

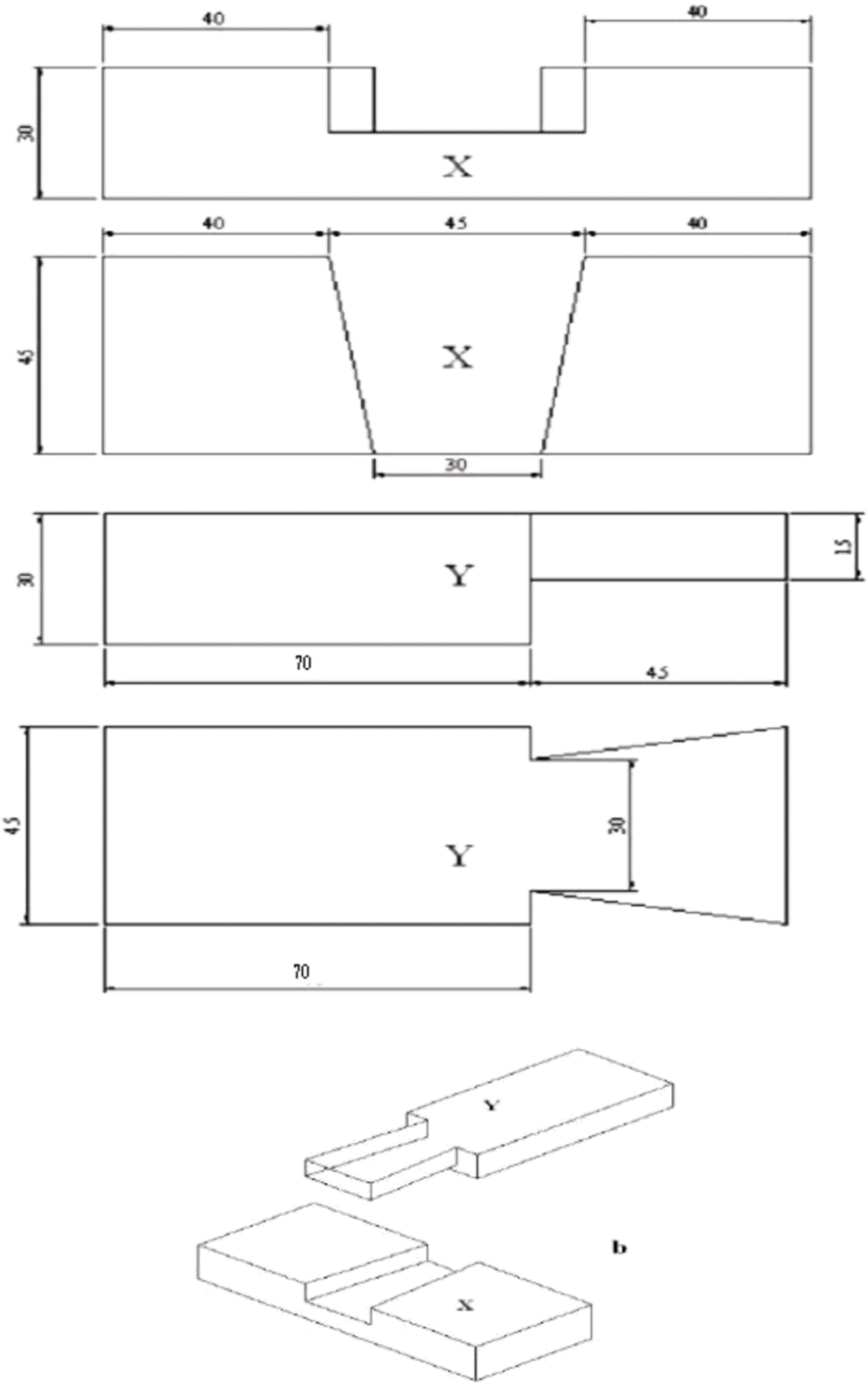
Tools required: -

1. Carpenter’s vice
2. Steel Rule
3. Try square
4. Jack plane
5. Scriber
6. Cross cut saw
7. Marking gauge
8. Firmer chisel
9. Mortise chisel
10. Mallet
11. Wood rasp file and smooth file

Material required: - Wooden pieces of size 50 x 35 x 250 mm–2 Nos.

Sequence of operations: -

1. Measuring and Marking
2. Planning
3. Check for square ness
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing



DOVETAIL LAP JOINT

Procedure: -

1. The given reaper is checked for dimensions.
2. They are planed with jack plane and checked for straightness.
3. The two surfaces are checked for square ness with a try square.
4. Marking gauge is set and lines are marked at 30 and 45 mm to mark the thickness and width of the model respectively.
5. The excess material is first chiseled with firmer chisel and then planned to correct size.
6. The mating dimensions of the parts X and Y are then marked using steel rule and marking gauge.
7. Using the crosscut saw, the portions to be removed are cut in both the pieces, followed by chiseling.
8. The ends of both the parts are chiseled to the exact lengths.
9. The fine finishing is given to the parts, if required so that, proper fitting is obtained.
10. The parts are fitted to obtain a slightly tight joint.

Safety precautions: -

1. Loose cloths are to be avoided.
2. Tools to be placed at their proper placed.
3. Hands should not be placed in front of sharp edged tools.
4. Use only sharp tools.
5. Care should be taken, when thumb is used as a guide in cross cutting and ripping.
6. Handle while chiseling, sawing and planning with care.

Result: - Dovetail lap joint is made as per the required dimensions.

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.

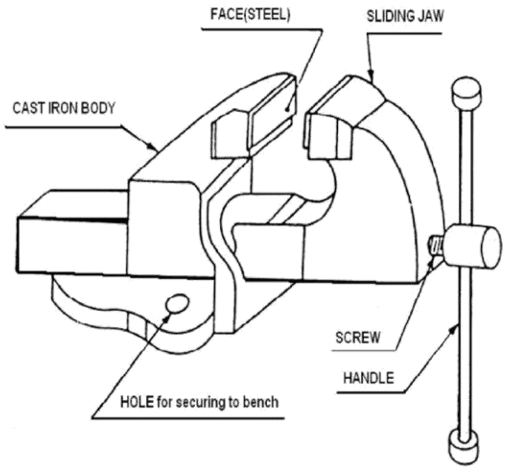
C-clamp:-

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.



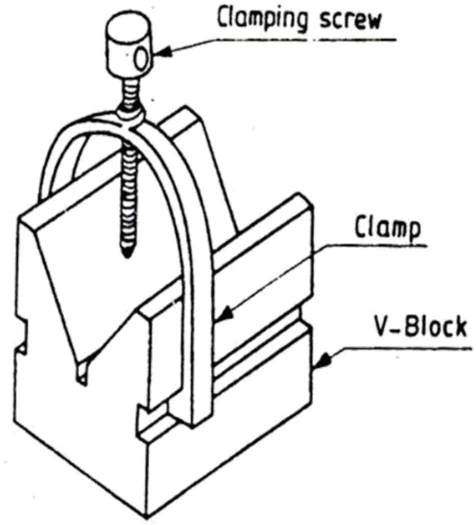
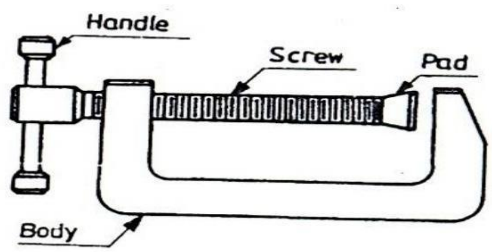


Fig: 1 Bench wise

Fig: 2 V- Block



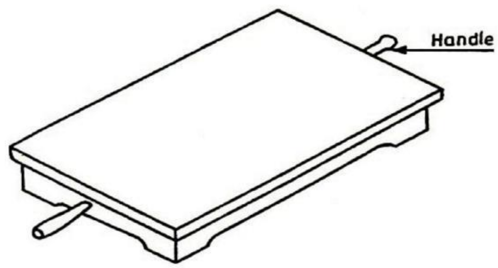
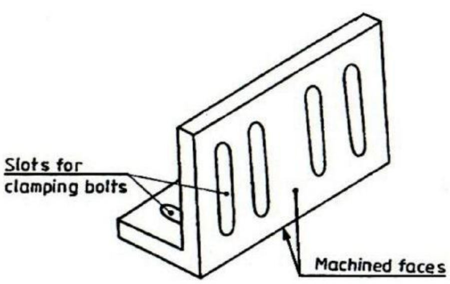


Fig: 3 C – Clamp

Fig: 4 Surface plate



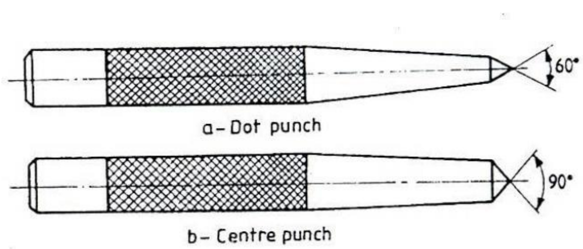
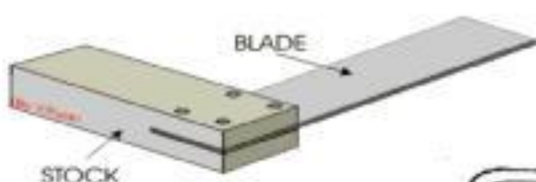


Fig: 5 Angle plate

Fig: 6 Dot punch



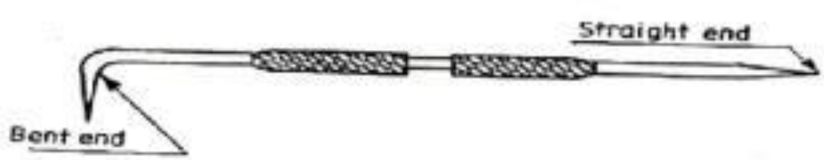


Fig: 7 try square

Fig: 8 scriber

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 $1/3^{rd}$ length in width and thickness.

Square file:-

Square in section and tapered for $1/3^{rd}$ length on all sides.

Half round file:-

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

Round file:-

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

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.

EXPERIMENT NO:4

Aim: - To make M.S Plate into required model by T-fitting.

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 34–2 Nos.

Sequence of Operations: -

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

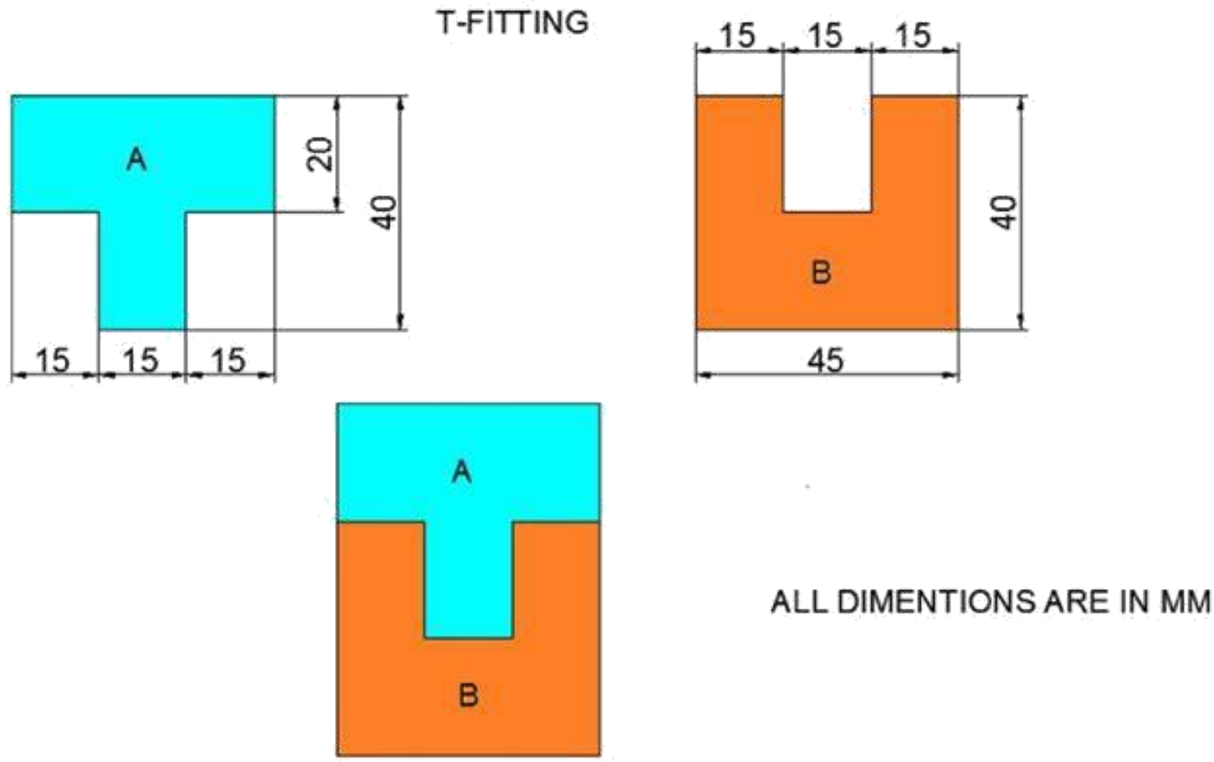


Fig: SQUARE (T) - FITTING

<u>Procedure</u>: -

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 square ness 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 the flat chisel, 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.

<u>Safety precautions</u>: -

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 hack saw 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.

<u>Result</u>: - T-fit is made as per the required dimensions.

EXPERIMENT NO:5

Aim: - To make M.S Plate into required model by V- fitting.

To make a V- fitting from the given two M.S pieces.

Tools required: -

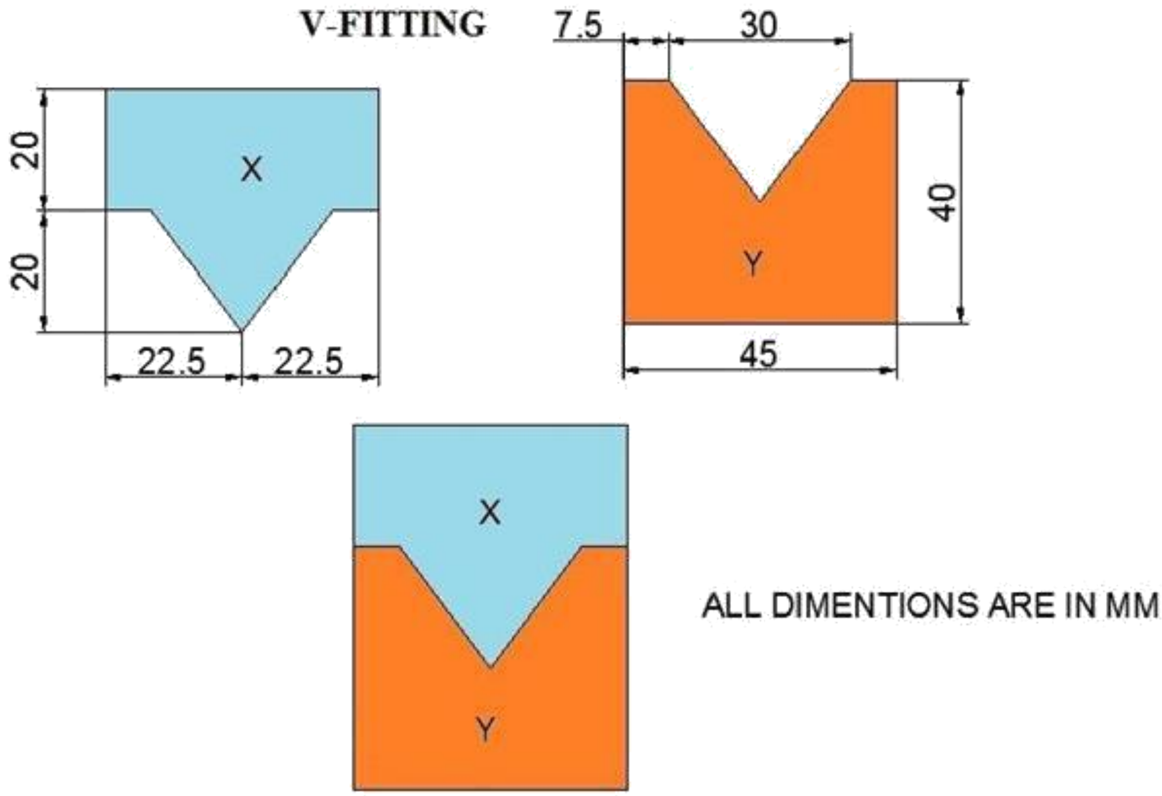
1. Bench vice
2. Steel rule
3. Try square
4. Ball peen hammer
5. Scriber
6. Hack saw with blade
7. Dot punch and Centre punch
8. Surface plate
9. Vernier height gauge
10. Rough and smooth flat files
11. Flat chisel and triangular file

Material required: - Mild steel (M.S) plate of size 48 x 34–2 Nos.

Sequence of Operations: -

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

V-FITTING



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 square ness 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 V-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 the flat chisel, 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 hack saw 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: - V- fit is made as per the required dimensions.

WELDING

INTRODUCTION

Welding is the process of joining similar metals by the application of heat, with or without application of pressure or filler metal, in such a way that the joint is equivalent in composition and characteristics of the metals joined. In the beginning, welding was mainly used for repairing all kinds of worn or damaged parts. Now, it is extensively used in manufacturing industry, construction industry (construction of ships, tanks, locomotives and automobiles) and maintenance work, replacing riveting and bolting, to a greater extent. The various welding processes are:

1. Electric arc welding,
2. Gas welding
3. Thermal welding
4. Electrical Resistance welding and
5. Friction welding

However, only electric arc welding process is discussed in the subject point of view.

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.

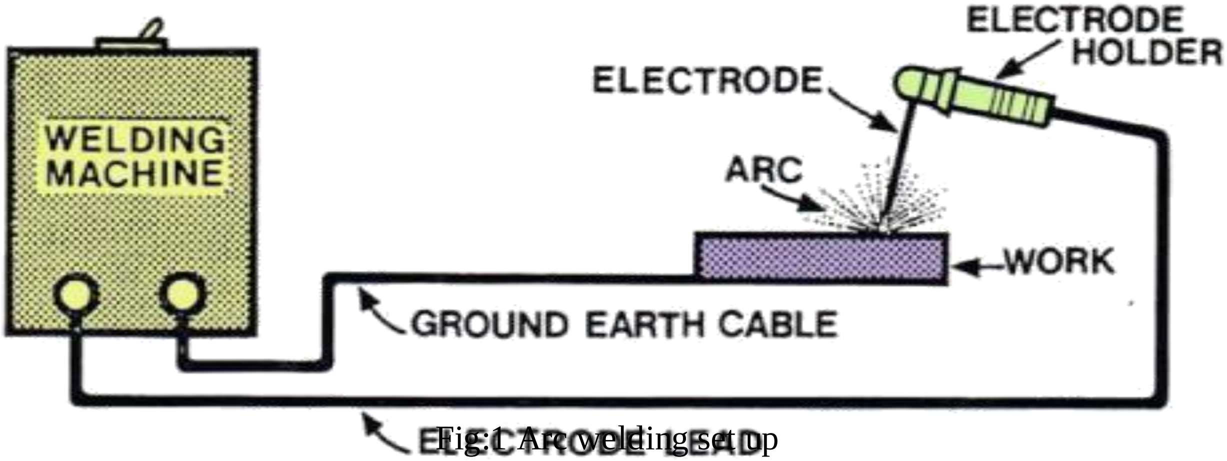


Fig:1 Arc welding set up

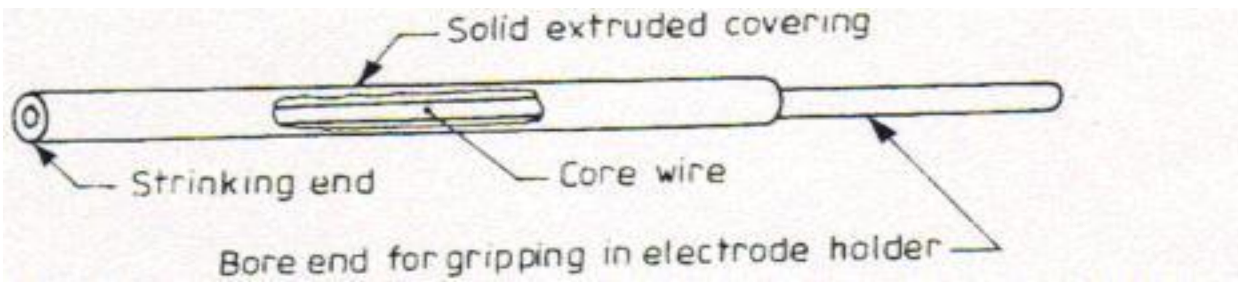


Fig :2 parts of an electrode

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 and length, apart from the brand and code names; indicating the purpose for which there are most suitable

Electrodes may be classified on the basis of thickness of the coated flux. As

1. Dust coated or light coated
2. Semi or medium coated and
3. Heavily coated or shielded

1. Metallic and
2. Non-metallic or carbon
3. Ferrous metal arc electrode (mild steel, low/medium/high carbon steel, cast iron, stainless steel, etc)
4. Non-ferrous metal arc electrodes (copper, brass, bronze, aluminum, etc).
5. In case of non-metallic arc electrodes, mainly carbon and graphite are used to make the electrodes.

WELDING TOOLS

Fig: 3 Electrode holder

Fig: 4 Ground Clamp

Fig: 5 Wire brush

Fig: 6 Chipping hammer

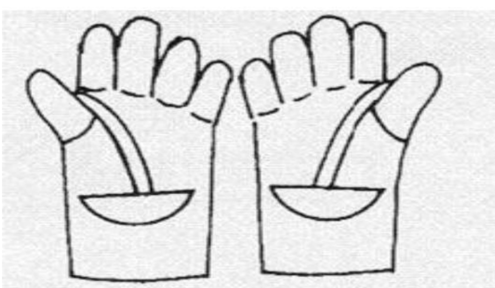


Fig : 7 Hand gloves

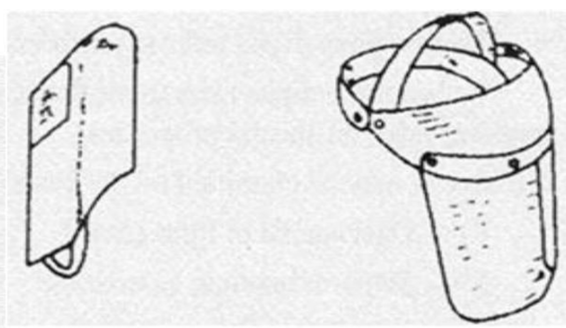


Fig :8Face shield

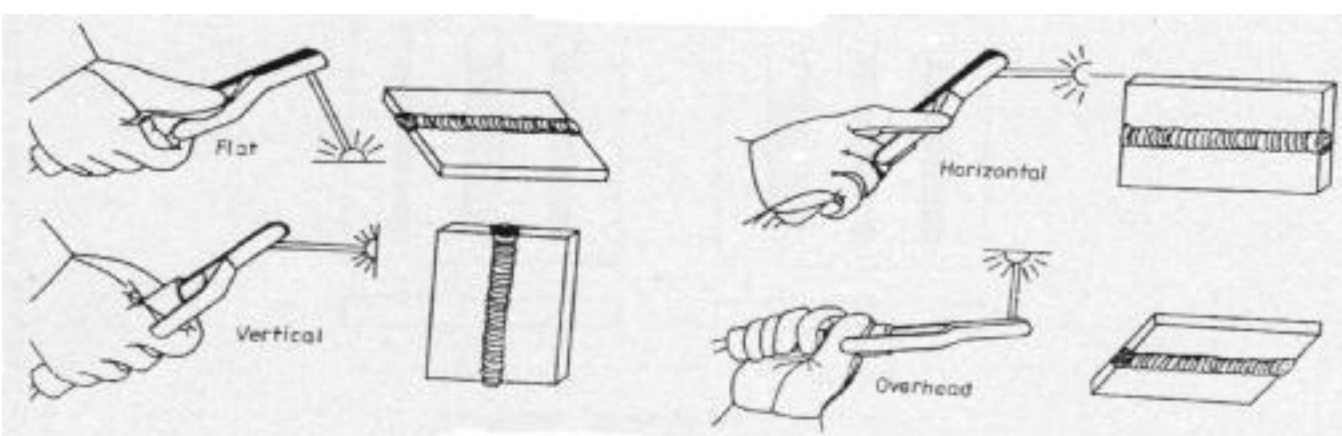


Fig : 9 Weld positions

Electrode holder

The electrode holder is connected to the end of the welding cable and holds the electrode. It should 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

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:6

Aim:- To make a double lap joint, using the given mild steel pieces and by arc welding.

Material used: Two mild steel pieces of 100X40X6 mm.

Tools and equipment used

1. Arc welding machine,
2. Mild steel electrodes,
3. Electrode holder,
4. Ground clamp,
5. flat nose Tong,
6. Face shield,
7. Apron,
8. Hand gloves,
9. Metallic work Table,
10. Bench vice,
11. Rough flat file,
12. Try square,
13. Steel rule,
14. Wire brush,
15. Ball peen hammer,
16. Chipping hammer.

Operations to be carried out

1. Cleaning the work pieces
2. Tack welding
3. Full welding
4. Cooling
5. Chipping
6. Finishing

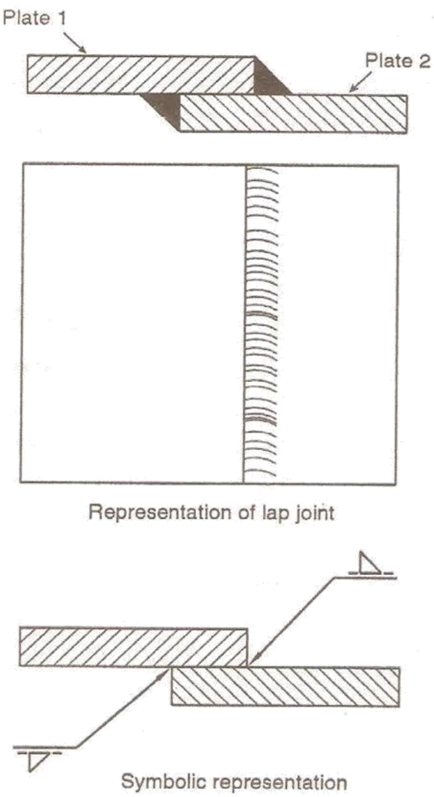


Fig: lap joint

Procedure

1. Take the two mild steel pieces of given dimensions and clean the surfaces thoroughly from rust, dust particles, oil and grease.
2. Remove the sharp corners and burrs by filing or grinding and prepare the work pieces.
3. The work pieces are positioned on the welding table, to form a lap joint with the required over lapping.
4. The electrode is fitted in to the electrode holder and the welding current is set to a proper value.
5. The ground clamp is fastened to the welding table.
6. Wearing the apron, hand gloves, using the face shield and holding the over lapped pieces the arc is struck and the work pieces are tack-welded at the ends of both the sides
7. The alignment of the lap joint is checked and the tack-welded pieces are reset, if required.
8. Welding is then carried out throughout the length of the lap joint, on both the sides.
9. Remove the slag, spatters and clean the joint.

Precautions:

1. Use goggles, gloves in order to protect the human body.
2. Maintain the constant arc length.

Result The lap joint is thus made, using the tools and equipment as mentioned above.

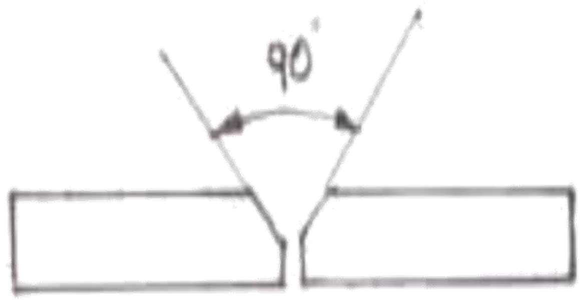
EXPERIMENT No:7

Aim: preparation of butt joint as shown in figure using shielded metal arc welding process.

Material required: 2m.s flat pieces of given size.

Tools required:

1. welding transformer,
2. connecting cables,
3. electrode holder,
4. ground clamp,
5. electrodes,
6. hipping hammer,
7. Welding shield etc.



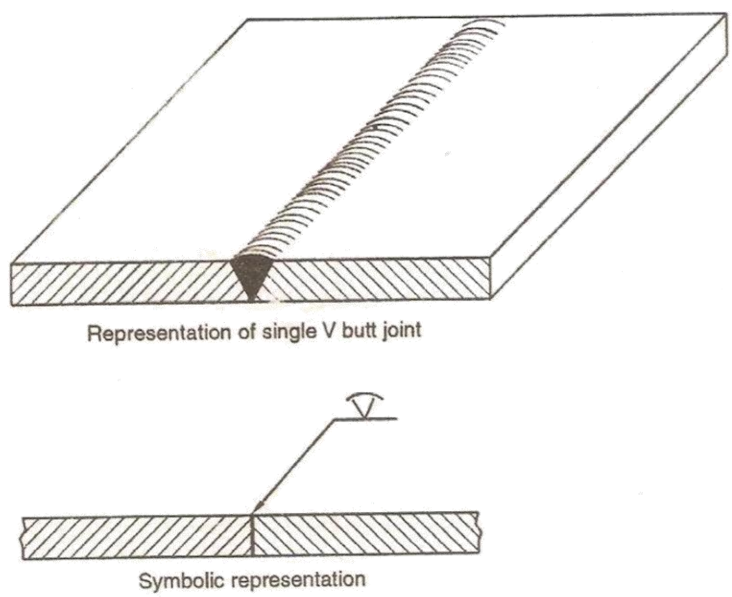


Fig- V – butt joint

Procedure:

1. The given metallic pieces filled to the desired size.

2. On both pieces beveled in order to have V groove.

3. The metallic pieces are thoroughly cleaned from rust grease, oil, etc.

4. The metallic pieces are connected to terminals of Trans former.

5. Select electrode diameter based on thickness of work piece and hold it on the electrode holder. Select suitable range of current for selected dia.

6. Switch on the power supply and initiates the arc by either striking arc method or touch and drag method.

7. Take welding to be done before full welding.

8. In full welding process after completion one part before going to second part. Slag is removed from the weld bed. With the metal wire brush or chipping hammer.

9. Then the above process will be repeated until to fill the groove with weld bed or weld

Metal.

Precautions:

1. Use goggles, gloves in order to protect the human body.

2. Maintain the constant arc length.

Result: butt joint is prepared as shown in figure by using arc-welding process.

MACHINE SHOP

INTRODUCTION

In a machine shop, metals are cut to shape on different machine tools. A lathe is used to cut and shape the metal by revolving the work against a cutting tool. The work is clamped either in a chuck, fitted on to the lathe spindle or in between the centers. The cutting tool is fixed in a tool post, mounted on a movable carriage that is positioned on the lathe bed. The cutting tool can be fed on to the work, either lengthwise or crosswise. While turning, the chuck rotates in counter clockwise direction, when viewed from the tail stock end.

Principal parts of a Lathe

Figure 4.1 shows a center lathe, indicating the main parts. The name is due to the fact that work pieces are held by the centers.

Bed

It is an essential part of a lathe, which must be strong and rigid. It carries all parts of the machine and resists the cutting forces. The carriage and the tail stock move along the guide ways provided on the bed. It is usually made of cast iron.

Head stock

It contains either a cone pulley or gearings to provide the necessary range of speeds and feeds. It contains the main spindle, to which the work is held and rotated.

Tail stock

It is used to support the right hand end of a long work piece. It may be clamped in any position along the lathe bed. The tail stock spindle has an internal Morse taper to receive the dead center that supports the work. Drills, reamers, taps may also be fitted into the spindle, for performing operations such as drilling, reaming and tapping.

Carriage or Saddle

It is used to control the movement of the cutting tool. The carriage assembly consists of the longitudinal slide, cross slide and the compound slide and apron. The cross slide moves across the length of the bed and perpendicular to the axis of the spindle. This movement is used for facing and to provide the necessary depth of cut while turning. The apron, which is bolted to the saddle, is on the front of the lathe and contains the longitudinal and cross slide controls.

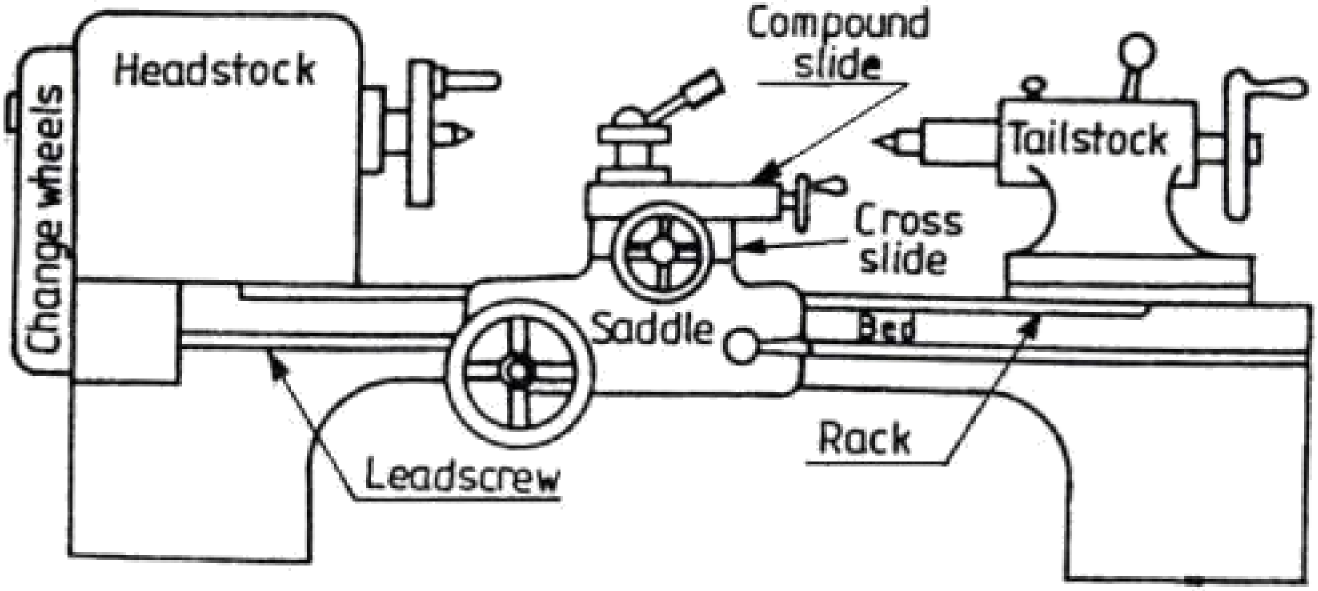
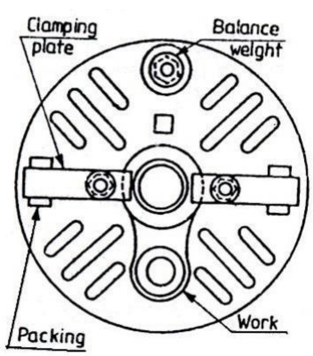
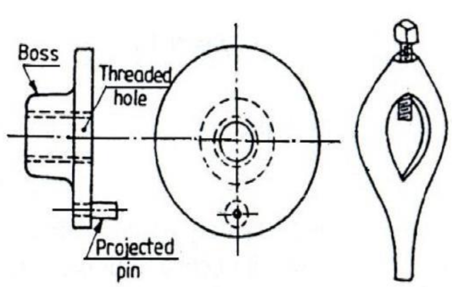


Fig:1 Parts of a center Lathe

Fig:2 three jaw and four jaw chuck





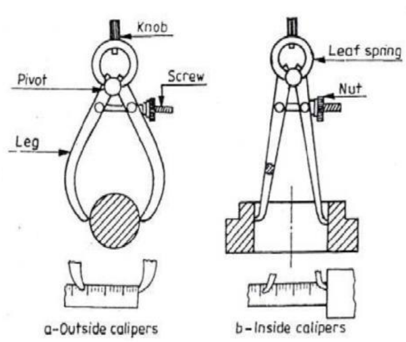


Fig:3 face plate **Fig :4 lathe dog and driving plate** **Fig: 5 calipers**

Compound Rest

It supports the tool post. By swiveling the compound rest on the cross slide, short tapers may be turned to any desired angles.

Tool Post

The tool post, holds the tool holder or the tool, which may be adjusted to any working position.

Lead Screw

It is a long threaded shaft, located in front of the carriage, running from the head-stock to the tail stock. It is geared to the spindle and controls the movement of the tool, either for automatic feeding or for cutting threads.

Centers

There are two centers known as dead center and live center. The dead center is positioned in the tail stock spindle and the live center, in the head-stock spindle. While turning between centers, the dead center does not revolve with the work while the live center revolves with the work holding devices

1. Three jaw chuck

It is a work holding device having three jaws (self-centering) which will close or open with respect to the chuck center or the spindle center, as shown in figure. It is used for holding regular objects like round bars, hexagonal rods, etc.

Face plate

It is a plate of large diameter, used for turning operations. Certain types of work that cannot be held in chucks are held on the face plate with the help of various accessories.

Lathe dogs and driving plate

These are used to drive a work piece that is held between centers. These are provided with an opening to receive and clamp the work piece and dog tail, the tail of the dog is carried by the pin provided in the driving plate for driving the work piece.

MEASURING INSTRUMENTS

1. outside and inside Calipers

Firm joint or spring calipers are used for transfer of dimensions with the help of a steel rule.

2. Vernier Calipers

Vernier caliper is a versatile instrument with which both outside and inside measurements may be made accurately. These instruments may have provision for depth measurement also.

3. Micrometers

Outside and inside micrometers are used for measuring components where greater accuracy is required.

CUTTING PARAMETERS

1. Cutting speed

It is defined as the speed at which the material is removed and is specified in meters per minute. Ti depends upon the work piece material, feed, depth of cut, type of operation and so many other cutting conditions. It is calculated from the relation,

Spindle speed (RPM) = cutting speed x 1000 / (πD)

Where D is the work piece diameter in mm.

2. Feed

It is the distance traversed by the tool along the bed, during one revolution of the work. Its value depends upon the depth of cut and surface finish of the work desired.

3. Depth of Cut

It is the movement of the tip of the cutting tool, from the surface of the work piece and perpendicular to the lathe axis. Its value depends upon the nature of operation like rough turning or finish turning.

TOOL MATERIALS

General purpose hand cutting tools are usually made from carbon steel or tool steel. The single point lathe cutting tools are made of high speed steel (HSS).the main alloying elements in 18-4-1 HSS tools are 18 percent tungsten, 4 percent chromium and 1 percent vanadium.5 to 10 percent cobalt is also added to improve the heat resisting properties of the tool. Carbide tipped tools fixed in tool holders, are mostly used in production shops.

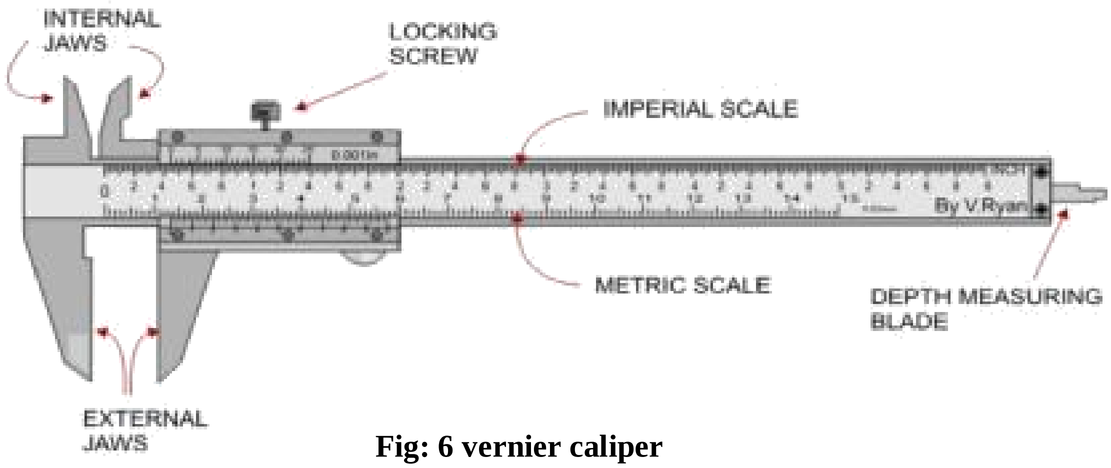


Fig: 6 vernier caliper

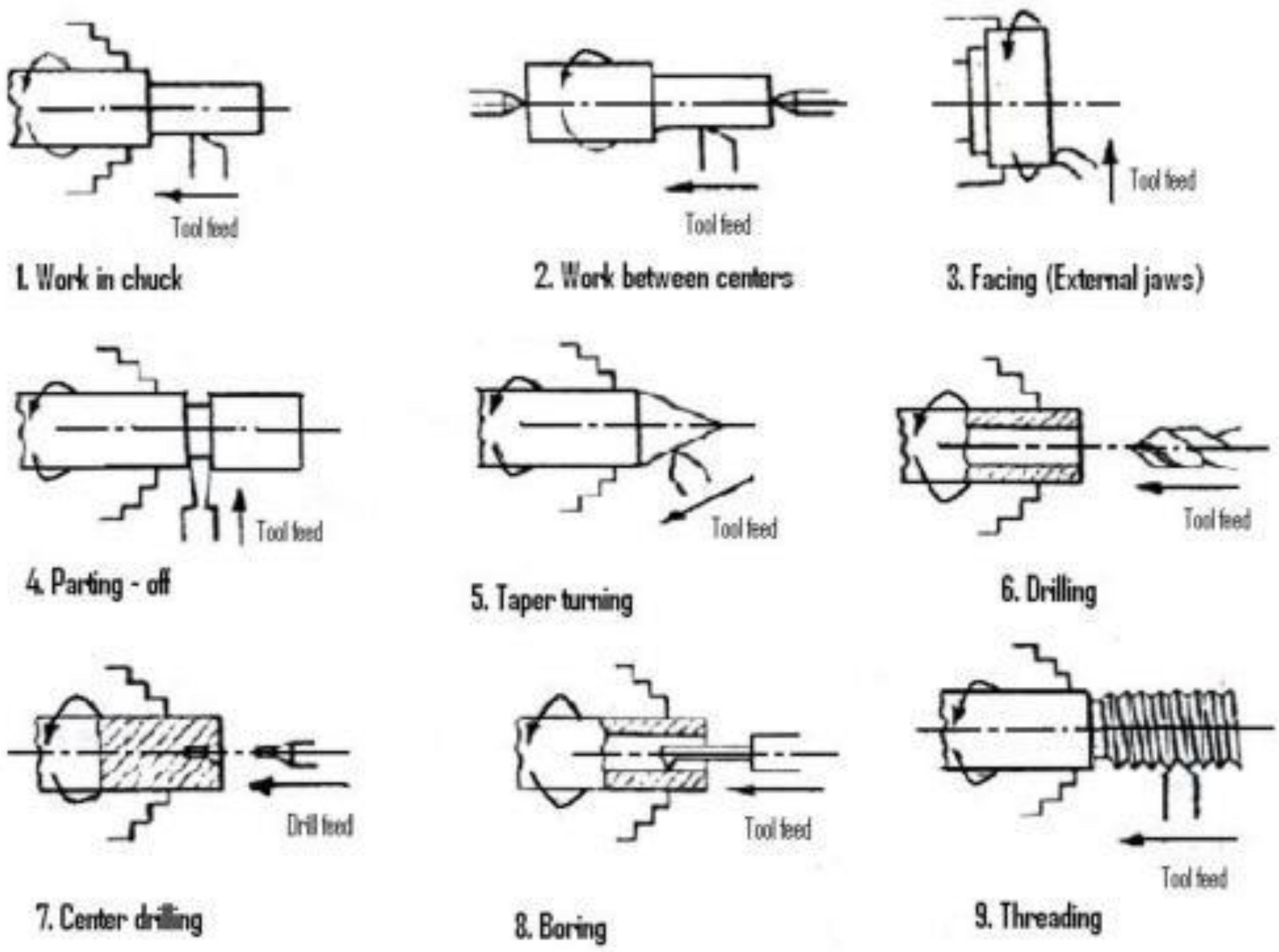


Fig: 7 operations on lathe

LATHE OPERATIONS

1. Turning

Cylindrical shapes, both external and internal, are produced by turning operation. Turning is the process in which the material is removed by a traversing cutting tool, from the surface of a rotating work piece. The operation used for machining internal surfaces is often called the boring operation in which a hole previously drilled is enlarged. For turning long work, first it should be faced and center drilled at one end and then supported by means of the tail-stock centre.

2. Boring

Boring is enlarging a hole and is used when correct size drill is not available. However, it should be noted that boring cannot make a hole.

3. Facing

Facing is a machining operation, performed to make the end surface of the work piece, flat and perpendicular to the axis of rotation. For this, the work piece may be held in a chuck and rotated about the lathe axis. A facing tool is fed perpendicular to the axis of the lathe. The tool is slightly inclined towards the end of the work piece.

4. Taper Turning

A taper is defined as the uniform change in the diameter of a work piece, measured along its length. It is expressed as a ratio of the difference in diameters to the length. It is also expressed in degrees of half the included (taper) angle. Taper turning refers to the production of a conical surface, on the work piece on a lathe. Short steep tapers may be cut on a lathe by swiveling the *compound rest* to the required angle. Here, the cutting tool is fed by means of the compound slide feed handle. The work piece is rotated in a chuck or face plate or between centers.

5. Drilling

Holes that are axially located in cylindrical parts are produced by drilling operation, using a twist drill. For this, the work piece is rotated in a chuck or face plate. The tail stock spindle has a standard taper. The drill bit is fitted into the tail stock spindle directly or through drill chuck. The tail stock is then moved over the bed and clamped on it near the work. When the job rotates, the drill bit is fed into the work by turning the tail stock hand wheel.

6. Knurling

It is the process of embossing a diamond shaped regular pattern on the surface of a work piece using a special knurling tool. This tool consists of a set of hardened steel rollers in a holder with the teeth cut on their surface in a definite pattern. The tool is held rigidly on the tool post and the rollers are pressed against the revolving work piece to squeeze the metal against the multiple Cutting edges. The purpose of knurling is to provide an effective gripping surface on a work piece to prevent it from slipping when operated by hand.

7. Chamfering

It is the operation of beveling the extreme end of a work piece. Chamfer is provided for better look, to enable nut to pass freely on threaded work piece, to remove burrs and protect the end of the work piece from being damaged.

8. Threading

Threading is nothing but cutting helical groove on a work piece. Threads may be cut either on the internal or external cylindrical surfaces. A specially shaped cutting tool, known as thread cutting tool, is used for this purpose. Thread cutting in a lathe is performed by traversing the cutting tool at a definite rate, in proportion to the rate at which the work revolv