ENGINEERING WORKSHOP PRACTICE MANUAL

GOVERNMENT POLYTECHNIC PURNEA

DEPARTMENT OF MECHANICAL ENGINEERING

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ACKNOWLEDGEMENT

This **"ENGINEERING WORKSHOP PRACTICE MANUAL**" is a work of continuous effort, support and dedication of all the members of the workshop.
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CONTENTS

UNIT - I

CARPENTARY

INTRODUCTION:

Carpentry (Woodwork) is defined as the process of making wooden components of desired shape. Carpentry is the art of marking, cutting, finishing, and joining of wood.

Wood is a natural construction material which is obtained from trees. Wood (Timber) has been used for many centuries for the construction of furniture, doors, windows, roofs, decorative items etc. The common types of well recognized timbers available in India are Shisham, Sal, Teak, Deodar, Mango, Mahogany, Chid, Babul, Fir wood etc.

CARPENTARY TOOLS

The following are the different tools used in carpentry shop.

MARKING AND MEASURING TOOLS

Accurate marking and measurement is very essential in carpentry work, to produce parts to exact size. To transfer dimensions on to the work; the following are the marking and measurement tools that are required in carpentry shop.

Steel Rule

It is an important tool for linear measurement .it can also be used as a marking tool (Fig.1.1).

Fig. 1.1 Steel rule

Marking Gauge

It is a tool used to mark lines parallel to the edge of a wooden piece .it consists of a square wooden Stem with a sliding wooden stop (head) on it on the stem is fitted a marking pin, made of steel. the stock is set at any desired distance from the marking point and fixed in position by a screw .it must be ensured that the marking pin projects through the stem, about 3mm and the end is sharp enough to make a very fine line (Fig.1.3a).A mortise Gauge (Fig.1.3b) consist of two pins. In this it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.

Fig. 1.3 Marking and mortise gauge

Try square

It is used for marking and testing the squareness and straightness of planed surfaces. It consists of a steel blade, fitted in a cast iron stock. It is also used for checking the planed surfaces for flatness (Fig.1.4).its size varies from 150 to 300mm, according to the length of the blade. It is less accurate when compared to the try square used in the fitting shop.

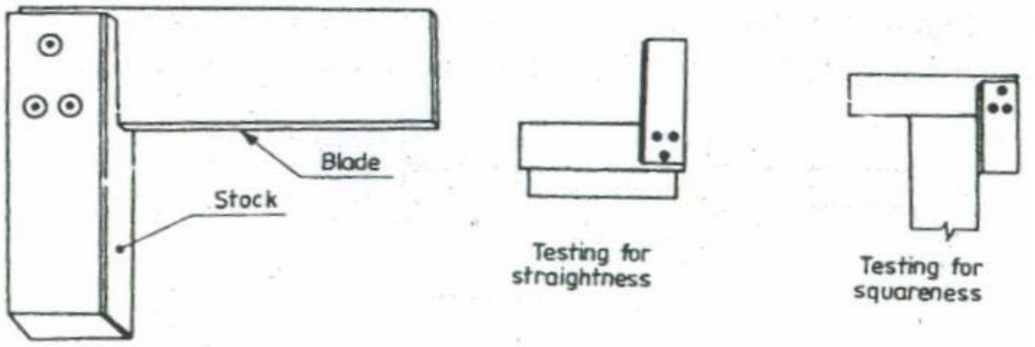


Fig. 1.4 Try square

Compass and Divider

Compass and divider, as shown in Fig.1.5, are used for marking arcs and circles on the planed surfaces of the wood.

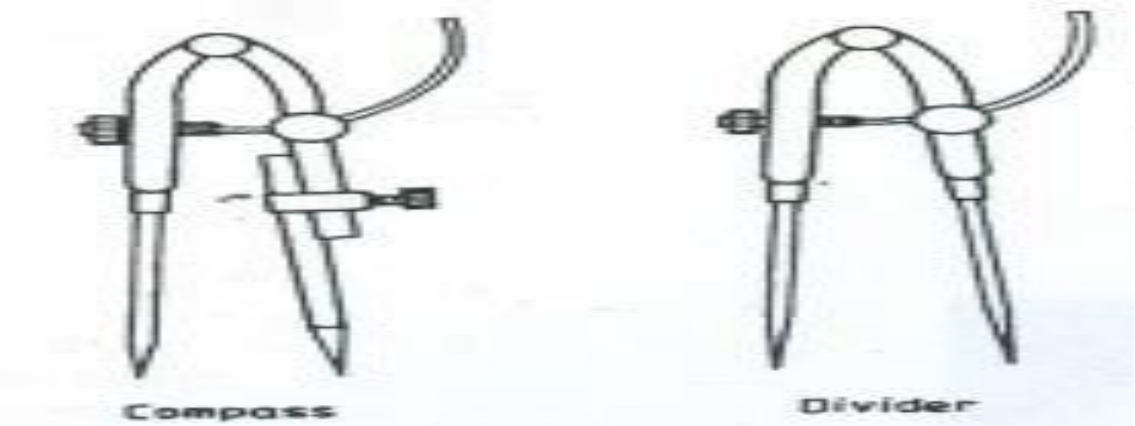


Fig. 1.5 Compass and divider

WORK HOLDING TOOLS

These are the tools used to hold the work piece on operations to be done.

Carpenter Vice

Figure 1.8 shows the carpenters Bench Vice, used as a work holding device in a carpenter shop. It's one jaw is fixed to the side of the table while the other jaw is movable by means of a screw and a handle. The jaws are lined with hard wooden faces.

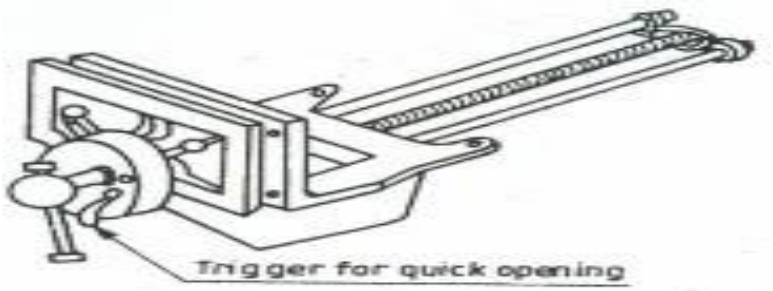


Fig. 1.8 Carpenter's vice

C-Clamp

Figure given below shows C-clamp, it is used for holding small works.

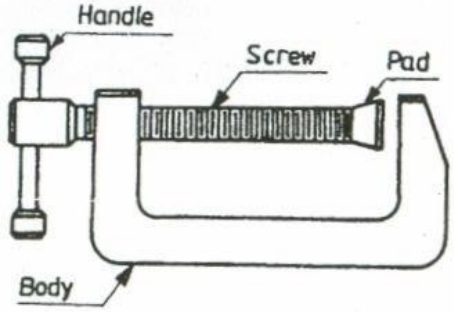


Fig. C-Clamp

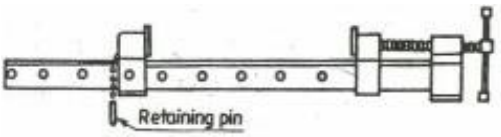


Fig. 1.9 Bar cramp

Bar cramp

Figure 1.9 shows a Bar cramp. It is made of steel bar of T-section, with malleable iron fittings and a steel screw .it is used for holding wide works such as frames or tops.

PLANNING TOOLS

Planning is the operation used to produce flat surfaces on wood. A plane is hand tool used for the purpose. The cutting blade used in a plane is very similar to chisel. The Blade of a plane is fitted in wooden or metallic block, at an angle.

Jack plane

It is the most commonly used general purpose plane .it is about 35cm long. The cutting iron (blade) should have a cutting edge of slight curvature. It is used for quick removal of material on rough work and is also used in oblique planning.

Smoothing plane
It is used for finishing work and hence, the blade should have a straight cutting edge. It is about 20 to 25cm long. Being short, it can follow even though slight depression in the stock, better than the jack plane. it is used after using the jack plane.

Rebate plane
It is used for making a rebate. A rebate is a recess along the edge of a piece of wood, which is generally used for positioning glass in frames and doors.

Plough plane
It is used to cut grooves, which are used to fix panels in a door. Figure 1.10 shows the various types of planes mentioned above.

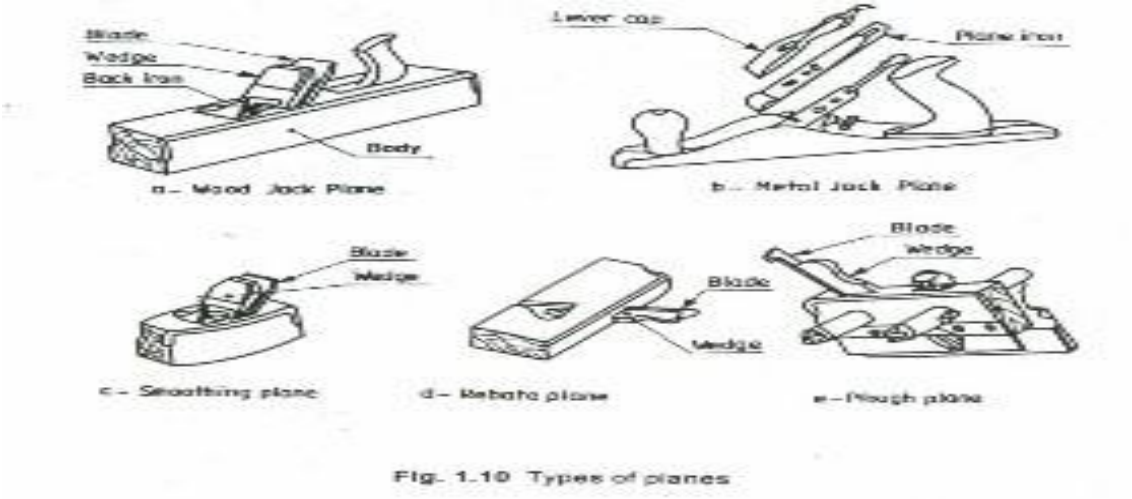


Fig. 1.10 Types of planes

CUTTING TOOLS
Cutting tools are used for wood cutting

Saws
A saw is used to cut wood into pieces .there are different types of saws, designed to suit different purposes .a saw is specified by the length of its toothed edge.

Cross- cut / Hand saw
It is used to cut across the grains of the stock. The teeth are so set that the saw kerfs will be wider than the blade thickness (Figs.1.11a and b). This allows the blade to move freely in the cut without sticking.

Rip saw
It is used for cutting the stock along the grains. The cutting edge of the saw makes a steeper angle, i.e., about 60^0 (Fig.1.11c), where as that of cross cut saw makes an angle of 45^0 with the surface of stock.

Tenon saw

It is used for cutting the stock either along or across the grains. It is used for cutting tenons and in fine cabinet work. However it is used for small and thin cuts. The blade of the saw is very thin and so it is stiffen with thick back steel handle. Hence, this is sometimes called as back- saw (Fig.1.12).in this; the teeth are shaped like those of cross- cut saw.

Compass saw

It has a narrow, longer and stronger tapering blade, which is used for heavy works (Fig.1.13).it is mostly used in radius cutting .the blade of the saw is fitted with an open type wooden handle.

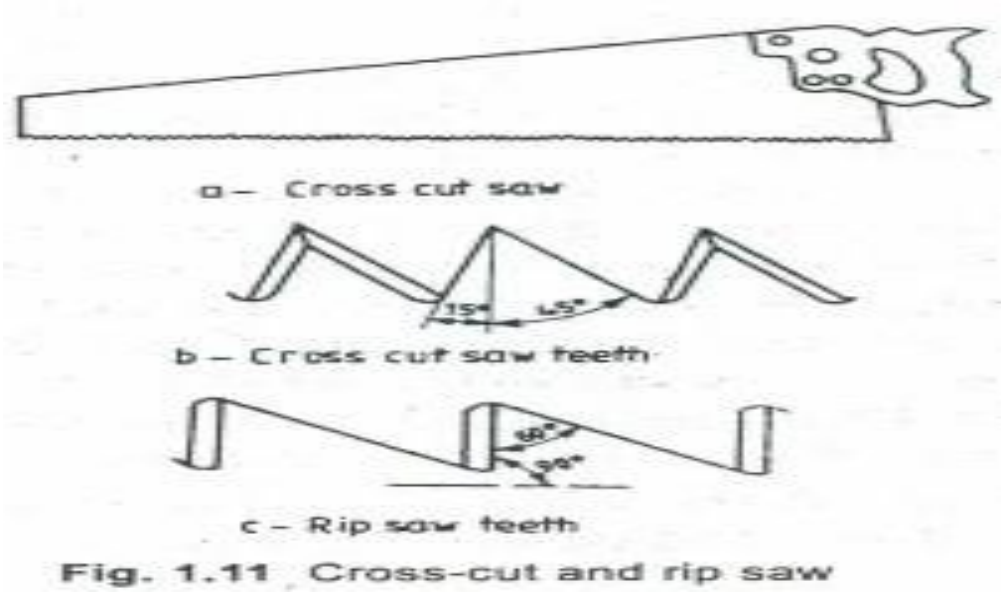


Fig. 1.11 Cross-cut and rip saw

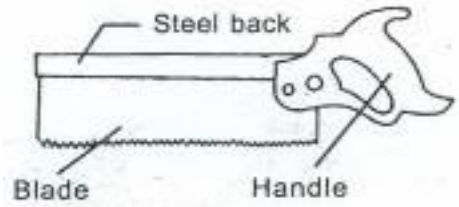


Fig. 1.12 Tenon saw

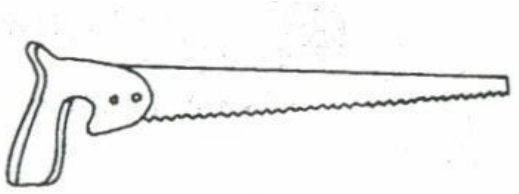


Fig. 1.13 Compass saw

Chisels

Chisels are used for cutting and shaping wood accurately. Wood chisels are made in various blade widths, ranging from 3 to 50mm.They are also made into tang type, having a steel shank which fits inside the handle (fig.1.14).These are made of forged steel or tool steel blades.

Firmer Chisel

The word ‘firmer’ means ‘stronger’ and hence firmer chisel is stronger than other chisels. It is a general purpose chisel and is used either by hand pressure or by a mallet.

The blade of a firmer chisel is flat, as shown in fig.1.15a.

Fig. 1.15 Chisels

Dovetail Chisel

It has a blade with a beveled back, as shown in fig.1.15b, due to which it can enter sharp corners for finishing, as in dovetail joints.

Mortise Chisel

It is used for cutting mortises and chipping inside holes, etc.The cross-section of the mortise chisel is proportioned to withstand heavy blows during mortising (fig.1.15c).Further; the cross-section is made stronger near the shank.

DRILLING AND BORING TOOLS

These tools are used for making hole in the workpiece

Carpenter's Brace

It is used for rotating auger bits, twist drills, etc., to produce holes in wood (Fig.1.16).In some designs, braces are made with ratchet device. With this, holes may be made in a corner where complete revolution of the handle cannot be made. The size of a brace is determined by its sweep.

Auger Bit

It is the most common tool used for making holes in wood. During drilling, the lead screw of the bit guides into the wood, necessitating only moderate pressure on the brace. The helical flutes on the surface carry the chips to the outer surface (Fig.1.17).

Hand Drill

Carpenter's 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 this tool. It is small, light in weight and may be conveniently used than the brace. The drill bit is clamped in the chuck at its end (Fig.1.18) and is rotated by a handle attached to gear and pinion arrangement.

Gimlet

It has cutting edges like a twisted drill (Fig.1.19).it is used for drilling large diameter holes with the hand pressure.

Fig. 1.16 Carpenter's brace

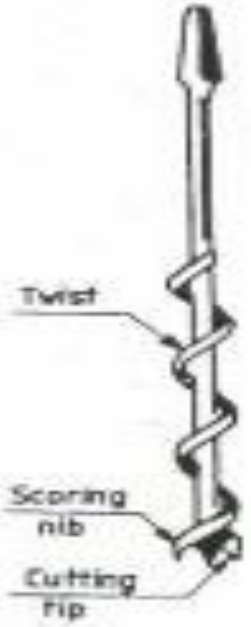


Fig. 1.17 Auger bit

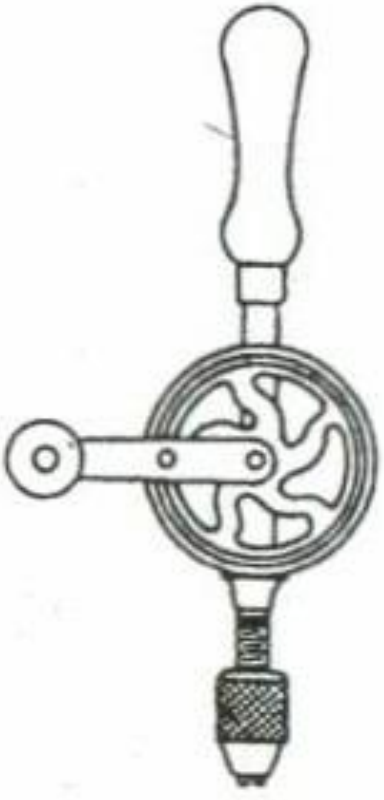


Fig. 1.18 Hand drill

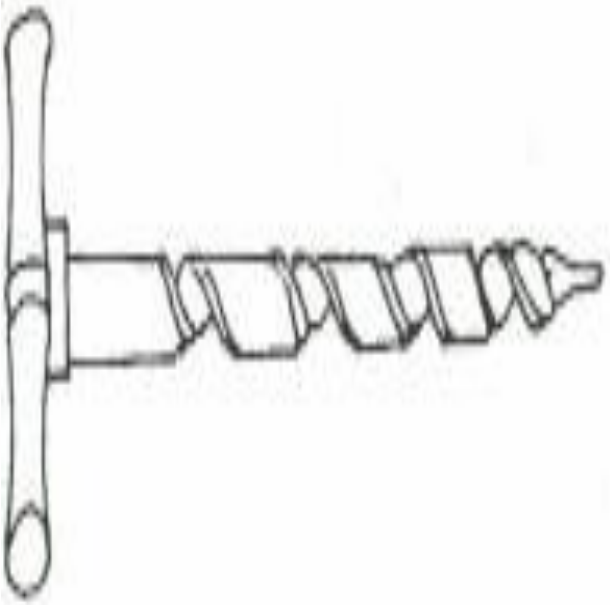


Fig. 1.19 Gimlet

MISCELLANEOUS TOOLS

Mallet

It is used to drive the chisel, when considerable force is to be applied, which may be the case in making deep rough cuts (Fig.1.20).Steel hammer should not be used for the purpose, as it may damage the chisel handle. Further, for better control, it is better to apply a series of light taps with the mallet rather than a heavy single blow.

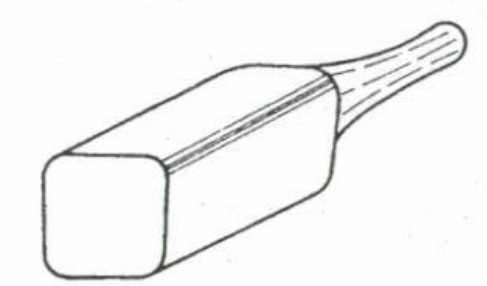


Fig. 1.20 Mallet

Pincer

Figure 1.21 shows the shape of a pincer. It is made of two forged steel arms with a hinged joint and is used for pulling-out small nails from wood. The inner faces of the pincer jaws are beveled and the outer faces are plain. The end of one arm has a ball and the other has a claw. The beveled jaws and the claw are used for pulling out small nails, pins and screws from the wood.

Claw Hammer

It has a striking flat face at one end and the claw at the other, as shown in Fig.1.22.The face is used to drive nails into wood and for other striking purposes and the claw for extracting relatively large nails out of it wood. It is made of cast steel and weighs from 0.25 kg to 0.75kg.

Screw Driver

It is used for driving wood screws into wood or unscrewing them. The screw driver of a carpenter is different from the other common types, as shown in Fig.1.23.

The length of a screw driver is determined by the length of the blade. As the length of the blade increases, the width and thickness of the tip also increase.

Fig. 1.21 Pincer

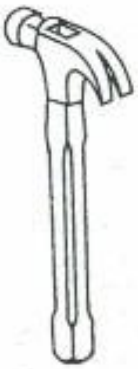


Fig. 1.22 Claw hammer

Fig. 1.23 Screw driver

Wood Rasp File

It is a finishing tool used to make the wood surface smooth; remove sharp edges, finish fillets and other interior surfaces (Fig.1.24).Sharp cutting teeth are provided on its surface for the purpose. This file is exclusively used in wood work.

Fig. 1.24 Wood rasp file

Fig. 1.25 Bradawl

Bradawl

It is a hand operated tool, used to bore small holes for starting a screw or large nail (Fig.1.25)

CARPENTRY SECTION

T-LAP JOINT

EXPERIMENT NO: 1 **DATE:**

Aim: -
To make a T- lap joint

Tools required: -

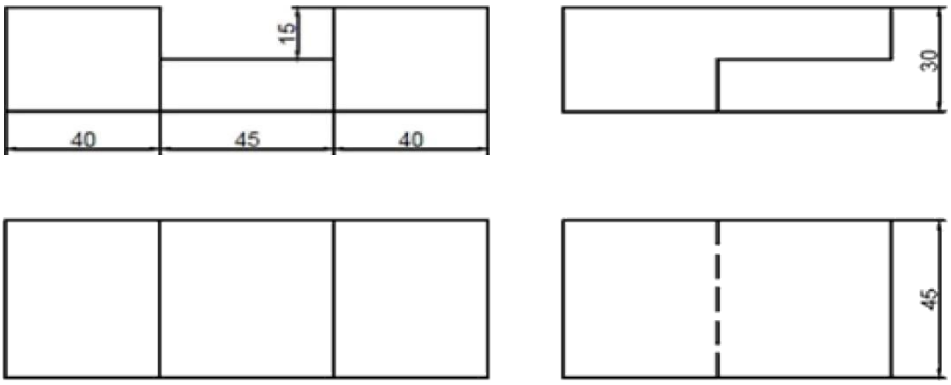
1. Carpenter's vice
2. Steel Rule
3. Try square
4. Jack plane
5. Scriber
6. Cross cut saw
7. Marking gauge
8. Firmer chisel
9. Mallet
10. Wood rasp file and smooth file

Material required: -

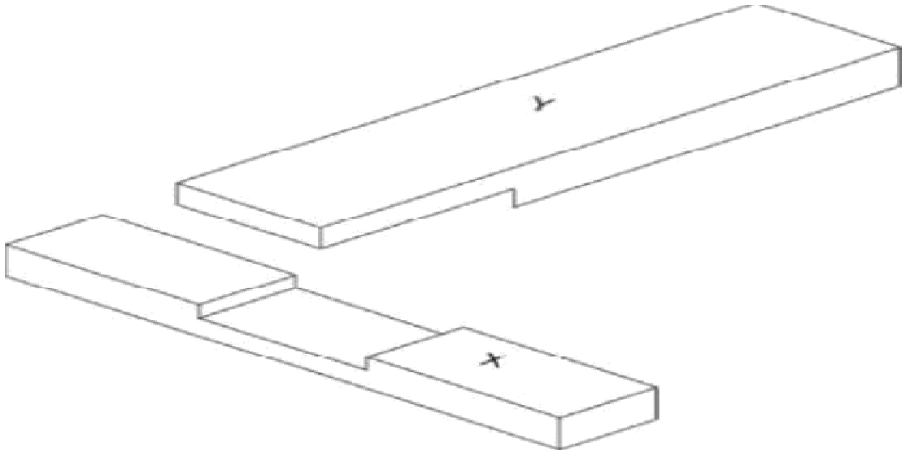
Wooden pieces of size 50 x 35 x 250 mm - 2 Nos

Sequence of operations: -

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



(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.

CARPENTRY SECTION

DOVETAIL LAP JOINT

EXPERIMENT NO: **DATE:**

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

Tools required: -

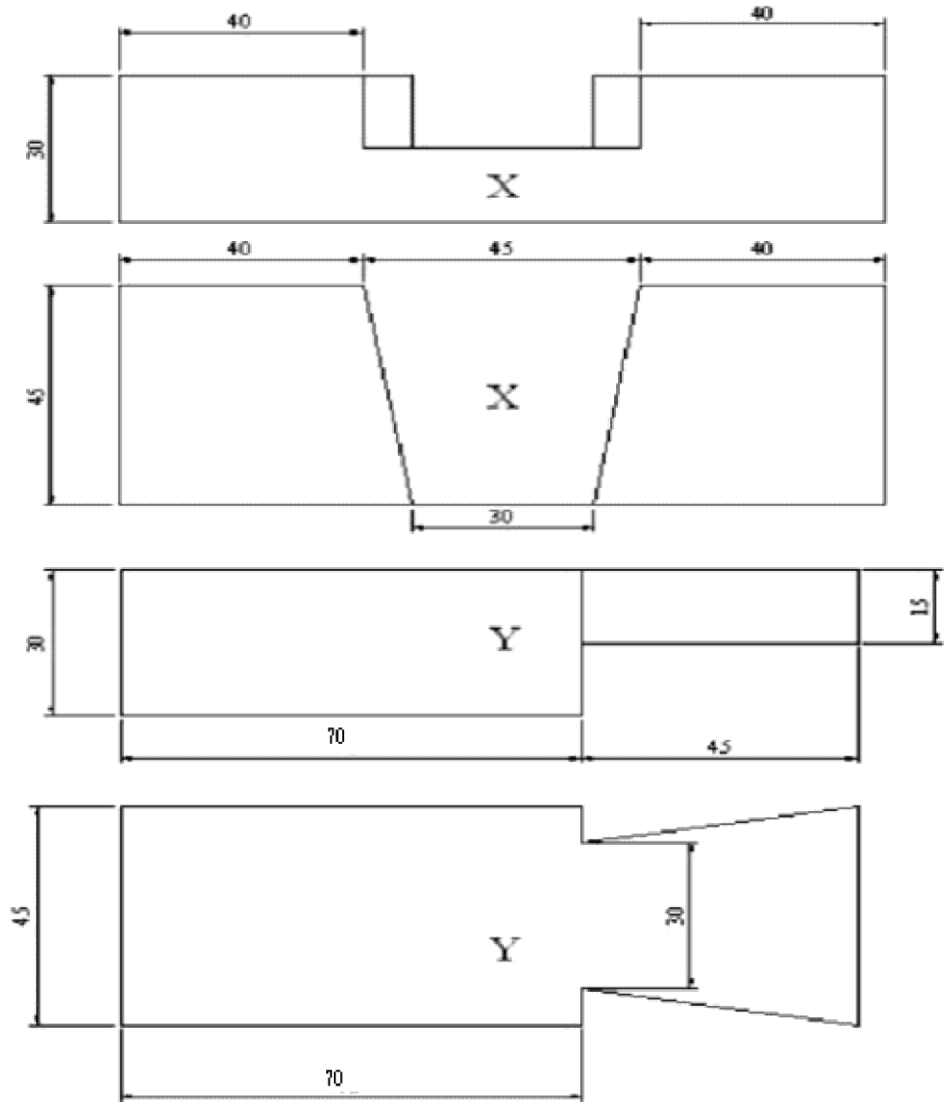
1. Carpenter's vice
2. Steel Rule
3. Try square
4. Jack plane
5. Scriber
6. Cross cut saw
7. Marking gauge
8. Firmer chisel
9. Mortise chisel
10. Mallet
11. Wood rasp file and smooth file

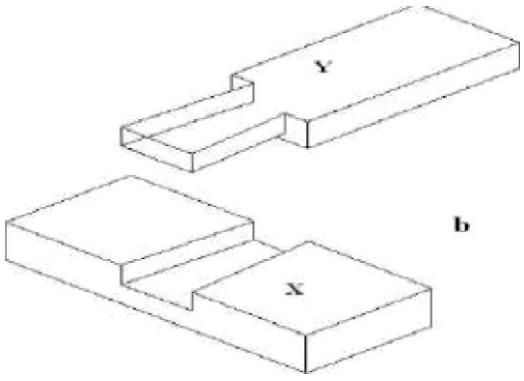
Material required: -

Wooden pieces of size 50 x 35 x 250 mm–2 Nos

Sequence of operations: -

1. Measuring and Marking
2. Planning
3. Check for squareness
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.
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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.

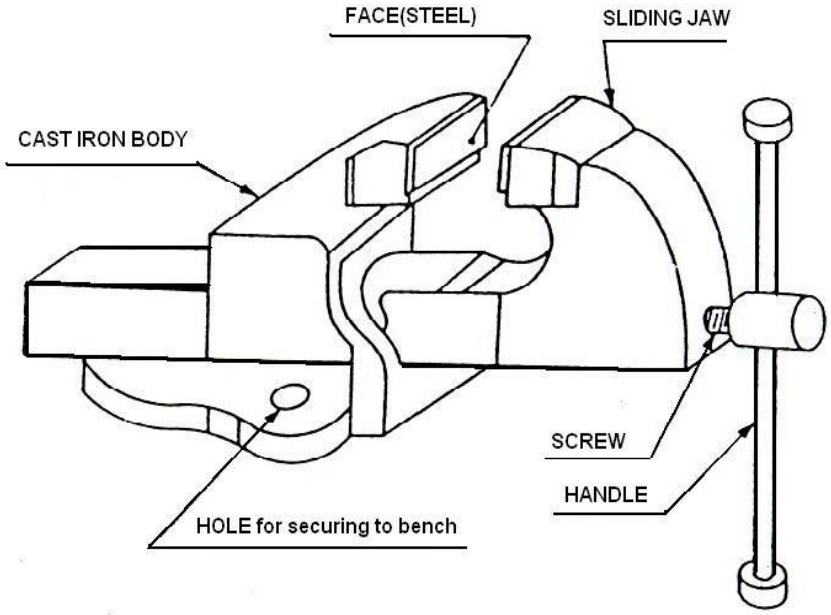
UNIT - II
FITTING

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

WORK HOLDING TOOLS

Bench vice
The bench vice is a work holding device. It is the most commonly used vice in a fitting shop.

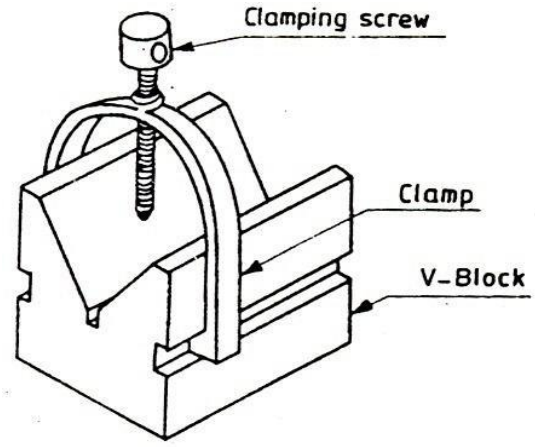


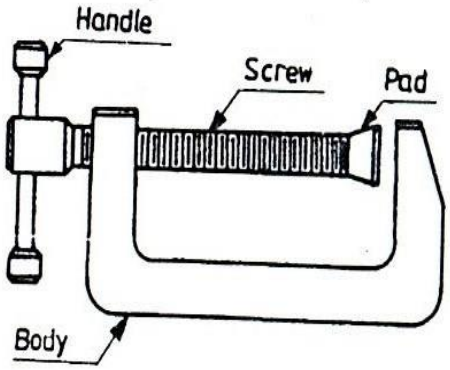
It is fixed to the bench with bolts and nuts. The vice body consists of two main parts, fixed jaw and movable jaw. When the vice handle is turned in a clockwise direction, the sliding jaw forces the work against the fixed jaw

V-block
V-block is rectangular or square block with a V-groove on one or both sides opposite to each other. The angle of the 'V' is usually 90*. V-block with a clamp is used to hold cylindrical work securely, during layout of measurement, for measuring operations or for drilling for this the bar is faced longitudinally in the V-Groove and the screw of V-clamp is tightened. This grip the rod is firm with its axis parallel to the axis of the v-groove.

C-Clamp

This is used to hold work against an angle plate or v-block or any other surface, when gripping is required. Its fixed jaw is shaped like English alphabet 'C' and the movable jaw is round in shape and directly fitted to the threaded screw at the end .The working principle of this clamp is the same as that of the bench vice.



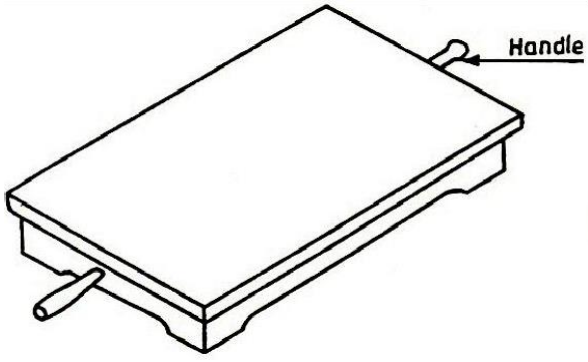


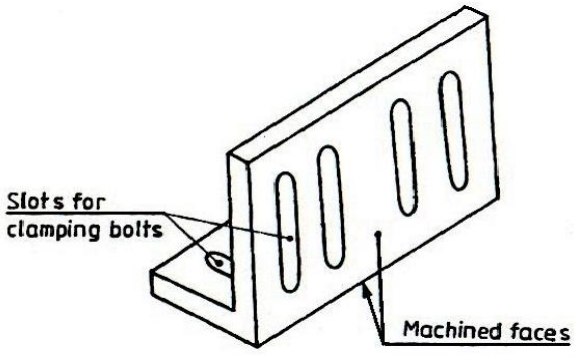
V Block C Clamp

MARKING AND MEASURING TOOLS

Surface plate

The surface plate is machined to fine limits and is used for testing the flatness of the work piece. It is also used for marking out small box and is more precious than the marking table. The degree of the finished depends upon whether it is designed for bench work in a fitting shop or for using in an inspection room; the surface plate is made of Cast Iron, hardened Steel or Granite stone. It is specified by length, width, height and grade. Handles are provided on two opposite sides, to carry it while shifting from one place to another.





Surface plate Angle plate

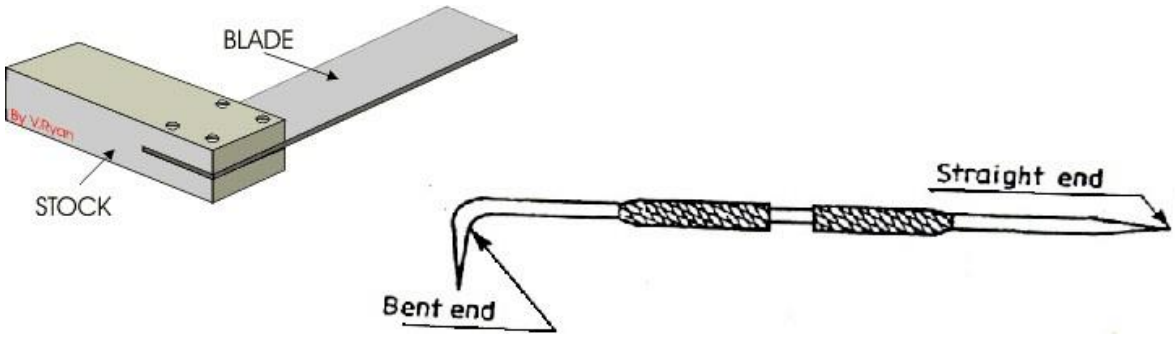
Try square

It is measuring and marking tool for 900 angle .In practice, it is used for checking the squareness of

many types of small works when extreme accuracy is not required .The blade of the Try square is made of hardened steel and the stock of cast Iron or steel. The size of the Try square is specified by the length of theblade.

Scriber

A Scriber is a slender steel tool, used to scribe or mark lines on metal work pieces. It is made of hardened and tempered High Carbon Steel. It is generally available in lengths, ranging from 125mm to 250mm .It has two pointed ends the bent end is used for marking lines where the straight end cannot reach.



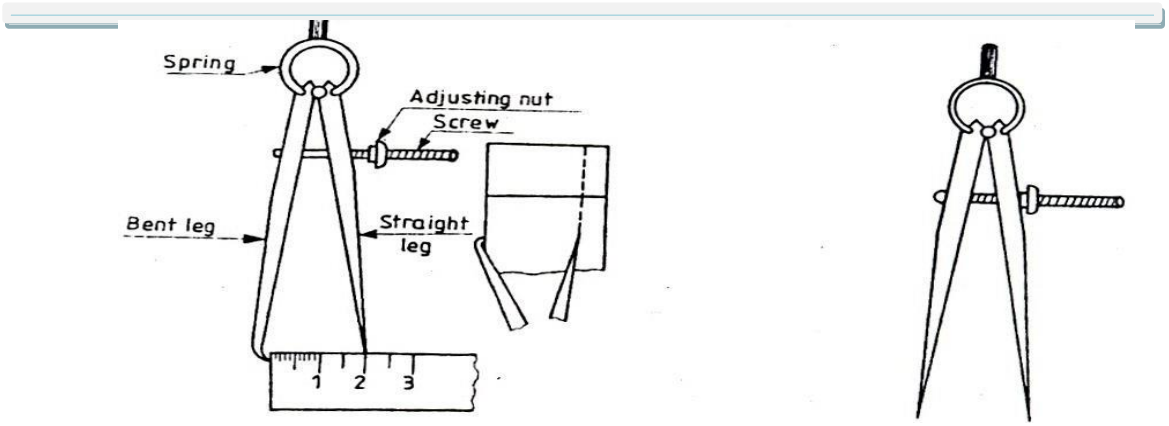
Try square Scriber

Odd leg Caliper

This is also called 'Jenny Caliper' or Hermaphrodite. This is used for marking parallel liners from a finished edge and also for locating the center of round bars; it has one leg pointed like a divider and the other leg bent like a caliper. It is specified by the length of the leg up to the hinge point.

Divider

It is basically similar to the calipers except that its legs are kept straight and pointed at the measuring edge. This is used for marking circles, arcs laying out perpendicular lines, by setting lines. It is made of case hardened mild steel or hardened and tempered low carbon steel. Its size is specified by the length of the leg**.**



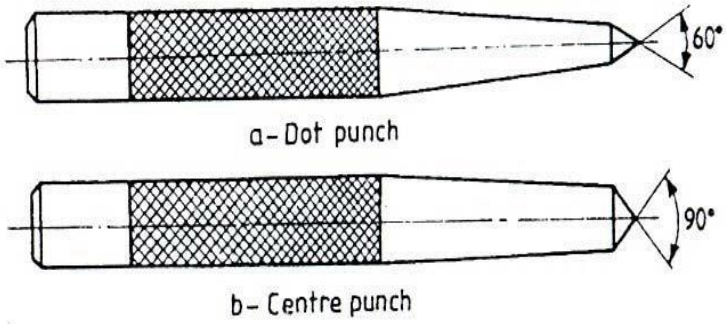
Odd leg caliper Divider

Punches

Punches are used for making indentations on the scribed lines, to make them visible clearly. These are made of high carbon steel. A punch is specified by its length and diameter (say as 150' 12.5mm). It consists of a cylindrical knurled body, which is plain for some length at the top of it. At the other end, it is ground to a point. The tapered point of the punch is hardened over a length of 20 to 30mm.

Dot punch is used to lightly indent along the layout lines, to locate center of holes and to provide a small center mark for divider point, etc. for this purpose, the punch is ground to a conical point having 60° included angle.

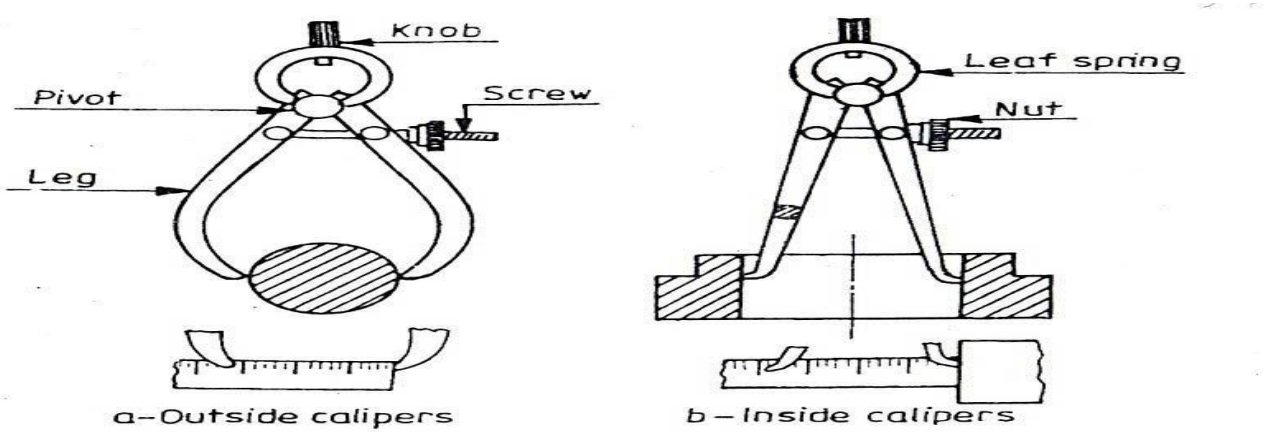
Center punch is similar to the dot punch, except that it is ground to a conical point having 90° included angle. It is used to mark the location of the holes to be drilled.



Punches

Calipers

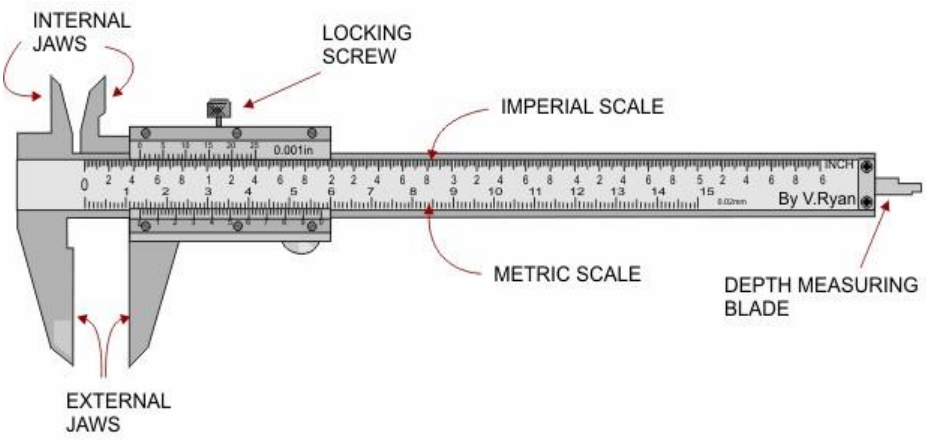
They are indirect measuring tools used to measure or transfer linear dimensions. These are used with the help of a steel Rule to check inside and outside measurements. These are made of Case hardened mild steel or hardened and tempered low carbon steel. While using, but the legs of the caliper are set against the surface of the work, whether inside or outside and the distance between the legs is measured with the help of a scale and the same can be transferred to another desired place. These are specified by the length of the leg. In the case of outside caliper, the legs are bent inwards and in the case of inside caliper, the legs bent outwards.



Calipers

Vernier Calipers

These are used for measuring outside as well as inside dimensions accurately. It may also be used as a depth gauge. It has two jaws. One jaw is formed at one end of its main scale and the other jaw is made part of a Vernier scale.



Vernier caliper

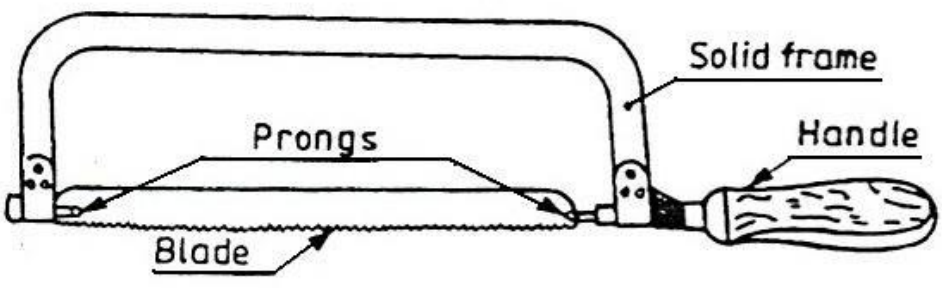
CUTTING TOOLS

Hack Saw

The Hack Saw is used for cutting metal by hand. It consists of a frame, which holds a thin blade, firmly in position. Hacksaw blade is specified by the number of teeth for centimeter. Hacksaw blades have a number of teeth ranging from 5 to 15 per centimeter (cm). Blades having lesser number of teeth per cm are used for cutting soft materials like aluminum, brass and bronze. Blades having larger number of teeth per centimeter are used for cutting hard materials like steel and cast Iron. Hacksaw blades are classified as (i) All hard and (ii) flexible type.

The all hard blades are made of H.S.S, hardened and tempered throughout to retain their cutting edges longer. These are used to cut hard metals. These blades are hard and brittle and can break easily by twisting and forcing them into the work while sawing. Flexible blades are made of H.S.S or low alloy steel but only the teeth are hardened and the rest of the blade is soft and flexible. These are suitable for use by un-skilled or semi-skilled persons.

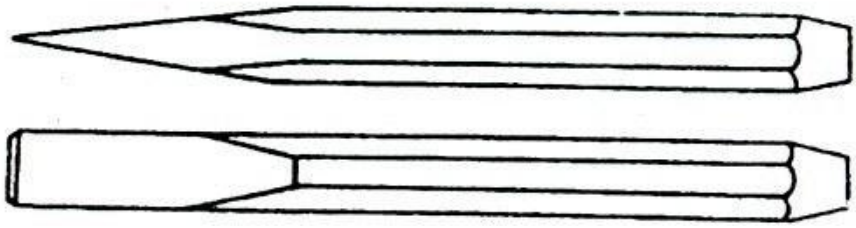
The teeth of the hacksaw blade are staggered, as shown in figure and known as a 'set of teeth'. These make slots wider than the blade thickness, preventing the blade from jamming.



Hacksaw frame with blade

Chisels

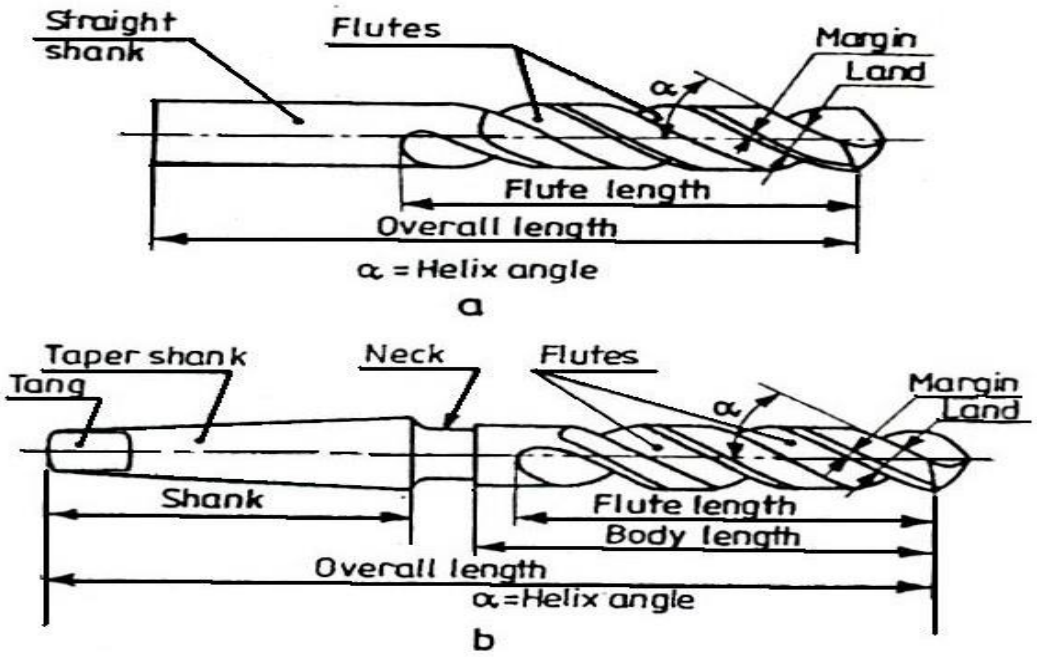
Chisels are used for removing surplus metal or for cutting thin sheets. These tools are made from 0.9% to 1.0% carbon steel of octagonal or hexagonal section. Chisels are annealed, hardened and tempered to produce a tough shank and hard cutting edge. Annealing relieves the internal stresses in a metal. The cutting angle of the chisel for general purpose is about 60°.



Chisels

Twist Drill

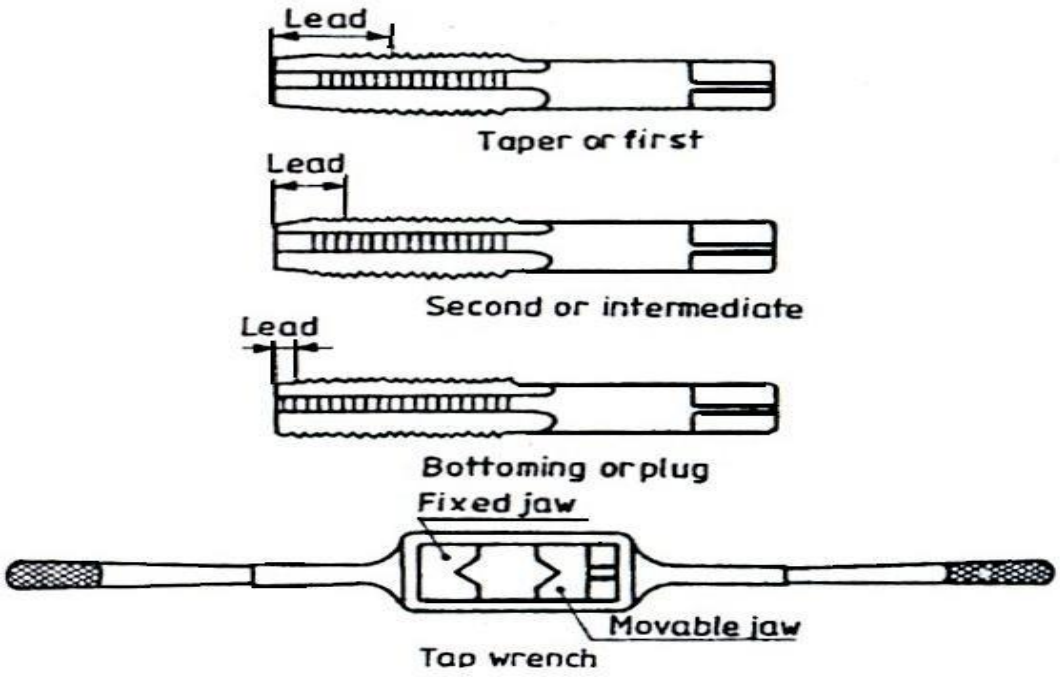
Twist drills are used for making holes. These are made of High speed steel. Both straight and taper shank twist drills are used. The parallel shank twist drill can be held in an ordinary self – centering drill check. The tapper shank twist drill fits into a corresponding tapered bore provided in the drilling machine spindle.



Twist drills

Taps and Tap wrenches

A tap is a hardened and steel tool, used for cutting internal thread in a drill hole. Hand Taps are usually supplied in sets of three in each diameter and thread size. Each set consists of a tapper tap, intermediate tap and plug or bottoming tap. Taps are made of high carbon steel or high speed steel.



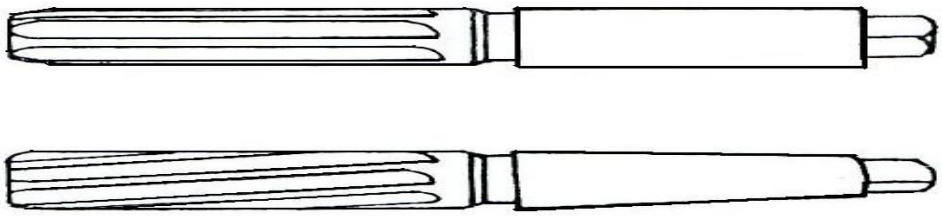
Taps and tap wrench

FINISHING TOOLS

Reamers

Reaming is an operation of sizing and finishing a drilled hole, with the help of a cutting tool called reamer having a number of cutting edges. For this, a hole is first drilled, the size of which is slightly smaller than the finished size and then a hand reamer or machine reamer is used for finishing the hole to the correct size.

Hand Reamer is made of High Carbon Steel and has left-hand spiral flutes so that, it is prevented from screwing into the whole during operation. The Shank end of the reamer is made straight so that it can be held in a tap wrench. It is operated by hand, with a tap wrench fitted on the square end of the reamer and with the work piece held in the vice. The body of the reamer is given a slight tapper at its working end, for its easy entry into the whole during operation, it is rotated only in clock wise direction and also while removing it from the whole.

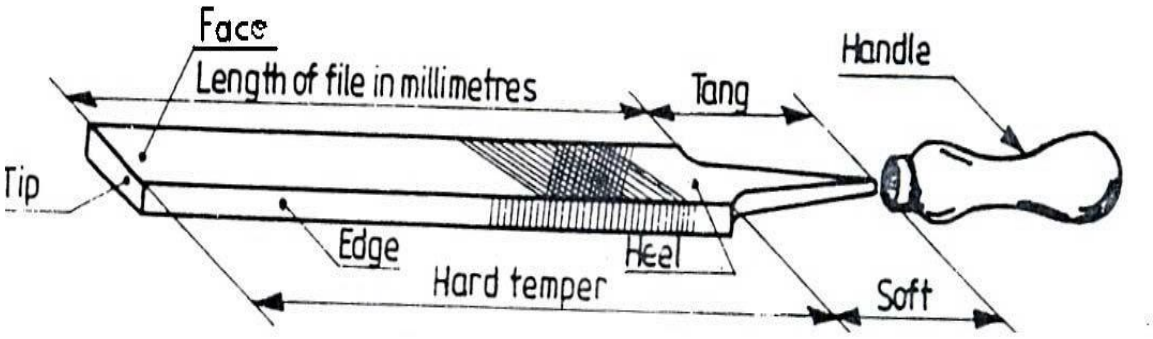


Reamers

Files

Filing is one of the methods of removing small amounts of material from the surface of a metal part. A file is hardened steel too, having small parallel rows of cutting edges or teeth on its surfaces.

On the faces, the teeth are usually diagonal to the edge. One end of the file is shaped to fit into a wooden handle. The figure shows various parts of a hand file. The hand file is parallel in width and tapering slightly in thickness, towards the tip. It is provided with double cut teeth. On the faces, single cut on one edge and no teeth on the other edge, this is known as a safe edge.



Parts of a hand file

Files are classified according to their shape, cutting teeth and pitch or grade of the teeth. The figure shows the various types of files based on their shape.

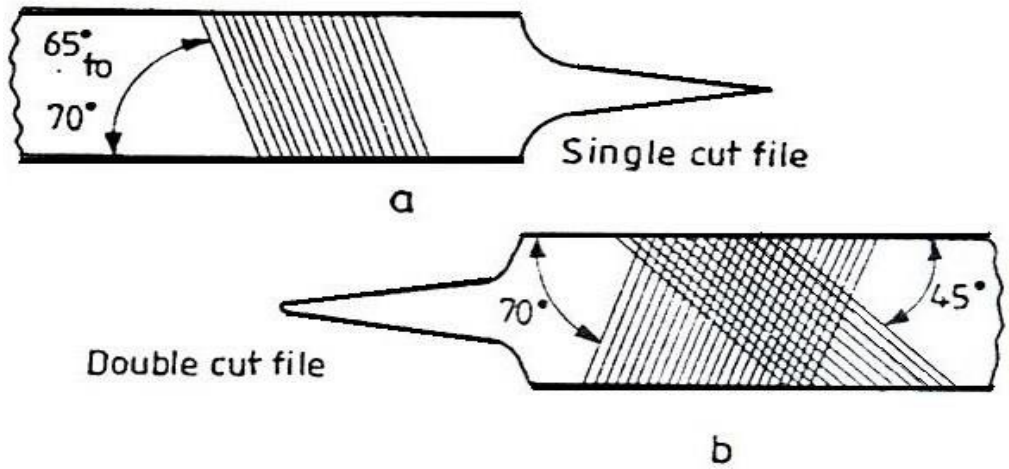
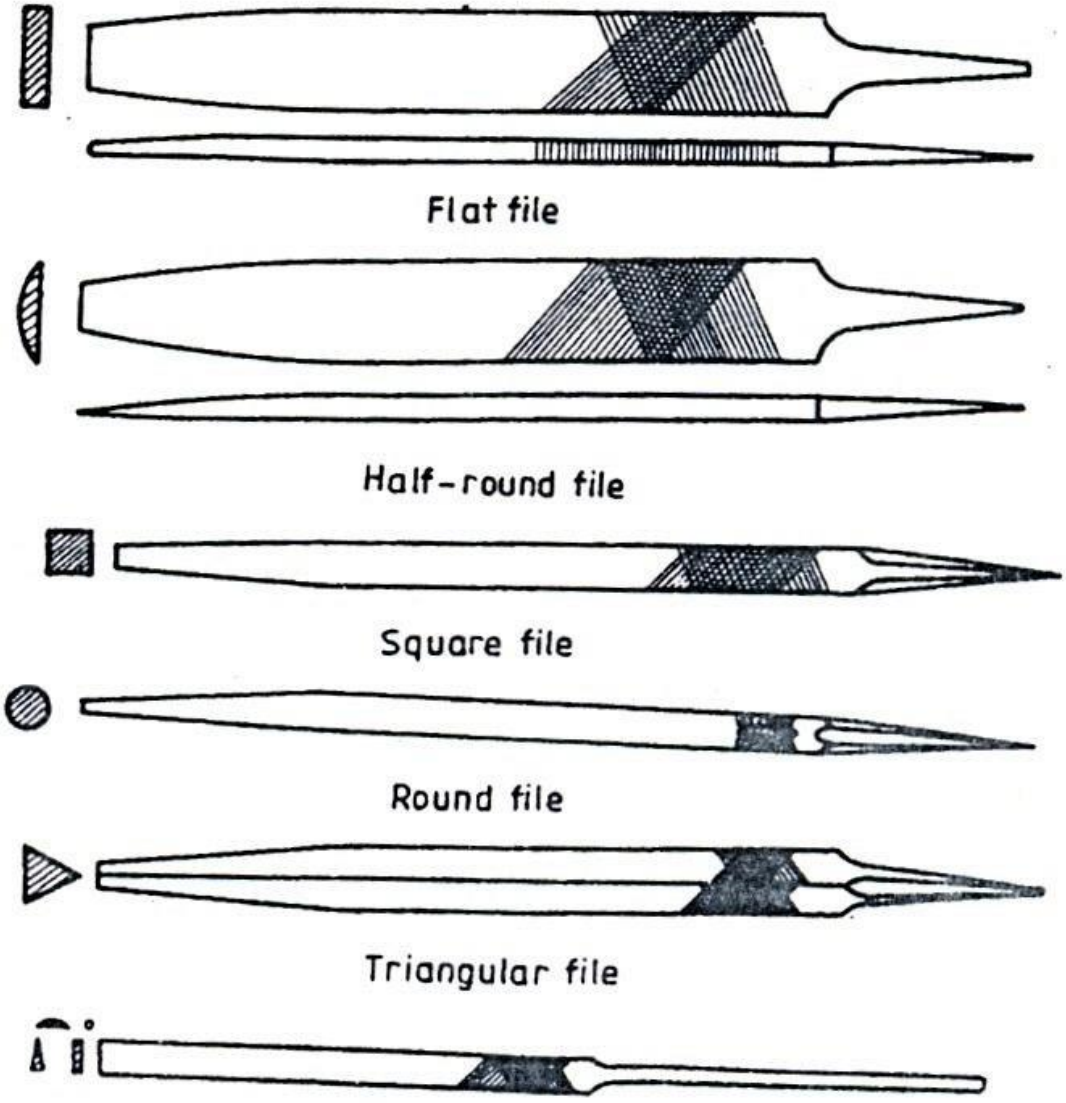


Figure 1.22: Single and double cut files

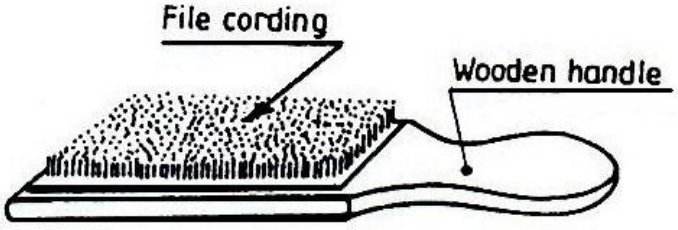


Types of file

MISCELLANEOUS TOOLS

File card

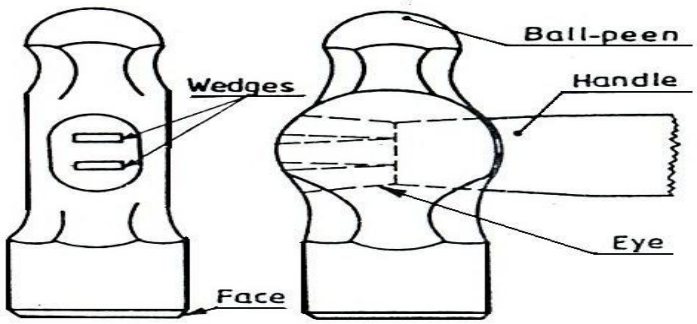
It is a metal brush, used for cleaning the files, to free them from filings, clogged in-between the teeth.



File card

Ball- Peen Hammer

Ball- Peen Hammers are named, depending upon their shape and material and specified by their weight. A ball peen hammer has a flat face which is used for general work and a ball end, particularly used for riveting.



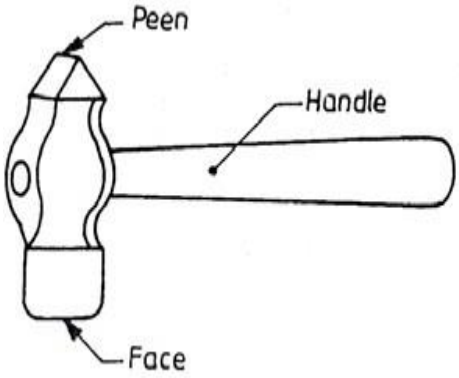
Ball peen hammer

Cross-Peen Hammer

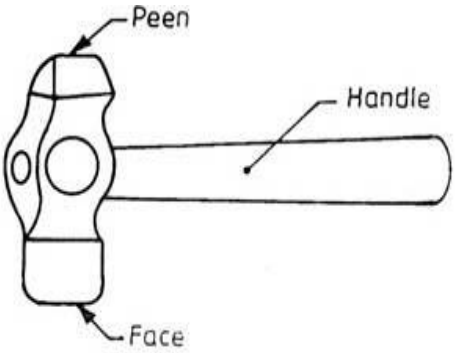
It is similar to ball peen hammer, except the shape of the peen. This is used for chipping, riveting, bending and stretching metals and hammering inside the curves and shoulders.

Straight-Peen Hammer

This is similar to cross peen hammer, but its peen is in-line with the hammer handle. It is used for swaging, riveting in restricted places and stretching metals.



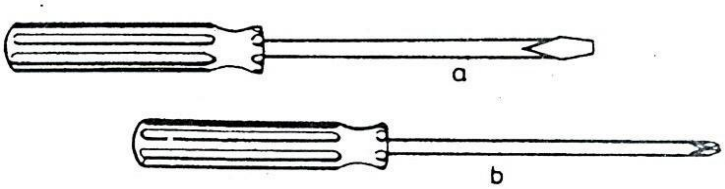
Cross peen hammer



Straight peen hammer

Screw driver

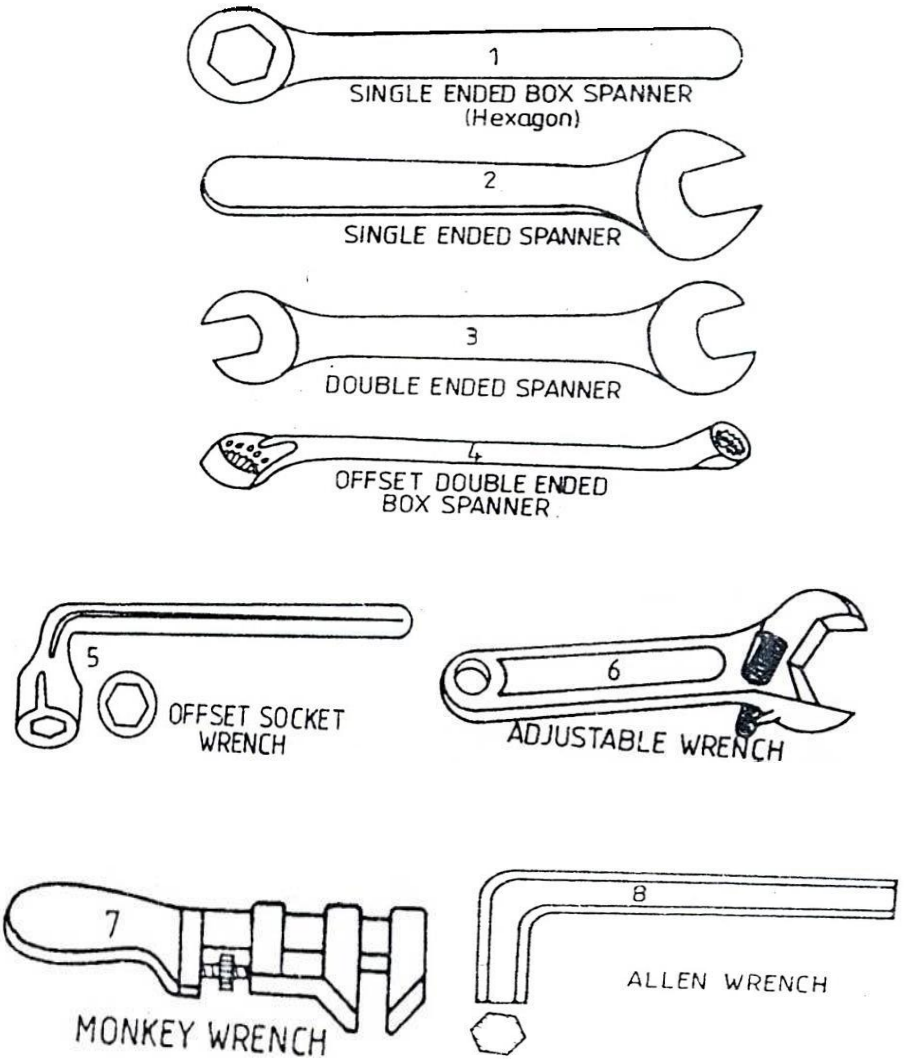
A screw driver is designed to turn screws. The blade is made of steel and is available in different lengths and diameters. The grinding of the tip to the correct shape is very important. A star screw driver is specially designed to fit the head of star screws. The end of the blade is fluted instead of flattened. The screw driver is specified by the length of the metal part from handle to the tip.



Screw drivers

Spanners

A spanner or wrench is a tool for turning nuts and bolts. It is usually made of forged steel. There are many kinds of spanners. They are named according to the application. The size of the spanner denotes the size of the bolt on which it can work.



Spanners

FITTING SECTION

SQUARE (T) - FITTING

EXPERIMENT NO: **DATE:**

Aim: -

To make a T-fitting from given two Mild Steel 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 squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

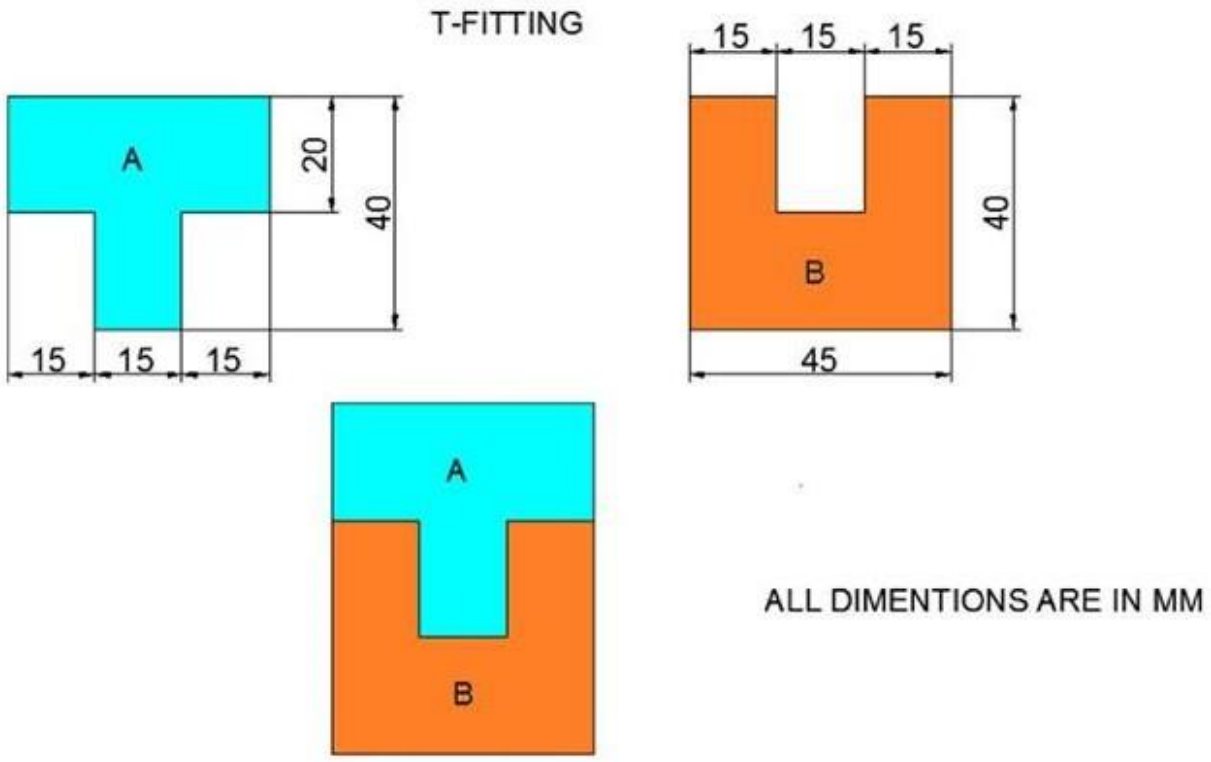


Fig: SQUARE (T) - FITTING

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 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 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: -

T-fit is made as per the required dimensions.

FITTING SECTION
V- FITTING

EXPERIMENT NO: **DATE:**

Aim: - 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 squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

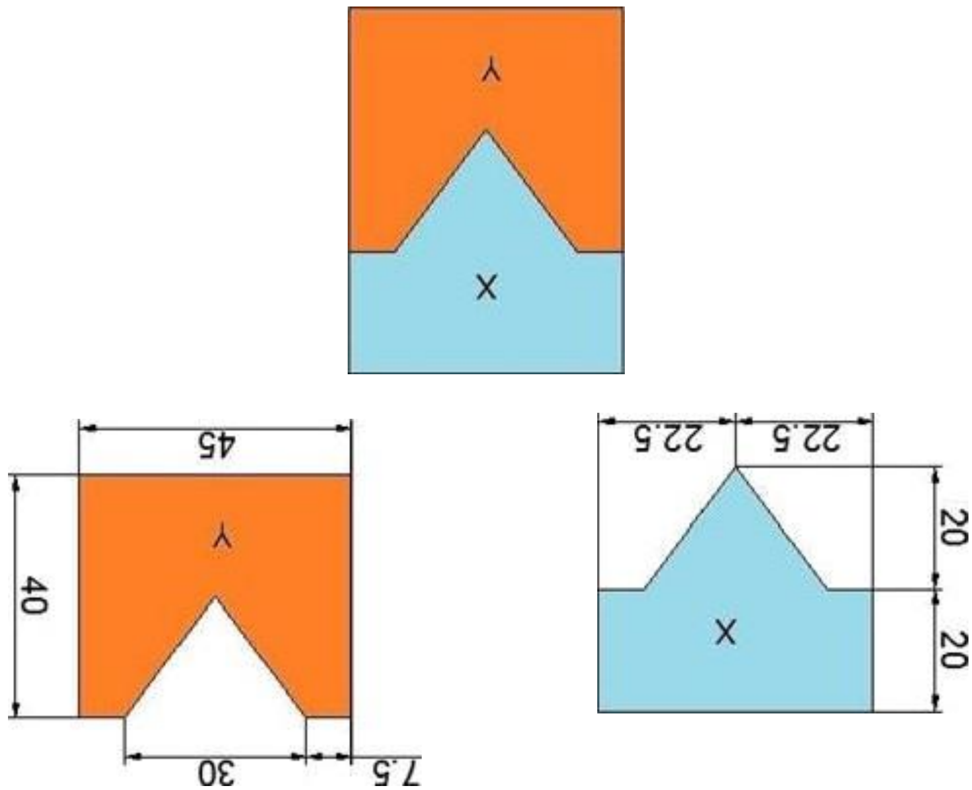


FIG - V FITTING

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 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 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.

UNIT - III

WELDING

INTRODUCTION

Welding is the process of joining similar or dissimilar 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
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.

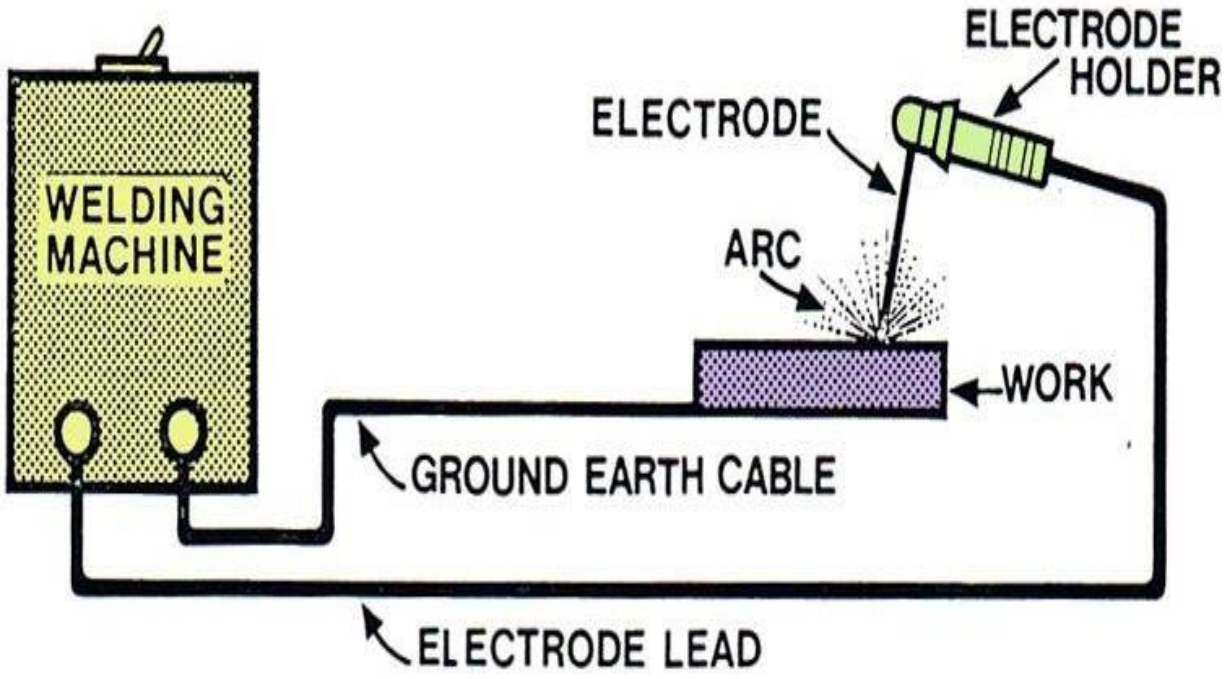
Any arc welding method is based on an electric circuit consisting of the following parts:

a. Power supply (AC or DC);

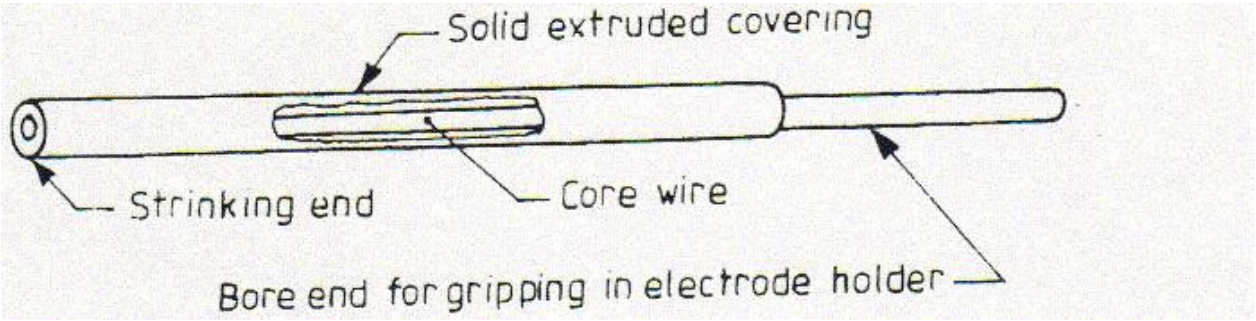
b. Welding electrode;

c. Work piece;

d. Welding leads (electric cables) connecting the electrode and work piece to the power supply.



Arc welding set up



Parts of welding 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.

Welding machines

Transformers, motor generators and rectifier 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 the least 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 using and 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.

WELDING TOOLS

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.

Hand gloves

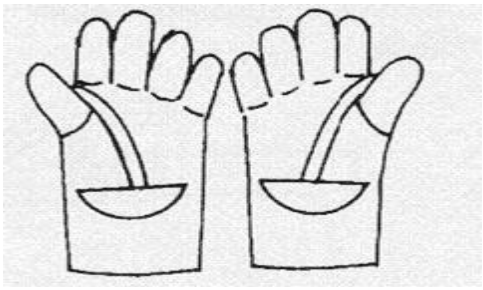
These are used to protect the hands from electric shocks and hot spatters

Electrode holder

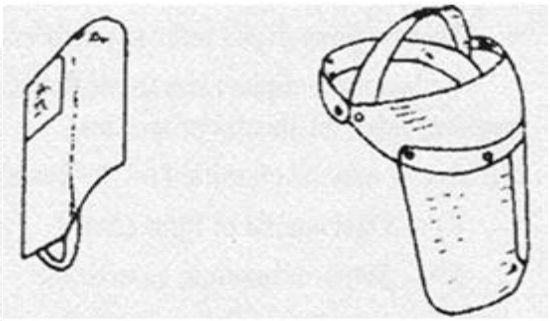
Ground Clamp

Wire brush

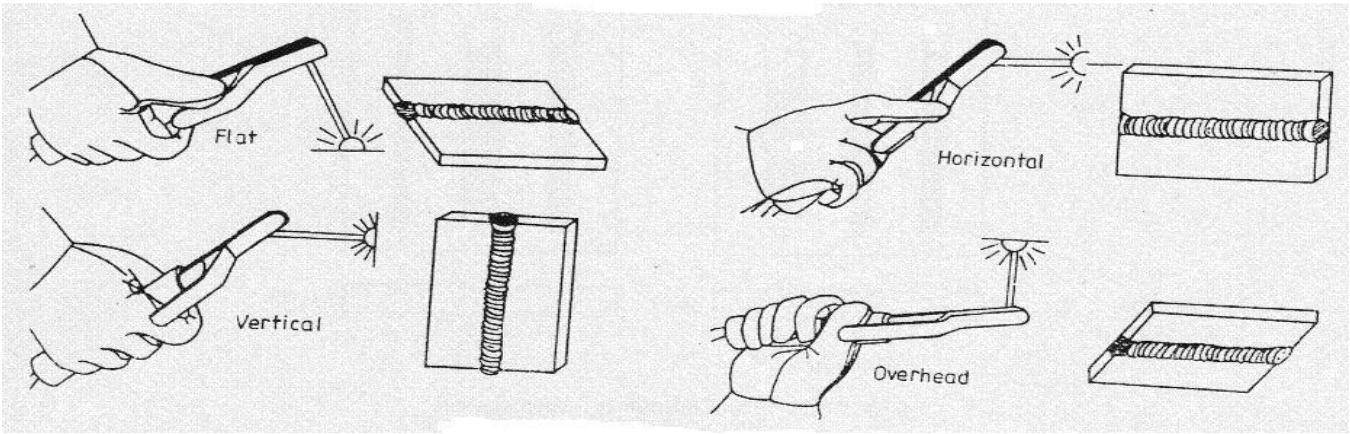
chipping hammer



Hand glove



Face shield



Weld position

WELDING POSITIONS

Depending upon the location of the welding joints, appropriate position of the electrode and hand movement is selected.

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

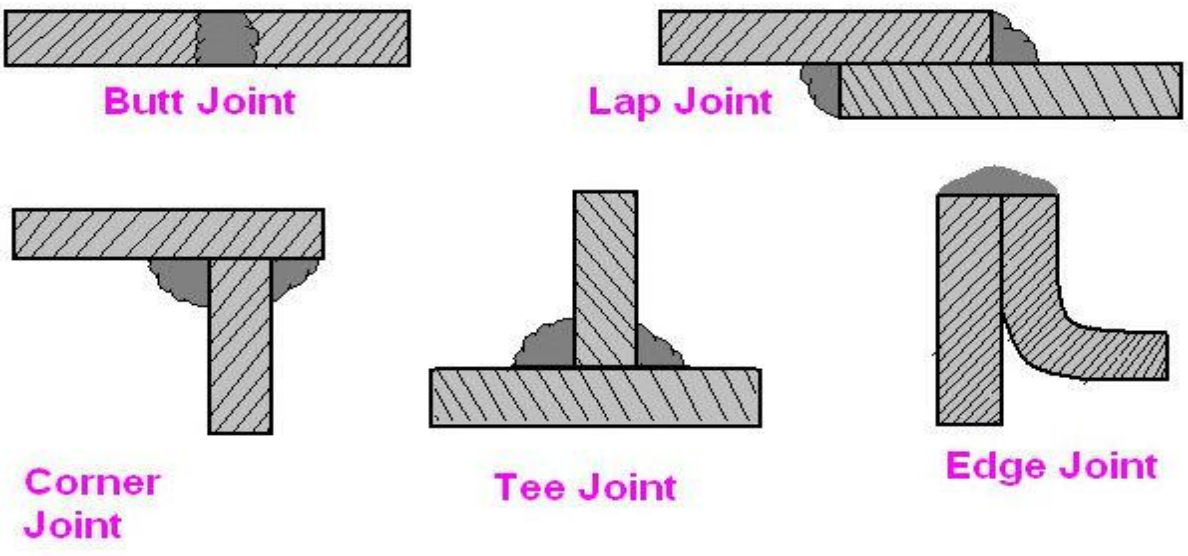
In this position, welding is performed on the upper side of an approximately horizontal surface and against an approximately vertical surface.

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.



Welding joints

WELDING SECTION

Lap joint

EXPERIMENT No: **DATE:**

Aim

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

Material required

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

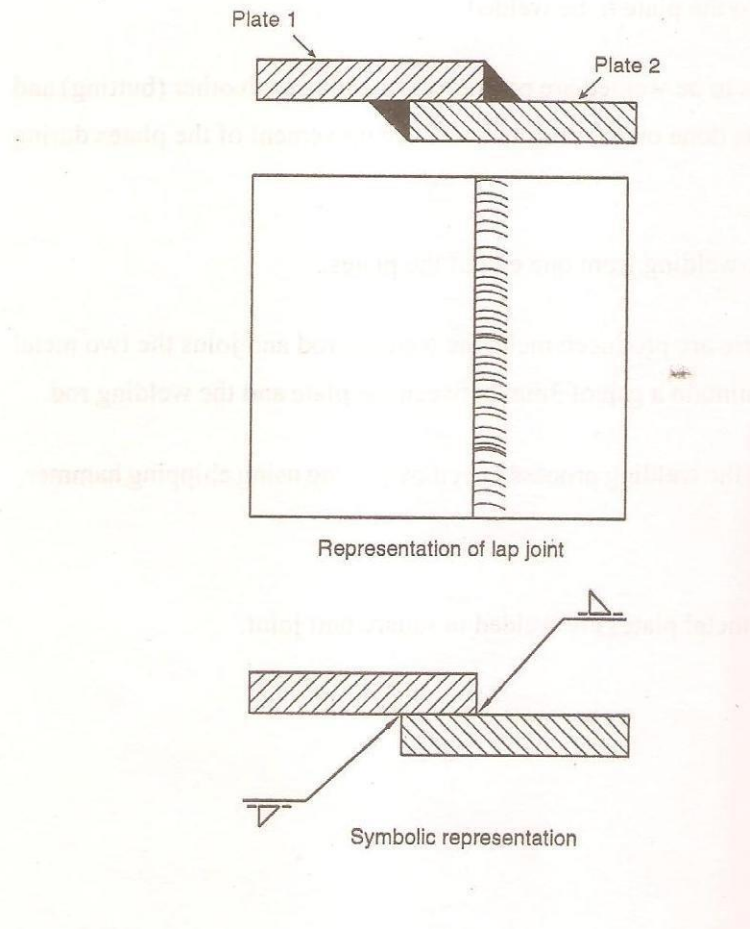


Fig: lap joint

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.

WELDING

BUTT JOINT

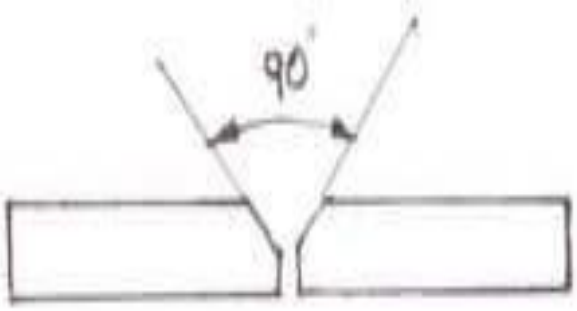
EXPERIMENT No: **DATE:**

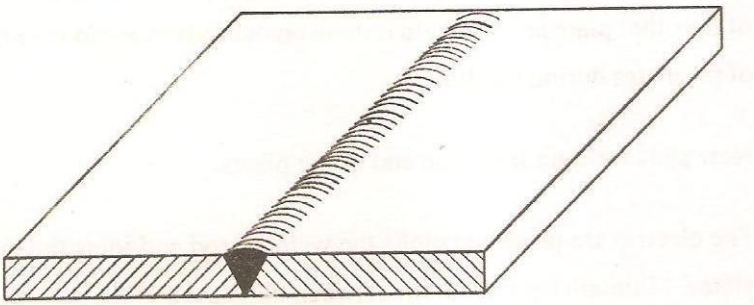
Aim:
Preparation of butt joint as shown in figure using arc welding process.

Material required:
2 M.S flat pieces of given size.

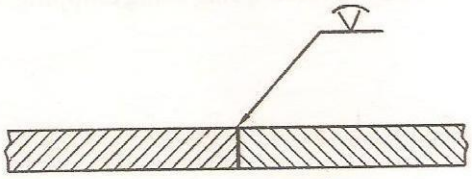
Tools required:

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





Representation of single V butt joint



Symbolic representation

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 dia 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.

UNIT – IV
SHEET METAL WORKING

INTRODUCTION:

Many engineering and house hold articles such as boxes, cans, funnels, ducts etc., are made from a flat sheet of metals. These process being known as tin smithy. For this, the development of the article is first drawn on the sheet metal then cut and folded to form the required shape of the article. The edge of the articles is then secured through welding, brazing, soldering, riveting etc.

Sheet metal materials

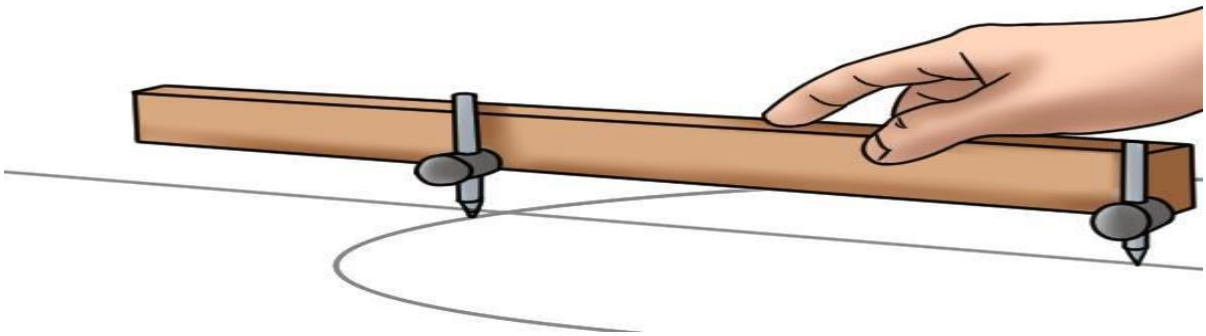
A variety of metals used in a sheet metal shop such as black iron, aluminum and stainless steel. A sheet of soft steel which is coated with molten zinc is known as galvanized iron. The zinc coat forms a coating that resists rust, improves the appearance of the metal and permits it to be solderized with greater care.

HAND TOOLS

The common hand tools used in sheet metals work are steel rule, usually of 60 cm length, wire gauge, dot punch, scriber, trammels, ball peen hammer, and straight peen hammer, cross peen hammer, mallets, snips and soldering iron.

Trammels

Sheet metals layouts require marking of arcs and circles. This may be done by using the trammels. The length of the beam decides the maximum size of the arc that can be scribed.



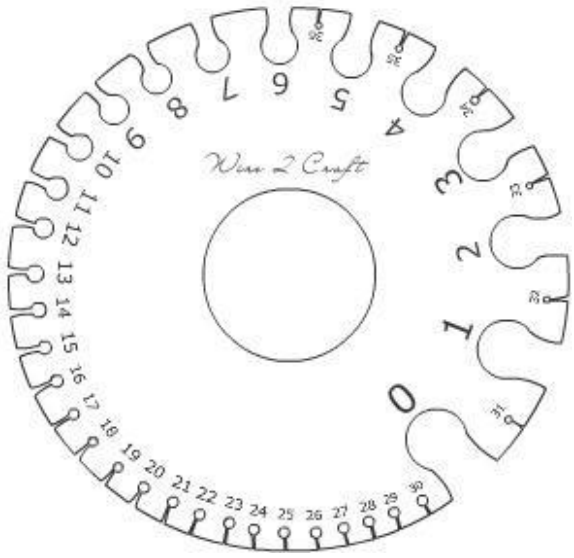
Trammel

Wire gauge

The thickness of the sheet metal is referred in numbers known as standard wire gauge (SWG). The gaps in the circumference of the gauge are used to check the gauge number.

Some of the standard wire gauge numbers with corresponding thick nesses are as follows.

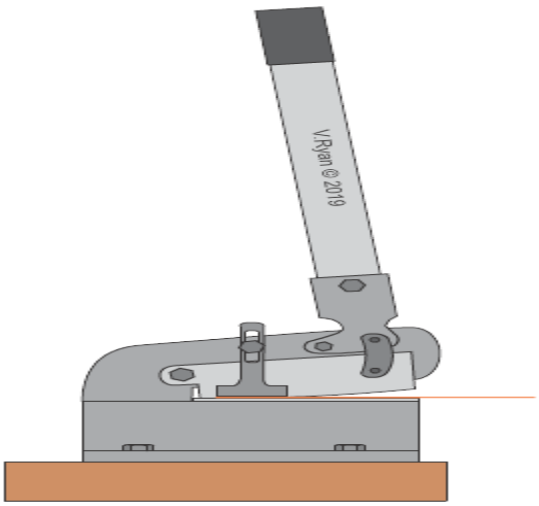
SWG No	Thickness, mm
10	3.20
12	2.60
14	2.30
16	1.60
20	1.00
22	0.70
24	0.65
26	0.45
30	0.30



Wire gauge

Bench shears

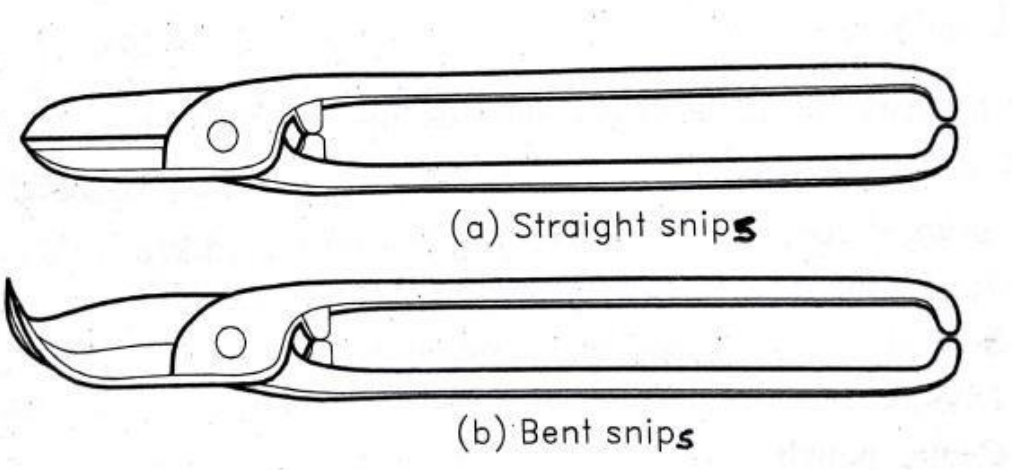
Sheet metal may be cut by shearing action. In this the force is applied through a compound lever, making it possible to cut sheet metal up to 4mm thick.



Bench shear

Snips

Snips are hand shears, varying in length from 200mm to 600mm. 200mm to 250mm being the lengths commonly used. The straight snips is used for cutting along outside curves and straight lines and curved snips or bent snips is for trimming along inside curves**.**



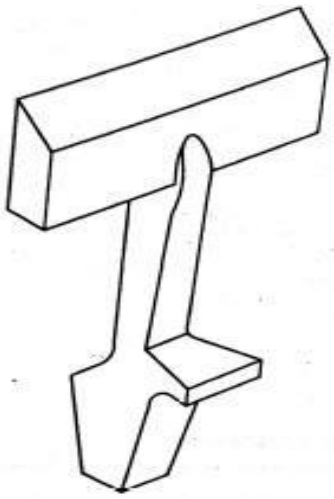
Snips

Mallet

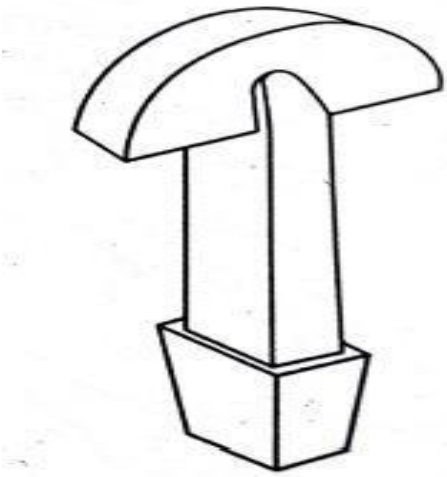
It is used for bending and folding work. It is called as soft hammer. Generally, it is made of wood. It is light in weight, covers more area and does not dent the work.

Stakes

Stakes are nothing but anvils, which are used as supporting tools and to form, seam, bend or rivet sheet metal objects. These are available in different shapes and sizes, to suit the requirements of the work. They are made from wrought iron, faced with steel.



HATCHET STAKE



HALF MOON STAKE

SHEET METAL JOINTS

Various types of joints are used in sheet metal work, to suit the varying requirements. Some commonly used sheet metal joints and folded edges. These are self secured joints, formed by joining together two pieces of sheet metal and using the metal itself to form the joint. These joints are to be used on sheets of less than 1.6 mm thickness. Various forms of seams and hems are associated with sheet metal works; as described below:

Seam

A seam is a joint made by fastening two edges together. The following are the type of seams.

Single Seam

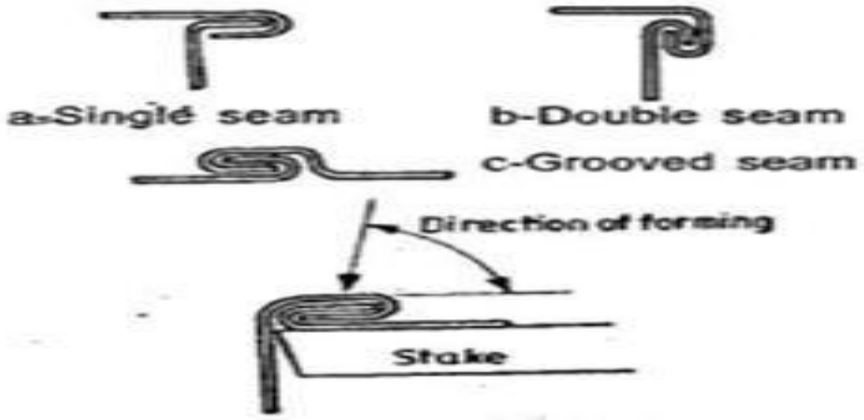
It is used to join bottom surface to a vertical body.

Double Seam

It is similar to single seam, with the main difference that its formed edge is bent upward against the body. The layout process for this seam is similar to that used for a single seam.

Grooved Seam

It is made by hooking two folded edges together and then off- setting the seam.



Seams

Hem

A hem is an edge made by folding. The following are the types of hems.

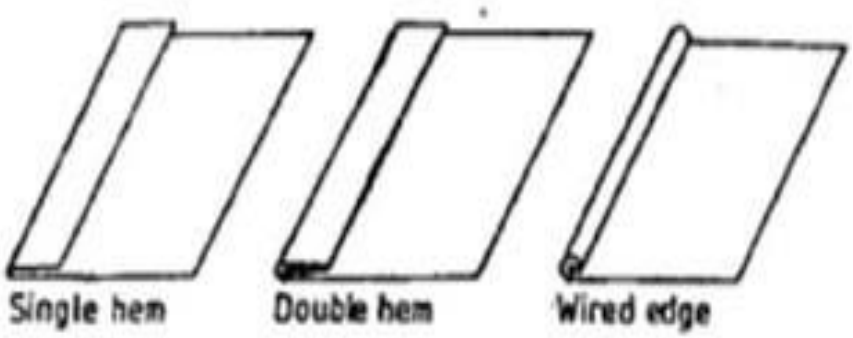
Single Hem

It is made by folding the edge of the sheet metal, to make it smooth and stiff.

Double Hem

It is a single hem, with its end bent.

Wired Edge
It consists of an edge which has been wrapped around a piece of wire. This edge is used where more strength is needed.



Hems

Riveting
Rivets are used to fasten two or more sheets of metal together. It is the common practice to use rivets of the same material as that of the sheets being fastened. Tin men's rivets with flat heads are used on sheet metal work. For successful riveting operation, the selection of proper size and spacing of rivets is essential.

Soldering
Soldering is one method of joining two or more pieces of metals by means of fusible alloy, called solder, applied in the molten state-. The melting temperature of the solder should be lower than that of the base metals being joined. For a good job, the metals to be joined must be free from dirt, grease and oxide. Solder is made of tin and lead, usually in equal proportions. It comes either in the form of wire or bar. A soldered joint cannot withstand high temperatures (more than 150° C) and pressures**.**

SHEET METAL SECTION

TRAY

EXPERIMENT NO: **DATE:**

Aim: -

To make a tray using the given G.I. Sheet.

Tools required: -

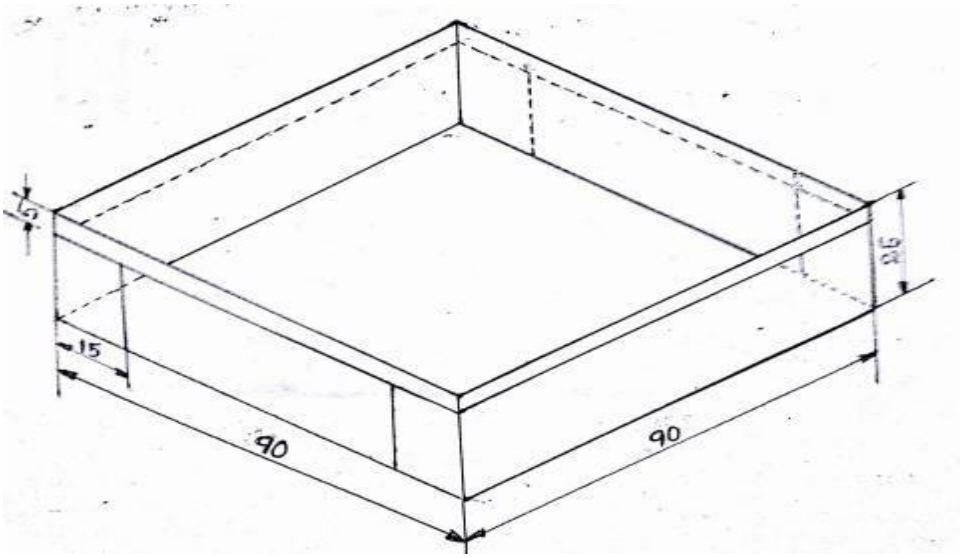
1. Steel rule
2. Scriber
3. Straight snip
4. Bench vice
5. Stake
6. Cross peen hammer
7. Wooden mallet
8. Snip

Material required: -

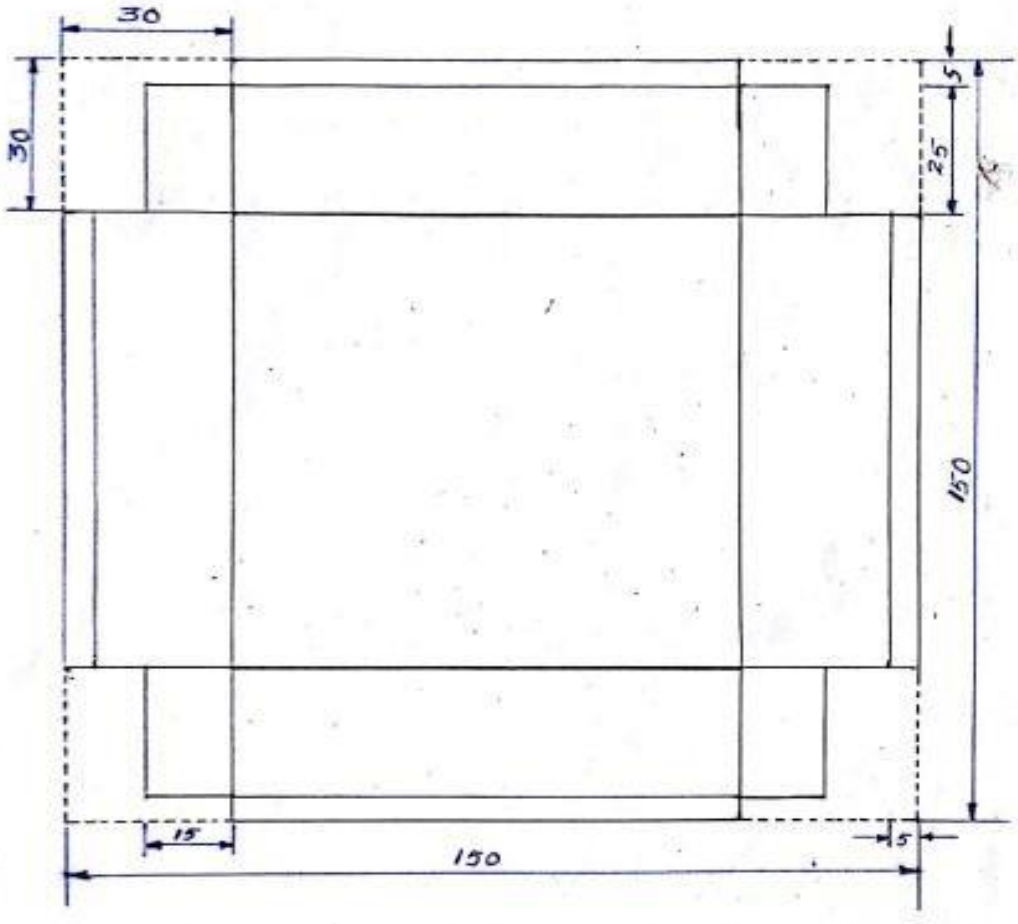
Galvanized Iron (G.I) sheet 140 x 100 mm size.

Sequence of operations: -

1. Cleaning
2. Surface leveling
3. Marking
4. Cutting
5. Folding



SQUARE TRAY



All dimensions are in mm

Procedure

1. Copy the given drawing.
2. Collect the tools and sheet metal.
3. Draw the layout on the work material.
4. Cut the Sheet along the marked out line.
5. Check the edges of sheet for straightness and perpendicularity with the help of try square.
6. Mark all the necessary line to make the required model.
7. Cut the sheet along the lines with straight snips.
8. Do all the bending operations to get the square as vertical sides.
9. Bent all edges to avoid sharp corners and edges for safety.
10. Straighten the four sides and then finish the model.
11. Check all the dimensions and finish.

SHEET METAL SECTION

CYLINDER

EXPERIMENT NO: **DATE:**

Aim: -

To make a Cylinder using the given G.I. Sheet.

Tools required: -

1. Steel rule
2. Scriber
3. Straight snip
4. Bench vice
5. Stake
6. Cross peen hammer
7. Wooden mallet
8. Snip

Material required: -

Galvanized Iron (G.I) sheet 160 x 80mm size.

Sequence of operations: -

1. Cleaning
2. Surface leveling
3. Marking
4. Cutting
5. Folding

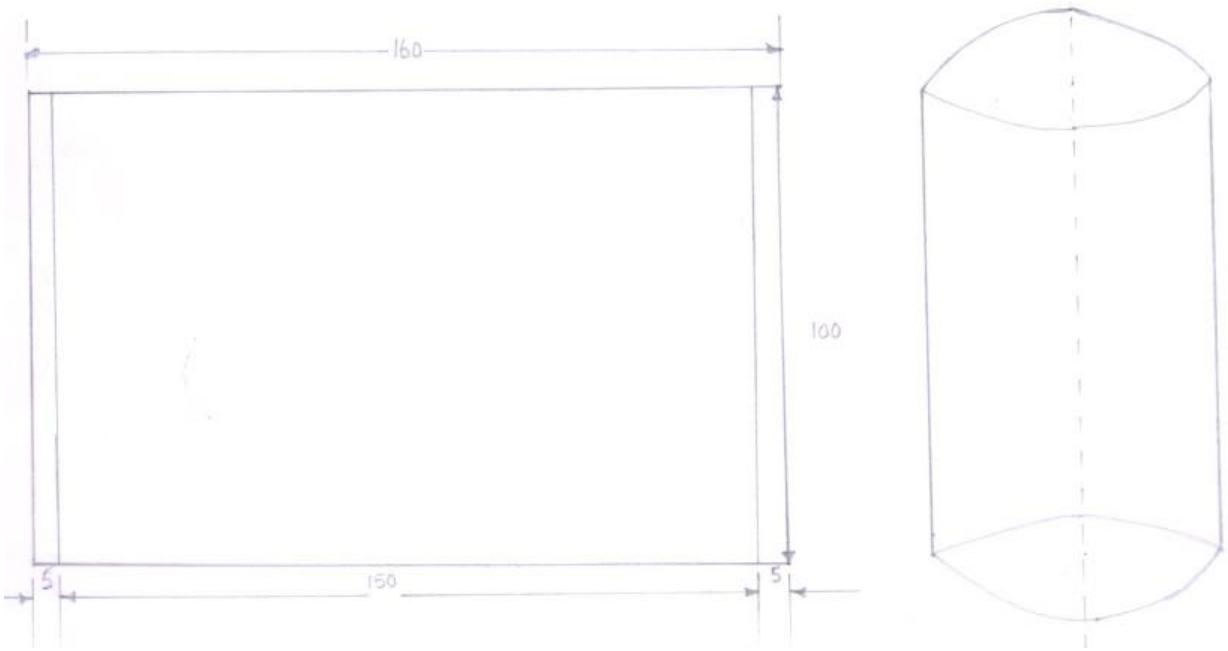


Fig: cylinder

Procedure: -

8. Clean the given sheet with cotton waste.
9. The size of the given sheet is checked with the steel rule.
10. Flatten the surface of the given sheet with wooden mallet.
11. Check the G.I. Sheet for dimensions and remove extra material, if any.
12. Mark all the measuring lines on the given sheet with scriber.
13. Cut the given sheet with straight snips as required.
14. Fold the given sheet by using stakes and ball peen hammer to the required shape.

Safety precautions: -

1. For marking purpose use scriber only. Do not use pencil or pen.
2. Sufficient care is to be taken while cutting and folding of G.I. sheet.
3. Remove the waste pieces immediately from the work place.

Result: -

Cylinder is prepared as per the given dimensions.

UNIT – V

ELECTRICAL HOUSE WIRING

Introduction:

Power is supplied to domestic installations through a phase and a neutral, forming a single phase. AC 230V 2 - wire system is for industrial establishments. Power is supplied through three phase four wire system to give 440V. The neutral is earthed at the distribution sub-station of the supply.
When supplied to domestic utilizes power is fed to a kilowatt meter and then to a distribution panel. The panel distributes power along several circuits' breakers. The panel also serves as a main switch.

Electrical wiring

Electrical wiring is defined as a system of electrical conductors, components and apparatus for conveying electrical power from the source to the point of use. The wiring system must be designed to provide a constant voltage to the load.

ELEMENTS OF HOUSE WIRING:

Fuses & circuit Breakers:

These are the devices to provide protection to a circuit against excess current. Open link fuses are not in safe in operations, even though they are cheaper and reliable. It consists of a thin strip of metal (or) wire.

Electric switch:

This is a device that makes and breaks or changes the course of electric circuit. It consists of 2 or more contacts mounted on an insulating structure and arranged such that they may be moved in to and out of contact with each other by a suitable operating mechanism.

Plug:

It is a device carrying 2 or 3 contact, designed for engagement with corresponding plugs pins and arranged for connection to fixed wiring and arranged for attachment to appliances such as radio, T.V, table, fan etc.

Socket outlet:-

It is a device carrying 2 or 3 contacts, designed for engagement with corresponding plug pins and arranged for connection to fixing wiring.

Lamp holder

These are designed to hold lamps & connect them in the circuit. Both bay one cap and screw lamp holders are available up to 200 watts lamps.

Ceiling rose

A ceiling rose consists of a circular base & cover made of Bakelite. The base has 2 or 3 terminal plates. One end of the plate is connected to supply wire connected to pendent lamp, ceiling fan, exhaust fan, etc.

Main switch

This is a switch intended to connect or cut-off the supply of electrical to the whole of an installation. It is generally of metal clad type. The metal clad gives greater strength and safety. The main switch contains one or more fuses, single phase, and A.C. circuits.

Interior wiring

A wire is defined as a bare or insulated conductor consisting of one (or) several strands. An insulating wire consists of a conductor with insulating material made of Vulcanized Indian Rubber (VIR) (or) Poly Vinyl Chloride (PVC). The wire may consist of 1 or several twisted strands. A multi sore conductor consists of several cores insulated from one another and enclosed in a common seating. Wire sizes are specified by the diameter of the wire, using a standard wire gauge (SWG), which also gives an idea of the current carrying capacity. The specification consists of the both the number of strands and the diameter of the each wire in it.

HOUSE WIRING SECTION

ONE LAMP CONTROLLED BY TWO TWO-WAY SWITCHES (STAIR CASE CONNECTION)

EXPERIMENT NO: DATE:

Aim: -

To give connections to one lamp controlled by two two-way switches.

Tools required: -

1. Screw driver
2. Cutting pliers
3. Ball peen hammer
4. Insulation remover
5. Tester

Material required: -

1. Wooden wiring board
2. Silk wire
3. Electrical bulb - 1 No
4. Two -way switches - 2Nos
5. Wooden round block - 1 No
6. Batten lamp holder - 1 No
7. Wire clips
8. Nails
9. Screws

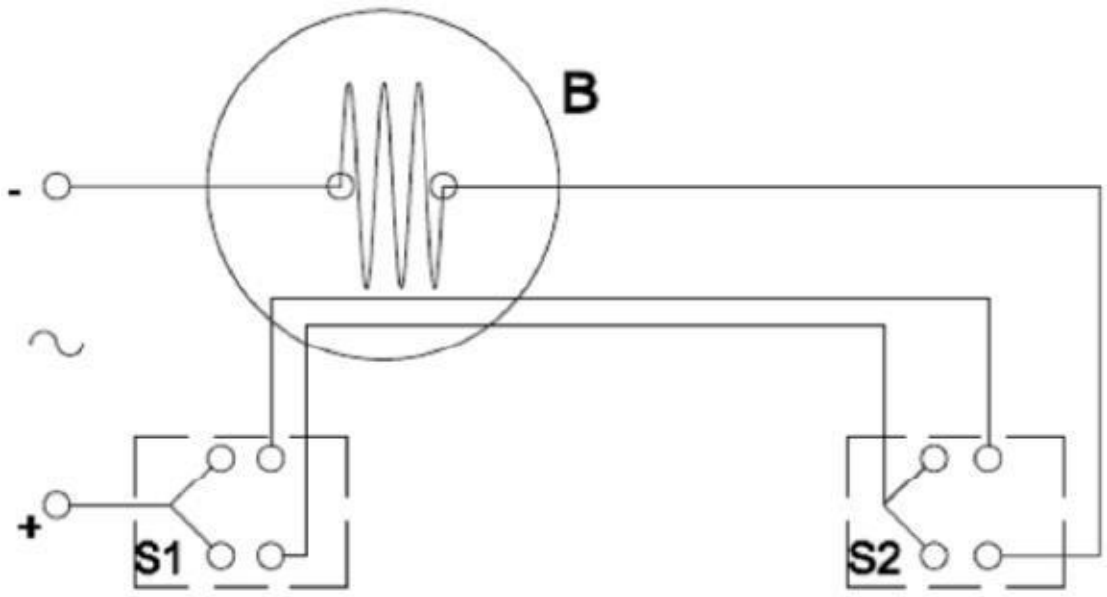


Fig - One lamp controlled by 2 two – way switches

Procedure

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wiring diagram.
3. Wires are stretched and clamped with the clips.
4. Round blocks are screwed on to the board, as per the diagram.
5. Wires are connected to the holders and the switch, which are then screwed on to the round blocks.
6. Bulb is fitted to the holder.
7. The wiring connections are tested, by giving power supply.

Safety precautions

1. Electricity has no respect for ignorance. Do not apply voltage or turn-on any device until it has been properly checked.
2. Care should be taken from electrical shocks.
3. Don't touch the connection points.
4. Avoid loose connection.
5. Don't work at damped areas and with wet clothing.
6. Handle the lamp carefully.

Result

Connections are given to one lamp controlled by two two-way switches and tested.

SWITCH POSITION		LAMP CONDITION
SWITCH- 1	SWITCH- 2	
OFF	OFF	OFF
ON	OFF	ON
OFF	ON	ON
ON	ON	OFF

HOUSE WIRING SECTION

WIRING FOR TWO LAMPS (BULBS) WITH INDEPENDENT SWITCH CONTROLS WITH OR WITHOUT LOOPING

EXPERIMENT NO: **DATE:**

Aim: -

To give connection to two lights controlled With Independent Switch Controls with or Without Looping.

Tools required: -

1. Screw driver
2. Cutting pliers
3. Ball peen hammer
4. Insulation remover
5. Tester

Material required: -

1. Wooden wiring board
2. Silk wire
3. Electrical bulbs - 2 No
4. One-way switch - 1No
5. Wooden round blocks - 1 No
6. Batten lamp holders - 1 No
7. Wire clips
8. Nails
9. Screws

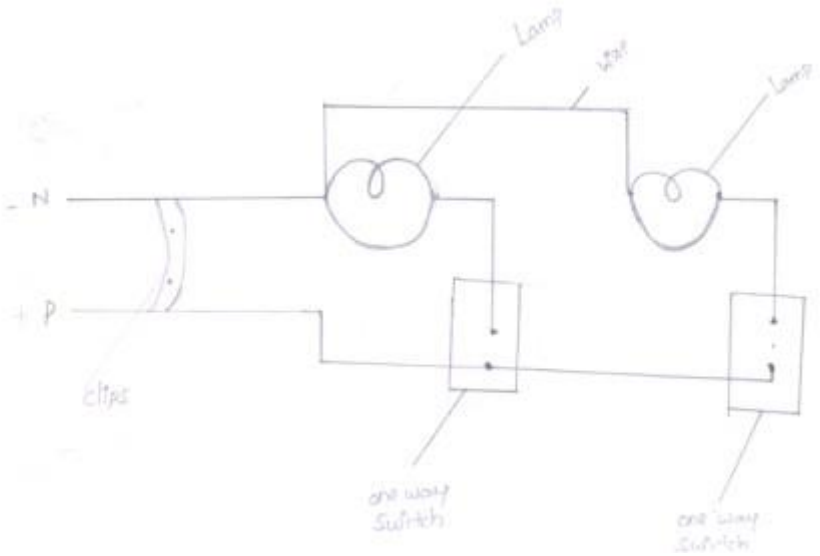


Fig - Two lights controlled by two independent switches

Procedure: -

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wiring diagram.
3. Wires are stretched and clamped with the clips.
4. Round blocks are screwed on to the board, as per the diagram.
5. Wires are connected to the holders and the switch, which are then screwed on to the round blocks.
6. Bulb is fitted to the holder.
7. The wiring connections are tested, by giving power supply.

Safety precautions

1. Electricity has no respect for ignorance. Do not apply voltage or turn-on any device until it has been properly checked.
2. Care should be taken from electrical shocks.
3. Don’t touch the connection points.
4. Avoid loose connection.
5. Don’t work at damped areas and with wet clothing.
6. Handle the lamp carefully.

Result

Connections are given to two bulbs controlled by the two independent switches and Tested

HOUSE WIRING SECTION

FLUORESCENT LAMP WIRING

EXPERIMENT NO: **DATE:**

Aim

To prepare wiring for a fluorescent tube light with switch control.

Tools Required

1. Screw driver
2. Hammer
3. Pliers
4. Line tester

Components Required

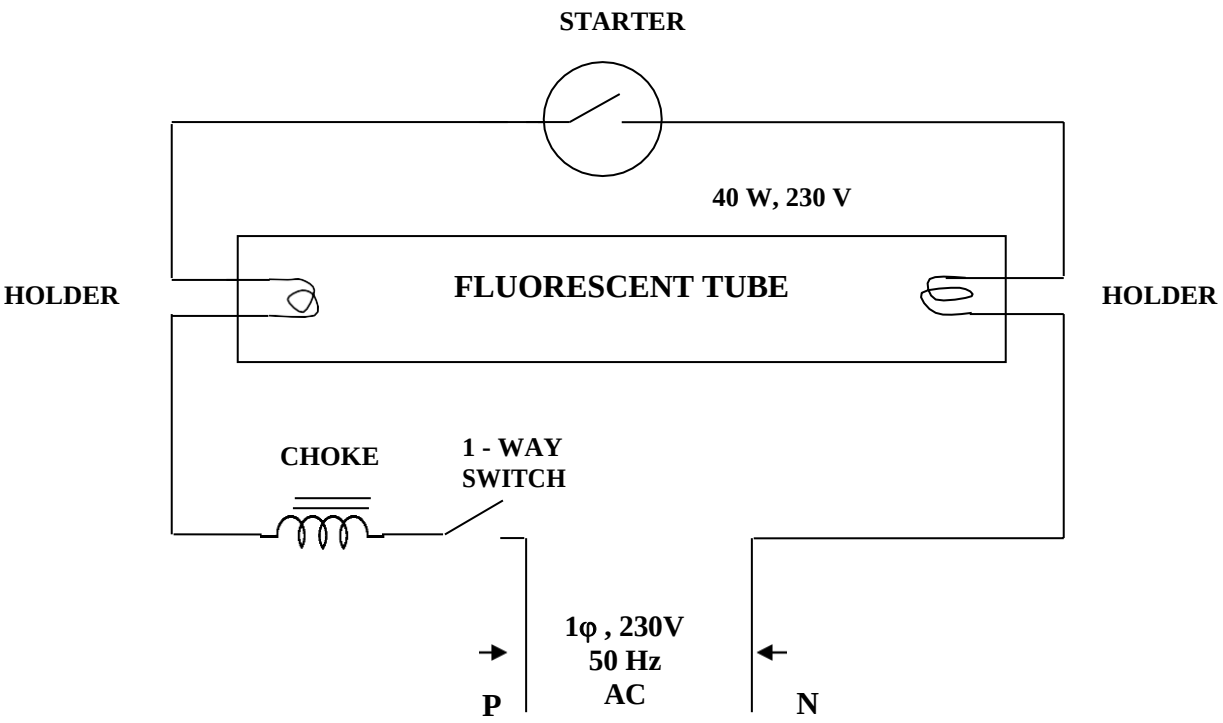
1. Switch 2. Tube light with fitting 3. Joint clips
4. Wires 5. Screws 6. Switch board

Working of the Fluorescent Tube Light:

Fluorescent lamp circuit consists of a choke, a starter, a fluorescent tube and a frame. The length of the commonly used fluorescent tube is 100 cm; its power rating is 40 W and 230V. The tube is filled with argon and a drop of mercury. When the supply is switched on, the current heats the filaments and initiates emission of electrons. After one or two seconds, the starter circuit opens and makes the choke to induce a momentary high voltage surge across the two filaments. Ionization takes place through argon and produces bright light.

Procedure

1. Mark the switch and tube light location points and draw lines for wiring on the wooden board.
2. Place wires along the lines and fix them with the help of clips.
3. Fix the switch and tube light fitting in the marked positions.
4. Complete the wiring as per the wiring diagram.
5. Test the working of the tube light by giving electric supply to the Circuit.



CIRCUIT DIAGRAM - FLUORESCENT LIGHT

Result

The wiring for the tube light is completed and tested.

UNIT – VI

DEMONSTRATION

MEASUREMENT OF ELECTRLCAL QUANTITIES-VOLTAGE CURRENT, POWER

Aim:

To measure electrical quantities for a given single phase circuit

Apparatus:

SL.NO	Components Required	Range	Type	Quantity
1	Ammeter	(0-10)	MI	1
2	Load	Variable	RLC	1
3	Volt meter	(0-300)	MI	1
4	Watt meter	300V, 10A	UPF	1
5	Autotransformer	1KVA 230/(0-240) V	1PH	1

Formulas:

Apparent Power = VI (Voltmeter reading x Ammeter reading)

Real Power = VI Cos Φ (Watt meter reading)

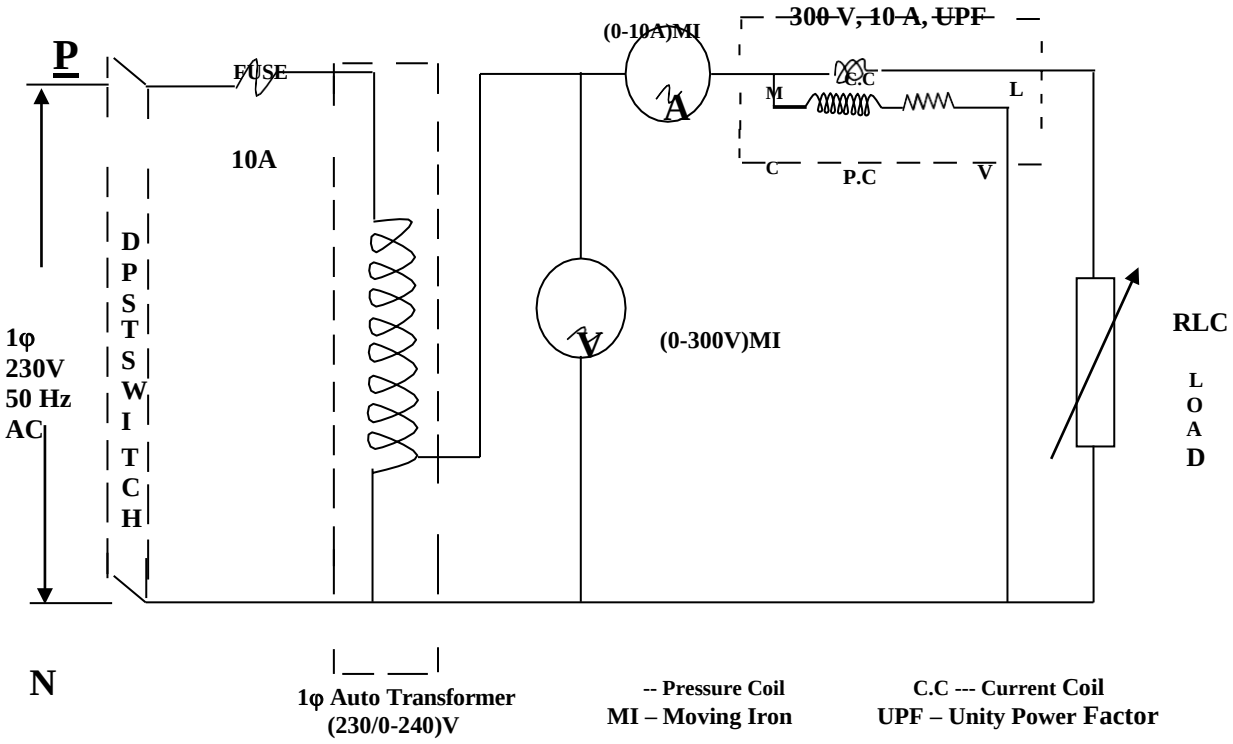
Power factor (Cos Φ) = Real Power / Apparent Power

Indicated Power = Observed reading X Multiplying factor

% Error = (Indicated Power –Actual Power) x100 /Actual Power

Actual Power = Voltmeter reading x Ammeter reading x Power factor

CIRCUIT DIAGRAM



TABULAR COLUMN

S.NO	Volt meter readings (Volts)	Ammeter readings (Amps)	Watt meter readings (Watts)		Power factor
			Observed reading	Indicated reading	
1. 2. 3. 4. 5.					

Procedure

1. Connections are given as per the circuit diagram
2. Set the rated voltage by adjusting Auto transformer
3. Observe the meter readings for various loading conditions.
4. Calculate the error and plot the graph between %error and current value.

Result:

Electrical quantities like Voltage, Current, and Power Values Measured.

ELECTRICAL WIRING TOOLS

Pliers

Pliers are available in different types, shape, and sizes. They are also available in both insulated and uninsulated handles. An insulated handle should be used when working on or near hot wires. It is also used for cutting big and small wires.

PLIERS

Screw Drivers

A screwdriver comes in various sizes and with several tip shapes. Screwdrivers used by electricians should have insulated handles. Using a screwdriver for a particular job, the width of the screwdriver tip should match the width of the screw slot.

SCREW DRIVERS

Drilling Equipment

Drilling equipment is needed to make holes in building structure passages of conduits and wires.

HAND DRILL MACHINE

Sawing and Cutting Tools

Saws are commonly used by electricians include the crosscut, keyhole, and hacksaw.

HACK SAW

Soldering Equipment

In doing electric wiring, splices and taps (connections made to wire) should be soldered, unless you use solderless connectors. Typical equipments available for soldering are shown below.

SOLDERING EQUIPMENT

Hammers

Hammers are used with chisels and for nailing and fitting. Below are examples of carpenter's claw hammer, lineman's hammer, and machinist's ball-peen hammer.

BALL PIN HAMMER

CLAW HAMMER

Measuring Tools

To measure wire length and other items, the electrician finds considerable use for measuring tools such as the extension or zigzag rule, push-pull rule and a steel tape as shown below.

ZIG ZAG RULE AND STEEL TAPE

POWER TOOLS LIST
(WITH NAMES AND PICTURES)


CORDLESS DRILL


IMPACT DRIVER


HAMMER DRILL


ROTARY HAMMER


IMPACT WRENCH


ELECTRIC SCREWDRIVER


ROTARY TOOL


JIGSAW


RECIPROCATING SAW (SAWZALL)


CIRCULAR SAW


MITER SAW


BAND SAW


TABLE SAW


CHAINSAW


BISCUIT JOINER


ANGLE GRINDER


BENCH GRINDER


SHOP VAC


BELT SANDER


RANDOM ORBITAL SANDER


DISC SANDER (FIXED)


DISC SANDER (HANDHELD)


WOOD ROUTER

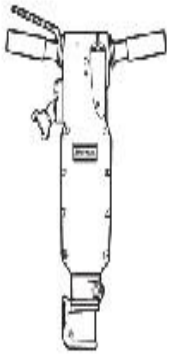

NAIL GUN

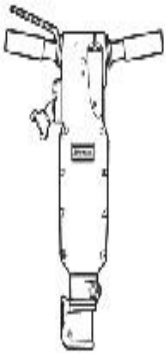
AIR COMPRESSOR


MOISTURE METER

TOOLSOWNER.COM

What are pneumatic tools?





Pneumatic tools are powered by compressed air. Common types of these air-powered hand tools that are used in industry include buffers, nailing and stapling guns, grinders, drills, jack hammers, chipping hammers, riveting guns, sanders and wrenches.

PNEUMATIC TOOLS