THE NEOTIA UNIVERSITY

ज्ञानम् आत्म प्रदीपाय

DEPARTMENT OF MECHANICAL ENGINEERING

Workshop/Manufacturing Practices

PC-MEP 201

EXPERIMENT NO.: PC-MEP 201/ 01

AIM: Study of Carpentry Tools

Marking and Measuring Tools:

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

Steel rule:

It is an important tool for linear measurement. It can also be used as a marking tool

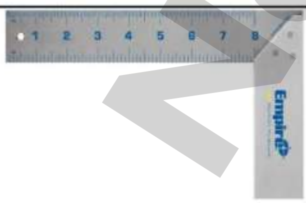
Steel tape:

	It is used for large measurements, such as marking on board and checking the overall dimensions of the work

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 stock (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 project through the stem, about 2 mm and the end is sharp enough to make a very fine line. A mortise gauge consists of two pins. In this, it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.

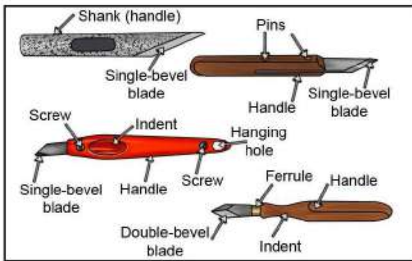
Try-Square:

	It is used for marking and testing the square ness 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. 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.

Compass and divider:

	They are used for marking Arcs and circles on the planed surfaces of the wood.

Scriber or marking knife:



It is used for marking on timber. It is made of steel, having one end pointed and the other end formed into a sharp cutting edge.

Bevel:

It is used for laying-out and checking angles. The blade of the bevel is adjustable and may be held in place by a thumb screw. After it is set to the desired angle, it can be used in much the same way as a try-square. A good way to set it to the required angle is to mark the angle on a surface and then adjust the blade to fit the angle.

HOLDING TOOLS:

Carpenter's vice:

Carpenter's 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 is movable by means of a screw and a handle. The jaws are lined with hard wooden faces.

C-Clamp:

Is used for holding small works.

Bar cramp:

It is a bar cram. 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.

C. PLANNING TOOLS:

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

Jack plane:

It is the most commonly used general purpose plane. It is about 35 cm 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 25 cm long. Being short, it can follow even the slight depressions in the stock, better than the jack plane. It is used after 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.

CUTTING TOOLS:

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 different purposes. A saw is specified by the length of its toothed edge.

Cross-cut or 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. This allows the blade to move freely in the cut, without sticking.

Rip 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 this saw is very thin and so it is stiffened with a thick back steel strip. Hence, this is sometimes called as back-saw. 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. It is mostly used in radius cutting. The blade of this saw is fitted with an open type wooden handle.

Chisels:

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

Firmer chisel:

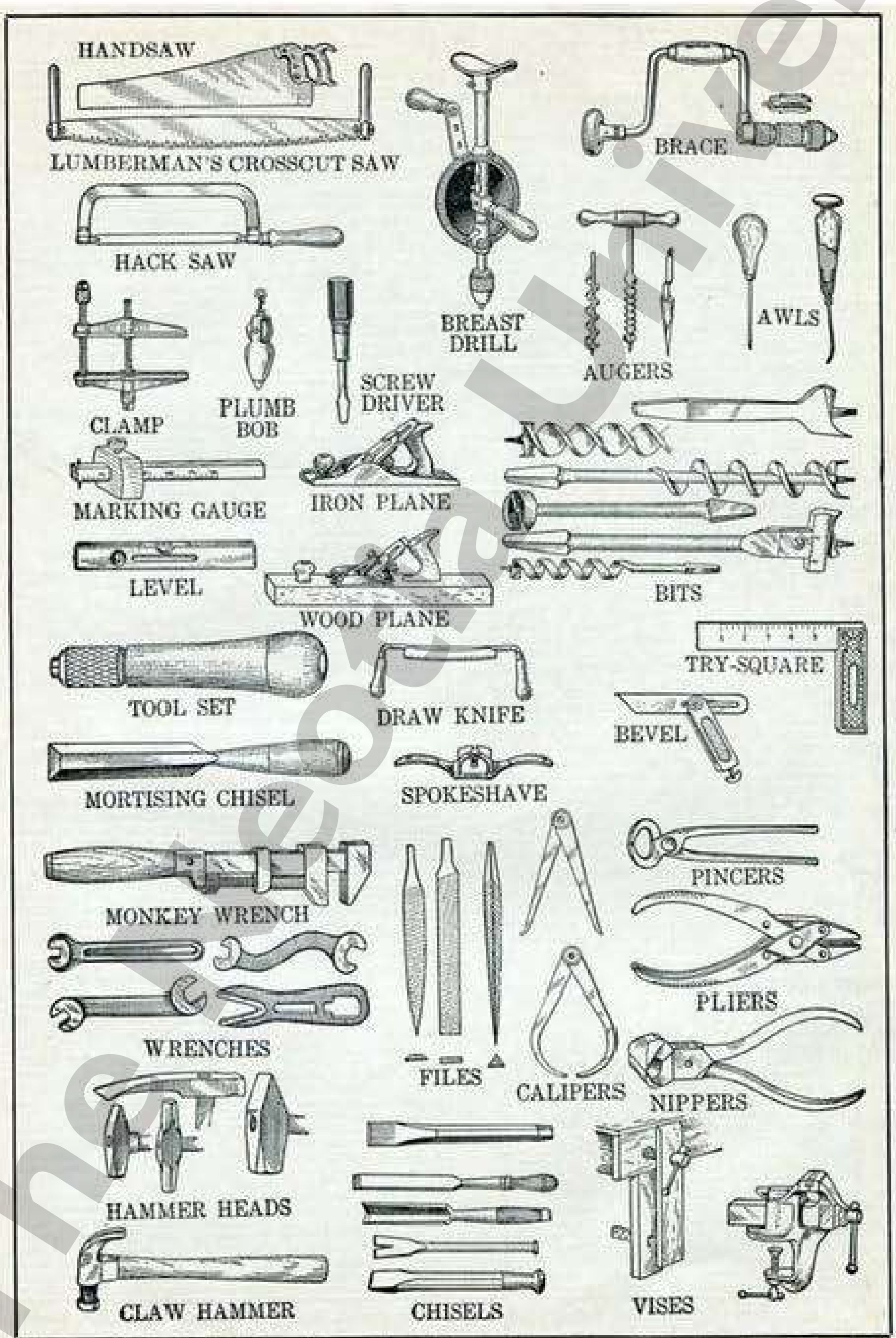
The work 'firmer' means 'stronger' and hence firmer chisel is stronger than other chisels. It is a general purpose chisel and is used either by hand pressure or by a mallet. The blade of a firmer chisel is flat.

Dovetail chisel:

It has a blade with a beveled back, 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. Further, the cross-section is made stronger near the shank.



Common Tools Used by Carpenters

EXPERIMENT NO.: PC-MEP 201/ 02

AIM: Study of different types of Carpentry joints.

Woodworking joints

Woodworking joinery is the craft of connecting and securing the separate members of the wooden construction to one another by means of specific cuts on the ends and/or sides of the members.

Woodworking joint is the spot where usually two pieces of wooden construction are joined together to form a rigid self supporting and permanent construction. Woodworking joints can be formed between the edges or between the end and the face, in the direction of the length, at right angles or it may be at an angle, other than a right angle. Various glues or fasteners (nails, screws, bolts…) are being used to increase the strength, effectiveness and rigidity of woodworking joints. Since the main purpose of woodworking joints is to join wooden parts together, their construction should be done carefully, so it would not weaken the parts that are joining.

Each of these joints has a name and is usually some variation of a hole or slot on one timber, and a corresponding, matching projection on the other.

The purpose of our woodworking joints database is to introduce the basic types and methods of making woodworking joints to the amateur woodworker and carpenter, and for the experienced craftsman to serve as a reminder, or to expand certain knowledge in this field, if needed.

There are many types of woodworking joints; some can be made easily and the others are quite difficult to make, but the practice will show you that the more complex the woodworking joint is, the stronger it is.

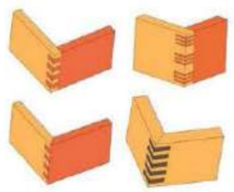
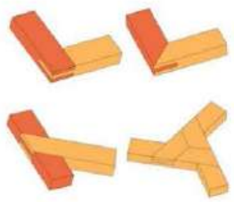
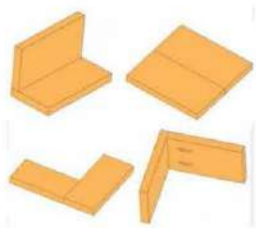
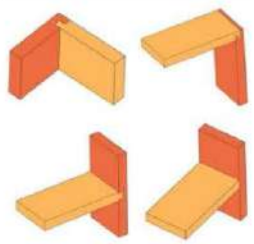
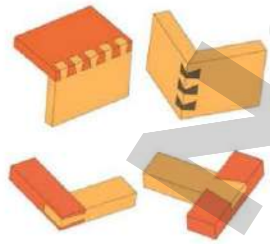
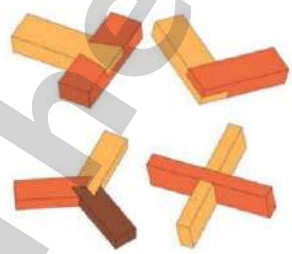
The quality woodworking joints can be manufactured with the hand tools, but if you need high productivity, you will have to rely on machines and power tools.

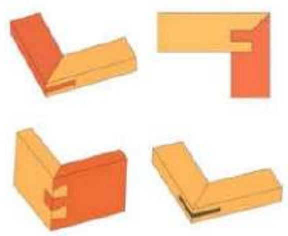
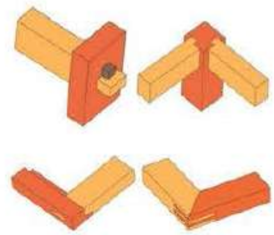
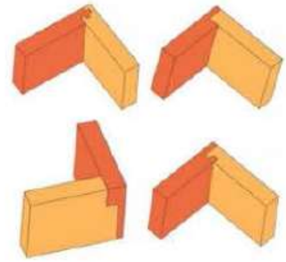
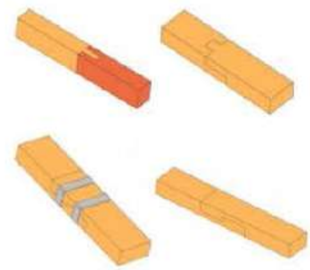
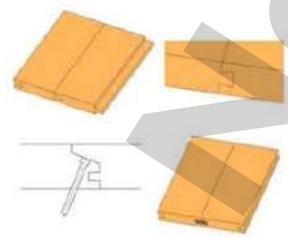
Our goal regarding this joint database is to provide as much information as possible about each joint. We own a large number of old carpentry books and magazines, and all the given information on joints have been found in them. If you know of any additional information about any of the joints described, its other name, or if you have noticed any mistake that we have made, do let us know - we are aiming to make this a great quality database of woodworking joints available to everyone!

Woodworking joints can be divided into four main categories, depending on the functions they perform:

- Lengthening
- Widening
- Framing
- Housing

Woodworking joints are usually divided into the following categories:

	**Box joints** A finger joint or box joint is used to join two pieces of wood at a corner. It is similar to a dovetail joint except that the pins are square and not angled.
	**Bridle joints** A bridle joint is similar to a mortise and tenon woodworking joint, thought in most circumstances it would not be as strong. It is open ended mortise and tenon joint.
	**Butt joints** A butt joint is made by placing the end of one piece of wood against the side of another and fastening them firmly to each other.
	**Dado joints** A dado joint is made by cutting a rectangular groove entirely across one member into which the end of another member fits.
	**Dovetail joints** Dovetail joints are so named from the shape of the piece which makes the joint. This is probably the strongest method for joining two pieces of wood.
	**Lap joints** A half lap joint usually consist of two members notched to half thickness and lapped on each other with the face flush.

	**Miter joints** A miter joint is one formed by the meeting of two pieces at a corner, on a line bisecting the right angle. The same class of joint can be used on angles greater or less than 90 degrees.
	**Mortise and tenon joints** A mortise and tenon joint is the method of joining by forming a solid rectangular projection in the one piece and cutting a corresponding cavity to receive it in the adjoining piece.
	**Rabbet joints** A rabbet is a recess cut out of the end or edge of a board. When a piece is butted into a rabbet, it is called a rabbet joint.
	**Scarf joints** A scarf joint is formed where two pieces lap each other in the direction of the grain, with flush surfaces.
	**Tongue and groove joints** A tongue and groove joint provide a mechanical means of joining the edges of narrow boards when forming a wider panel.

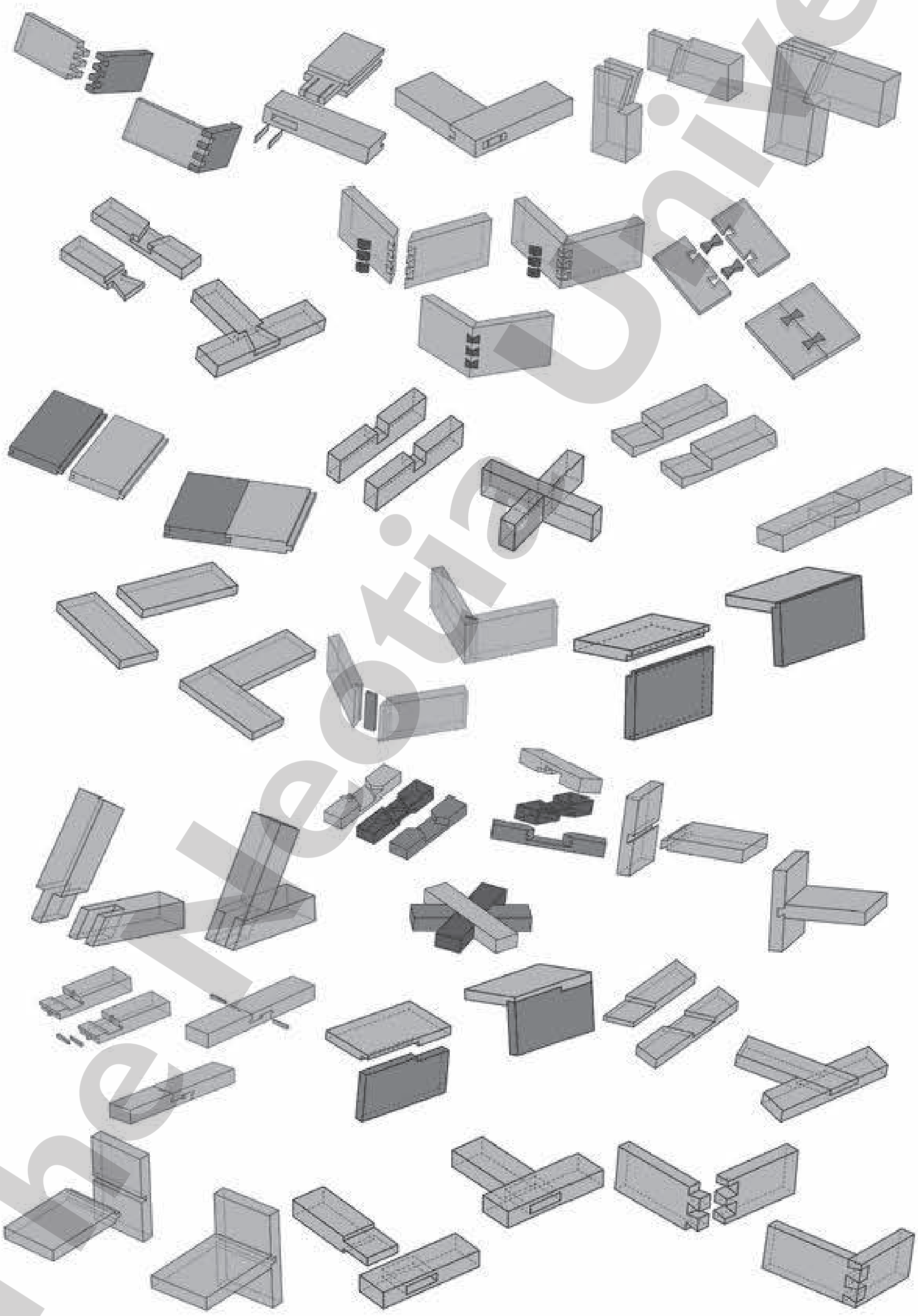
To be able to successfully design your wooden construction is necessary to bear in mind two things: to know the right woodworking joint to use, and to know how to make that woodworking joint in the right way.

Every woodworking joint must fulfil important requirements:

- It must support the load transmitted from other parts of wooden construction, or the load that has direct influence on the members of the woodworking joint. This load includes the weight of the construction itself, the external weight or the forces that influence your construction, various internal and residual stresses.

- It must let the wood move as it expands and contracts with changes in temperature and humidity
- It must provide suitable gluing surface or anchor for fasteners.

On some constructions the visual appearance is also important, so an additional requirement for woodworking joints is to be either decorative or unnoticeable. In both cases the woodworking joints must be properly and accurately crafted.



EXPERIMENT NO.: PC-MEP 201/ 03

AIM: Practice of 'T' half lap joint as shown in Figure from the given reaper of size 50 x 50x 250 mm.

TOOLS REQUIRED: Carpenter's vice, steel rule, jack plane, try-square, marking gauge, 25 mm firmer chisel, cross-cut saw, tenon saw, scriber and mallet.

MATERIAL REQUIRED: 50X50X250mm wood - two pieces.

SEQUENCE OF OPTIONS

1. CUTTING

2. PLANING

3. INSPECTION

PROCEDURE

1. The given reaper is checked to ensure its correct size.

2. The reaper is firmly clamped in the carpenter's vice and any two adjacent faces are planed by the jack plane and the two faces are checked for square ness with the try-square.

3. Marking gauge is set and lines are drawn at 50 and 50 mm, to mark the thickness and width of the model respectively.

4. The excess material is first chiseled out with firmer chisel and then planed to correct size.

5. The mating dimensions of the parts X and Yare then marked using scale and marking gauge.

6. Using the cross-cut saw, the portions to be removed are cut in both the pieces, followed by chiselling and also the parts X and Yare separated by cross-cutting, using the tenon saw.

7. The ends of both the parts are chiseled to the exact lengths.

8. A fine finishing is given to the parts, if required so that, proper fitting is obtained.

9. The parts are fitted to obtain a slightly tight joint.

SAFETY PRECAUTIONS:

1. Tools that are not being used should always be kept at their proper places.

2. Make sure that hands are not in front of sharp edged tools while using them.

3. Sharp tools are only to be used. A dull tool requires excessive pressure, causing the tool to slip.

4. Wooden pieces with nails should never be allowed to remain on the floor.

5. Care should be taken, when the thumb is used as a guide in cross-cutting and ripping.

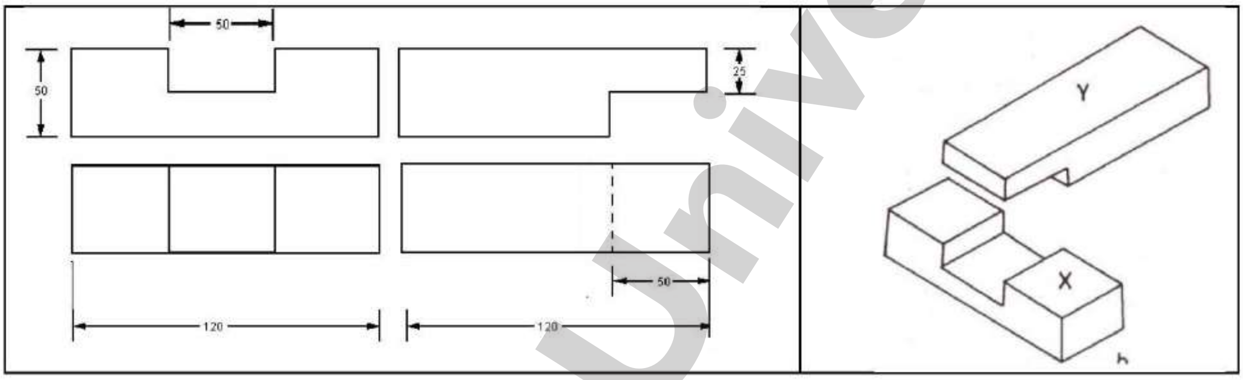
6. Test the sharpness of the cutting edge on wood or paper, but not on hand.

7. Never chisel towards any part of the body.

8. The tip of the screw driver must fit the slot without wobbling. The width of the tip should be equal to the length of the screw slot.

9. Keep the screw driver properly pointed to prevent injury to hands.

RESULT: The T-Lap joint is thus made by following the above sequence of operations.



EXPERIMENT NO.: PC-MEP 201/ 04

AIM: To make a Dovetail lap joint

APPARATUS & TOOLS REQUIRED:

Carpenter's vice, steel rule, jack plane, try-square, marking gauge, 25 mm firmer chisel, cross-cut saw, tenon saw, scriber and mallet.

MATERIAL REQUIRED: 50X50X250mm wood - two pieces.

SEQUENCE OF OPTIONS:

1. CUTTING

2. PLANNING

3. INSPECTION

PROCEDURE:

1. The given reaper is checked to ensure its correct size.

2. The reaper is firmly clamped in the carpenter's vice and any two adjacent faces are planned by the jack plane and the two faces are checked for square ness with the try square.

3. Marking gauge is set and lines are drawn at 50 and 50 mm, to mark the thickness and width of the model respectively. .

4. The excess material is first chiseled out with firmer chisel and then planed to correct Size.

5. The mating dimensions of the parts X and Yare then marked using scale and marking gauge.

6. Using the cross-cut saw, the portions to be removed are cut in both the pieces, followed by chiseling and also the parts X and Yare separated by cross cutting, using the tenon saw

7. The ends of both the parts are chiselled to exact lengths.

8. A fine finishing is given to the parts, if required so that, proper fitting is obtained.

9. The parts are fitted to obtain a slightly tight joint.

SAFETY PRECAUTIONS:

1. Tools that are not being used should always be kept at their proper places.

2. Make sure that hands are not in front of sharp edged tools while using them.

3. Sharp tools are only to be used. A dull tool requires excessive pressure, causing the tool to slip.

4. Wooden pieces with nails should never be allowed to remain on the floor.

5. Care should be taken, when the thumb is used as a guide in cross-cutting and ripping.

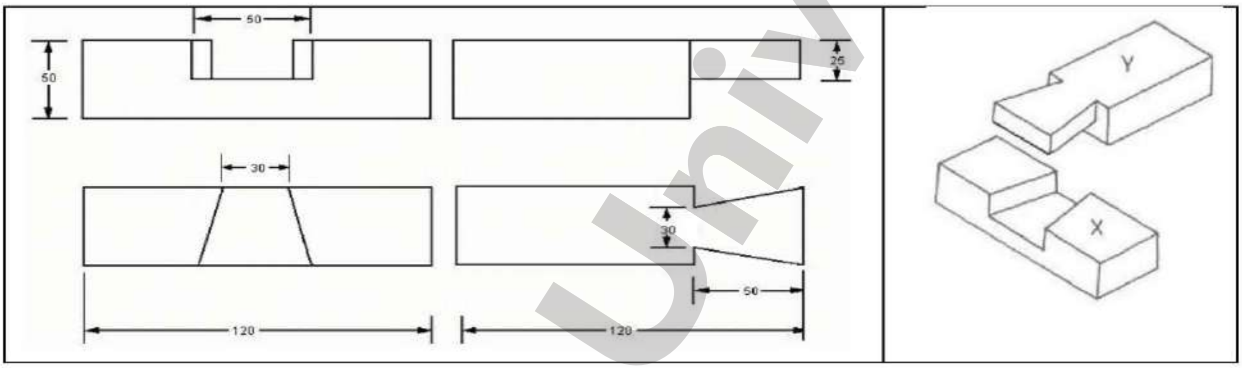
6. Test the sharpness of the cutting edge on wood or paper, but not on hand.

7. Never chisel towards any part of the body.

8. The tip of the screw driver must fit the slot without wobbling. The width of the tip should be equal to the length of the screw slot.

9. Keep the screw driver properly pointed to prevent injury to hands.

RESULT: The Dovetail lap joint is thus made by following the above sequence of operations.



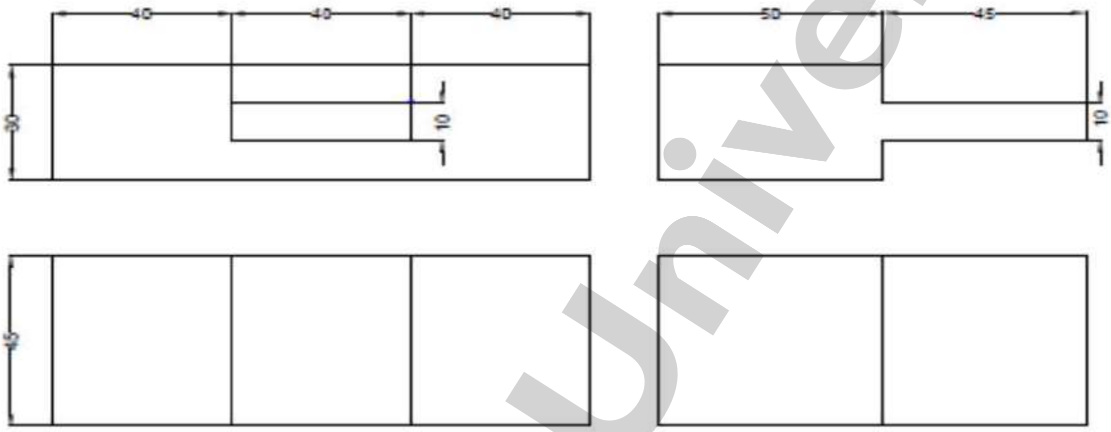
EXPERIMENT NO.: PC-MEP 201/ 05

AIM: To make a Mortise and Tenon 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 DIMENSIONS ARE IN MM

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 chiselled 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 chiselling.
8. The ends of both the parts are chiselled 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 chiselling, sawing and planning with care.

Result: - Mortise and Tenon joint is made as per the required dimensions.

EXPERIMENT NO.: PC-MEP 201/ 06

AIM.; TOOLS USED IN FITTING SHOP

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

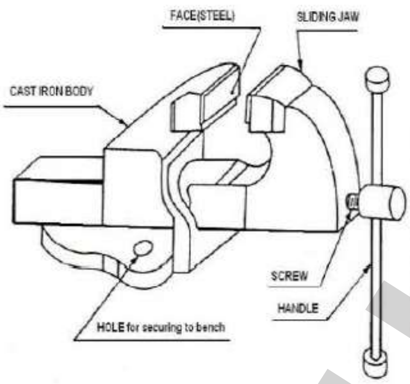
8. Calipers

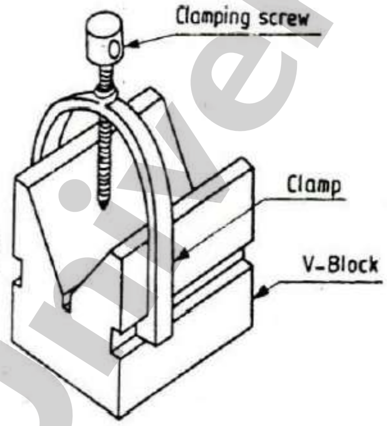
9. Dot punch

10. Vernier caliper

Surface plate:-

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





1) Bench Vice 2) 'V' Block

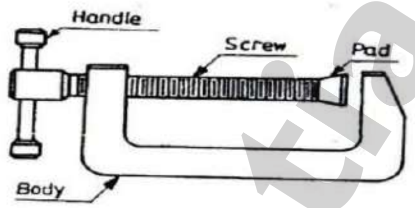


Fig: 3 C – Clamp

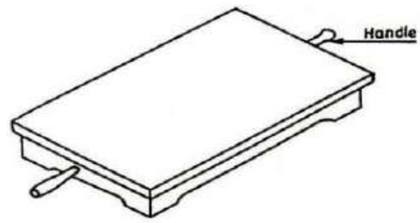


Fig: 4 Surface plate

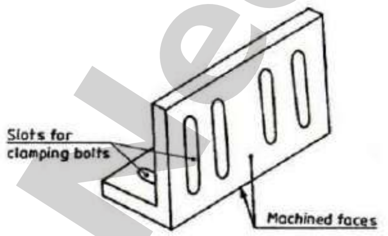


Fig: 5 Angle plate

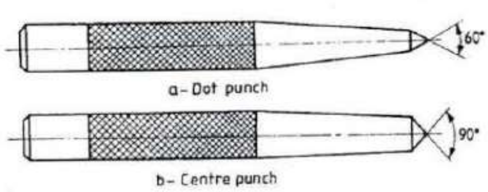


Fig: 6 Dot punch

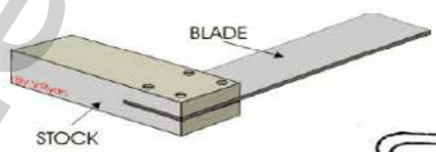


Fig: 6 try square

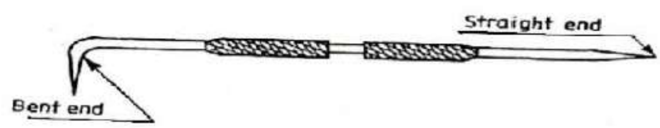


Fig: 7 scriber

Combination cutting pliers: -

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

Taps and die holders: -

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

Dies and die holders:-

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

TYPES OF FILES:

Hand file:-

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

Flat file:-

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

Square file:-

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

Half round file:-

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

Round file:-

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

MISCELLANEOUS TOOLS:

Ball peen hammer:-

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

Screw driver:-

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

Spanners:-

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

FITTING OPERATIONS:

Chipping:-

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

Fitting:-

1. Pinning of files:-

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

2. Checking flatness and square ness:-

To check flatness across thickness of plate.

MARKING AND MEASURING:

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

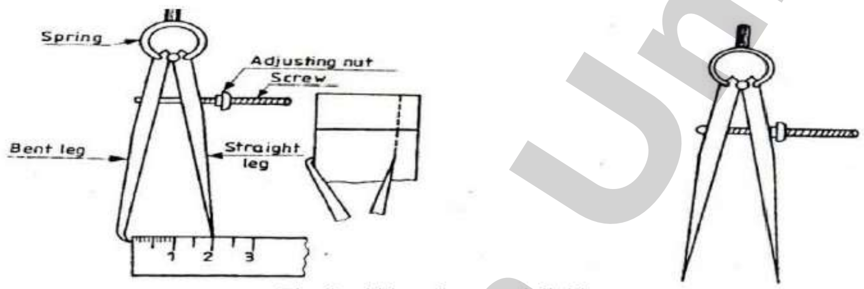


Fig: 8 odd leg clamp and divider

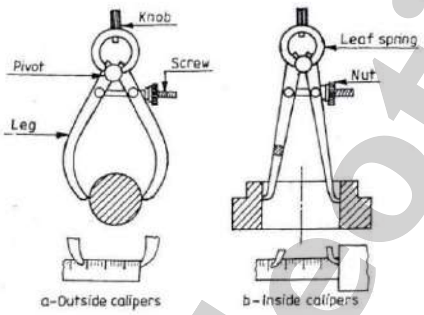


Fig: 9 calipers

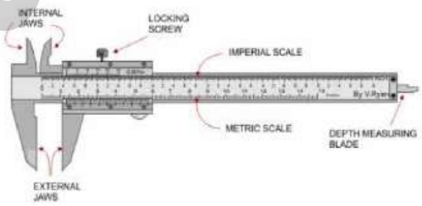


Fig: 10 Vernier calliper

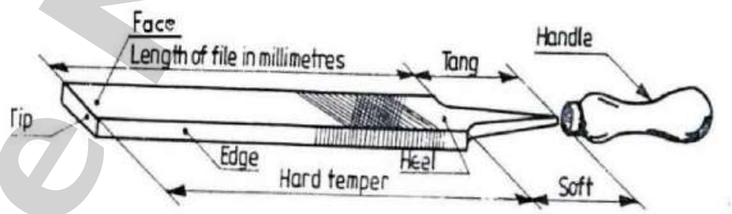


Fig: 11 Parts of hand file

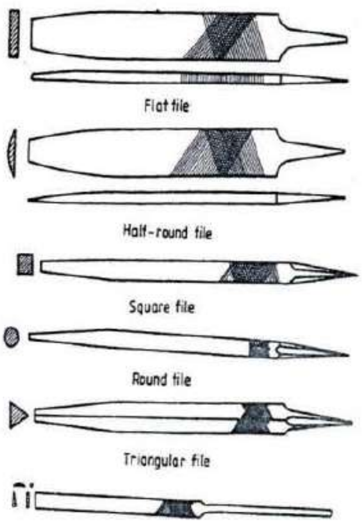


Fig: 12 Types of files

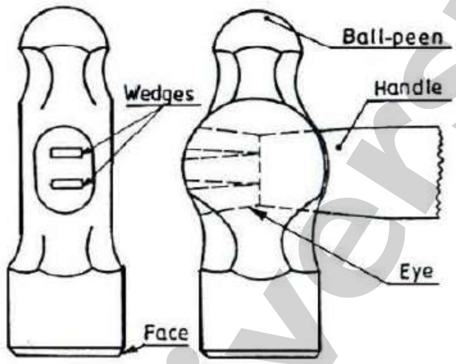


Fig: 13 ball peen hammer

EXPERIMENT NO: PC-MEP 201/ 07

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

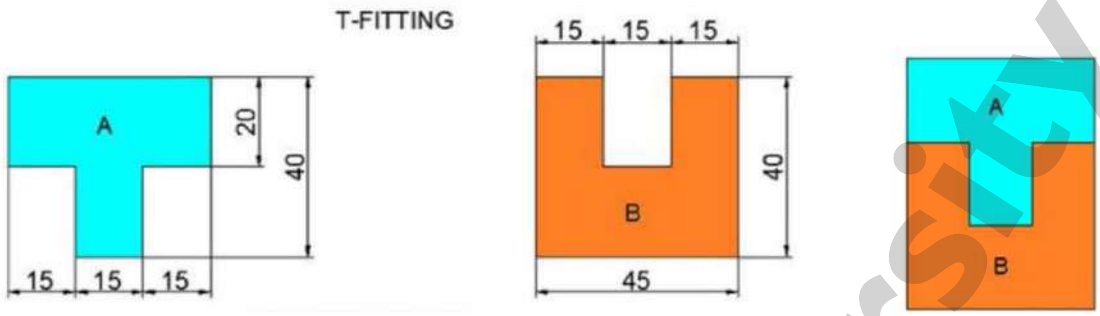


Fig: SQUARE (T) – FITTING [all dimension are in mm]

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 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.

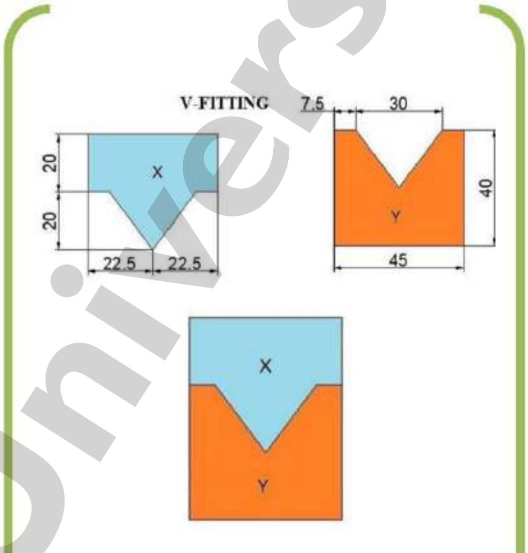
EXPERIMENT NO: PC-MEP 201/ 08

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



All Dimensions are in mm

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

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.

MACHINE SHOP SAFETY PRECAUTIONS

1. Turning shop has powered rotating machines like Centre Lathe. Take extreme care to ensure that anything which could get entangled in rotating parts is kept away.

2. Always wear lab coat in the Turning shop, loose clothing could be a serious safety hazard for chances of its entanglement in rotating parts.

3. Wearing neckties, bangles, bracelets, watches etc. while working on lathes could also be hazardous due to the risk of their getting caught in lathe chuck

4. Long loose hair has history of causing fatal accidents on lathes.

5. Wear closed shoes with rubber sole, hot chips can cause burns.

6. Never operate any Machine unless you know how to operate it.

7. Never touch moving parts like Chuck, Belt or rotating grinding wheels etc.

8. Stay clear of the starting switch on the lathe. Accidental pressing of the switch may cause fatal accident.

9. In case of risky or dangerous situation immediately cut off power supply by pressing red button on the starter.

10. Always stay careful while working on powered machines like lathes etc.

EXPERIMENT NO.: PC-MEP 201/ 09

Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools)

Metal Cutting/Machining: Metal Cutting or "Machining is the process, by which parts are produced by removing unwanted material from a block of metal in the forms of chips. This process is the most important as almost all the products get their final shape and size by machining.

Machine Shop: Parts having been formed to preliminary shapes by Casting or Forging etc. are finished to final shape & Size by machines called Machine Tools. The workshop where these Machine Tools are used for carrying out finishing operations on the parts is called the "Machine Shop."

Turning Shop: Machine Shop with only one type of Machine tools i.e. a Centre Lathe is used for manufacturing and finishing parts is called 'Turning Shop'. In any manufacturing activity the role of the Lathe is indispensable.

Machine Tool: - Machine tool is a powered device which performs material removal operation on the work piece to give desired shape and size to the work piece. Machine tool performs the following four main functions: It

1. Holds the work piece.

2. Holds the cutting tools.

3. Moves one or both of these.

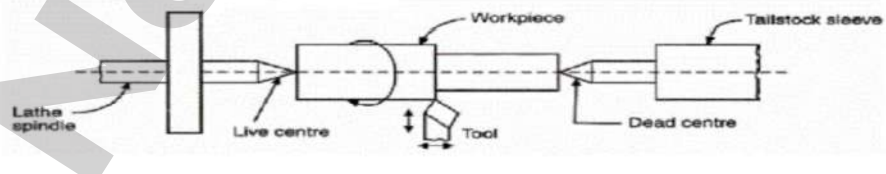
4. Provides feeding motion to one of them.

Examples of Machine Tools:-

1. Centre /Engine lathe. 2. Shaper / Shaping Machine. 3. Drilling Machine. 4. Planer / planning Machine. 5. Power Hacksaw. 6. Milling Machine. 7. Cylindrical Grinder etc.

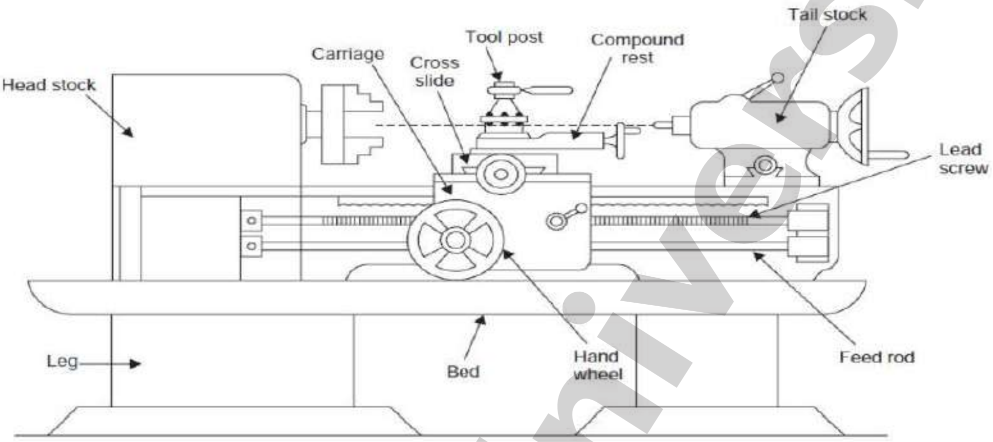
Centre Lathe. It is so called because it has two Centres between which the work piece can be held and rotated. It is also called "Engine Lathe" because firstly this type of lathe was driven by a steam engine. Its main objective is to remove material by rotating the work piece against the cutting tool. It may also be used for many other purposes such as Threading, Drilling Reaming, Boring, Grinding and Milling etc.

Working principle of Lathe. In this Machine Tool work piece is held in a chuck or between the Centres and rotated about it axis at a uniform speed. Cutting tool is held in the Tool Post and is fed in to the work piece in the desired direction i.e. in linear, transverse or lateral.



Types of lathes: Though the fundamental principle of operation of all lathes is same yet they are classified accordingly to design, type of drive, arrangement of gears, and the purpose of use etc, following are the important types of lathe:-1. Speed lathe 2.Engine/ Center lathe 3.

Bench lathe 4.Tool Room lathe 5.Capstan & Turret lathe 6.Automatic lathe 7.Speacial purpose lathe etc.



Block diagram of a Centre Lathe

The Main parts of lathe.

1. **Bed** - The Bed is the base or foundation of the lathe. It is a massive and rigid casting made in one piece to resist deflection and vibrations. It supports or holds all other parts of the lathe.

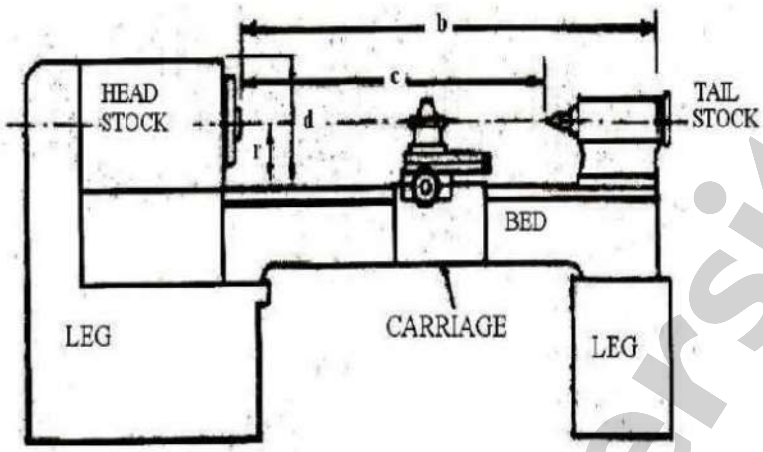
2. **Head Stock-** It supports the main spindle in the bearings and aligns it properly and provides different spindle speeds. Holding devices like Three Jaw Chuck, Four Jaw Chuck and Faceplate etc, are mounted on Head Stock spindle.

3. **Tail Stock** - It is movable part located opposite to Head Stock on the Bed ways. It is used for two purposes. (a) To support free end of the long jobs during machining.(b) To hold certain cutting tools for performing operations like drilling, reaming & tapping etc.

4. **Carriage-**It is located between Headstock and Tailstock. It can slide along Bed ways and can be located at any position by tightening the Carriage lock screw. It consists following five main parts. (a)Tool post (b) Compound Rest(c) Cross Slide (d) Saddle (e) Apron

5. **Feed mechanism**-provides feed motion to the cutting tool and consists of (a) Feed Gear Box (b) Feed Shaft(c) Feed Selectors etc.

Specifications of lathe- The size of the lathe is specified as below. (b) Length of Bed (c) Admittance b/w centers i.e. Maximum Job length that can be admitted b/w live & dead center. (d) Swing over Bed i.e. Maximum diameter of the work piece that can be rotated over Bed. (r) Centre height.



Operations performed on Lathe.

Facing: In the context of Turning work it involves moving the cutting tool at right angle to the axis of rotation of the rotating work piece. This can be performed by the operation of the cross-slide.

Straight Turning: It is one of the most basic machining operations. That is, the part is rotated while a single point cutting tool is moved parallel to the axis rotation.

Shoulder turning: In Shoulder turning, there is a 90 degree face moving from one diameter to the other as you can see in the fig. It is done by moving Cutting tool at Rt angle to the job axis using cross slide.

Taper Turning: Machining a cone or frustum of a cone by turning at an Angle to the job axis.

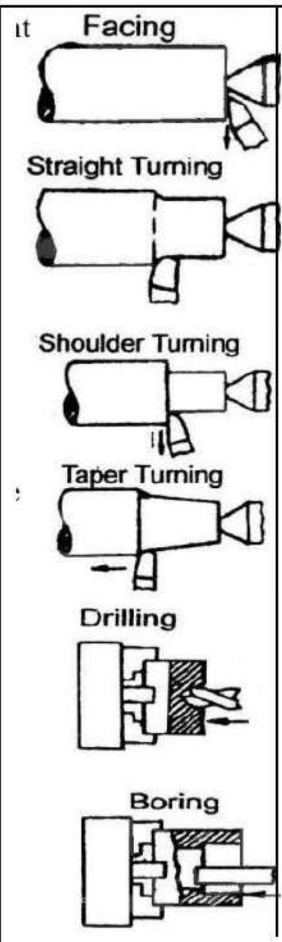
Drilling: is used to remove material from the inside of a work piece. This process utilizes standard drill bits held stationary in the tail stock of the lathe.

Boring : Enlarging or smoothing an existing hole created by drilling, moulding etc. by using a cutting tool mounted in a Boring bar.

Reaming: The sizing operation that removes a small amount of metal from a hole already drilled. It is done for making internal holes of very accurate diameters.

Threading : Both standard and non-standard screw threads can be turned on a lathe using an appropriate cutting tool. (Usually having a 60, or 55° nose angle) either externally, or within a bore.

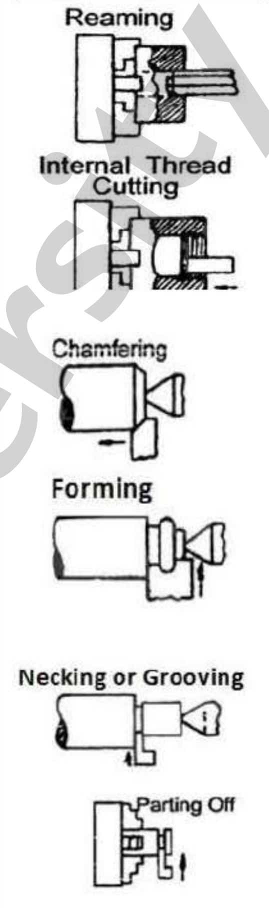
Chamfering: Chamfering connects two surfaces with a beveled edge. If the surfaces are at right angles, the chamfer will typically be symmetrical at 45 degrees. A form tool is used for chamfering.



Forming: The forming is an operation that produces a convex, concave or any irregular profile on the work piece, using a form tool having a form cut in opposite direction.

Grooving: Grooving is like parting, except that grooves are cut to a specific depth, instead of severing a completed / part-complete component from the stock.

Parting Off: This operation is also called **cut off.** It is used to create deep grooves which will remove a completed or part-complete component from its parent stock.



EXPERIMENT No.- PC-MEP 201/ 10

AIM: To make a job, involving Facing, Plain turning, Step turning & Chamfering etc.

Equipment & tools required: Center Lathe, Turning Tool, Grooving Tool, Steel Rule & Vernier Caliper etc

Material; Mild Steel bar Ø 25 x 125 mm.

Procedure:

1. Hold the bar in 3jaw chuck in a way that at least 20mm of bar stock is projected outside the chuck.

2. Do facing of both the ends of bar and maintain dimn.120mm.

3. Hold the turning tool in Tool post so that it projects out of the tool post about 25mm. The cutting edge of the tool should coincide with the center of work piece.

4. Hold the job in a 3 jaw chuck, about 45 mm of the job projecting out. The Ø22mm is obtained first taking one or more rough cuts then finally a finishing cut of not more than 0.50 mm depth is taken.

5. Similarly turn Ø 18mm to a length of 30 mm from the free end.

6. Champher the free end.

7. Remove job from the Chuck and hold from Ø 18mm resting against Ø 22mm shoulder.

8. Reduce and finish Ø 25mm to Ø 21mm up to length 78 mm from end by plain turning.

9. Turn Ø18mm up to length 30mm as explained above.

10. Do Champhering on the free end at the same setting.

11. De burr all over and remove job from the Chuck.

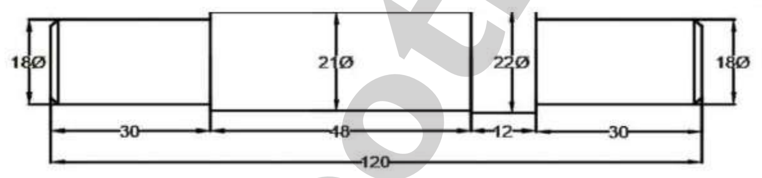


Fig. Practical Exercise no. 1

Tolerance ± 0.5mm on lengths
Tolerance ± 0.1mm on diameters

Observations:

Designed Dimensions	Actual Dimensions	Measuring Instrument Used
Ø 18, 18 mm		Vernier Caliper
Ø 22 mm		Vernier Caliper
Ø 21 mm		Vernier Caliper
Length 120 mm		Vernier Caliper
Length 30 mm		Vernier Caliper
Length 12 mm		Vernier Caliper
Length 48 mm		Vernier Caliper
Length 30 mm		Vernier Caliper

EXPERIMENT NO.- PC-MEP 201/ 11

AIM: To make a job, involving operations, Facing, Plain Turning, Step turning Grooving, Taper turning, Knurling and Chamfering etc.

Equipment & Tool Required; Center Lathe, Turning Tool, Grooving Tool, Steel Rule, Vernier Caliper etc.

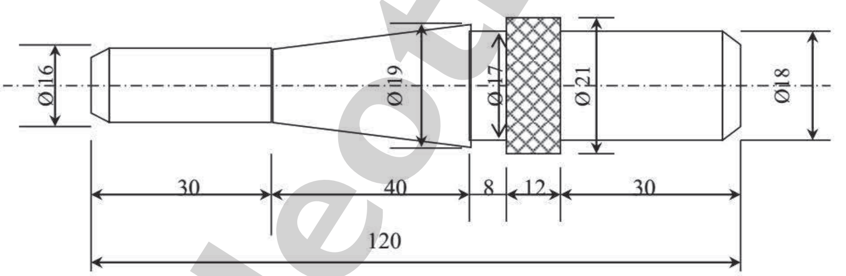
Material; Job made in practical No.10

Procedure:-

1. Hold the job from Ø 21mm and about 60mm length projected outside the chuck.
2. Turn Ø 22 to Ø 21 and turn a groove of 8mm width and Ø 17 using a parting tool.
3. Do diamond knurling on Ø 21.
4. Champher the free end.
5. Remove job from the chuck and hold from Ø 18 resting against the step Ø 22.
6. Turn Ø 21 mm to Ø 19 mm throughout length.
7. Find the half taper angle using the relation

$\tan\theta = D-d/2L = 19-16/2x40 = .0375, \theta = 2.15°$

8. Set the Compound slide at the calculated angle.
9. Turn taper slowly till a regular taper connecting Ø 16 to Ø 19 mm is achieved.
10. Champher the free end.
11. Deburr all over.
12. Remove job from the chuck and inspect.



All Dimensions are in MM
Tolerance ± 0.5MM on lengths
Tolerance ± 0.1MM on diameters

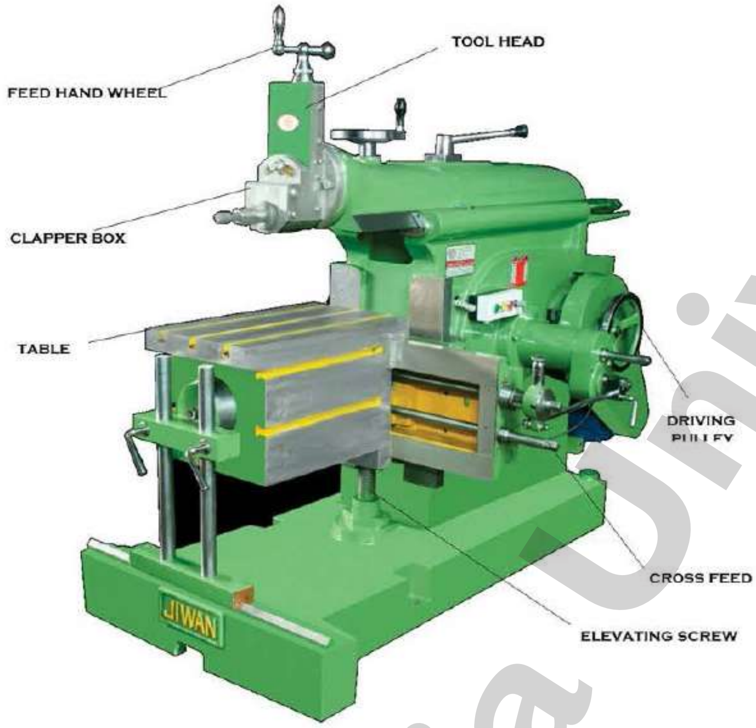
Observations:

Designed Dimensions	Actual Dimensions	Measuring Instrument Used
Ø 16 mm		**Vernier Caliper**
Ø 19 mm		**Vernier Caliper**
Ø 17 mm		**Vernier Caliper**
Ø 21 mm		**Vernier Caliper**
Ø 18 mm		**Vernier Caliper**
Length 30 mm		**Vernier Caliper**
Length 12 mm		**Vernier Caliper**
Length 8 mm		**Vernier Caliper**
Length 40 mm		**Vernier Caliper**
Length 30 mm		**Vernier Caliper**

EXPERIMENT NO.: PC-MEP 201/ 12

AIM: STUDY OF SHAPING MACHINE

Principle Parts of a Shaper Machine | Shaper Machine Mechanism



PARTS OF SHAPER MACHINE

Introduction:

The shaper is a machine tool used primarily for:

1. Producing a flat or plane surface which may be in a horizontal, a vertical or an angular plane.

2. Making slots, grooves and keyways

3. Producing contour of concave/convex or a combination of these

Working Principle:

Before starting the working principle of the shaper machine first discuss the cutting tool. The function of the cutting tool is to remove the material from a workpiece.

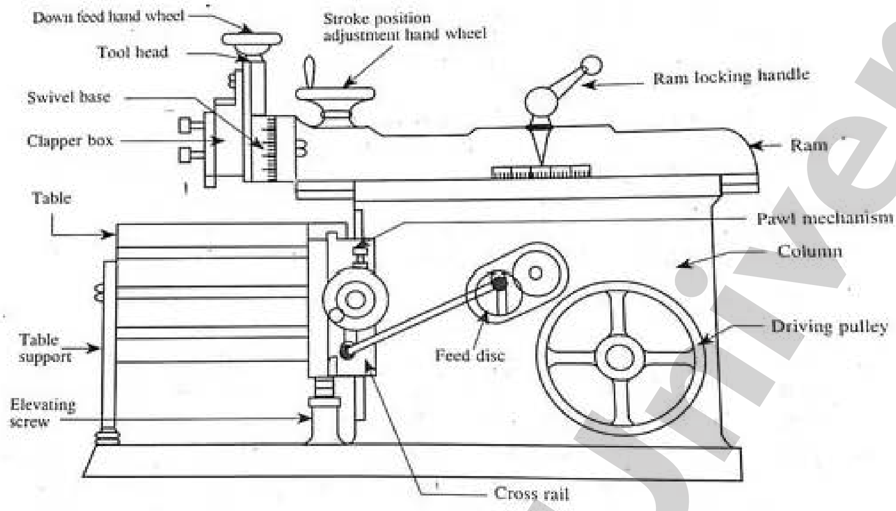
There is a single-point cutting tool used in a this machine and it has only one cutting edge. The turning tool is the best example of a single-point cutting tool. It is placed in the tool holder and also mounted on the ram.

The workpiece is clamped directly on the table for machining and it may support at another end. Ram is exhibiting the reciprocating motion. And the cutting tool holder is moved backward and forward on the surface of the workpiece.

Many of you think that the ram rotates and cutting in strokes. And it is depending on the shapes. The cutting takes place in forwarding stroke in a standard shaper machine and the backward stroke is considered to be idle.

The cutting tool got motion from the quick return mechanism and cutting depth is achieved by movement of the tool. Feed motion follows the pawl and ratchet mechanism.

Main Parts



Shaper

The different parts of a shaper are given and described below.

Base

The base is a heavy and robust in construction which is made of cast iron by casting process. It is the only part to support all other parts because all parts are mounted on the top of this base. So, it should be made to absorb vibrations due to load and cutting forces while machining.

Column

The column has a box type structure which is made of cast iron. The inside surface is made as hollow to reduce the total weight of the shaper. It is mounted on the base. The ram driving (Quick return) mechanism is housed. The two guide ways are supplied on the top. The ram reciprocates on the supplied guide ways. Similarly, there are two guide ways at the front vertical face of the column to move the cross rail along these guide ways.

Cross rail

It is also a heavy cast iron construction. It glides on the front vertical ways of the column with two mechanisms. One is aimed at elevating the table and the other one is for cross travel of the table. A saddle slides over two guide ways already provided in the front face of the cross slide. The crosswise movement of the table is obtained by cross feed screw and the vertical movement of the cross rail is obtained by an elevating screw.

Saddle

It is attached on the cross rail which holds the table in position on its top without any shake.

Table

It is also a box type rectangular hollow cast iron block. This table slides along the horizontal guide ways of the cross rail. The work is held in the table. The table has machined surfaces on the top and sides of T-slots for clamping work. It can be moved vertically by the elevating screw. An adjustable table supports the front face of the table.

Ram

Ram of cast iron has cross ribs for rigidity. Generally, it is a reciprocating type which slides over the guide ways on the top of the column. It is linked to driving mechanism of any one and also it carries the tool head at the front end.

Tool Head

It holds the tool rigidly having swivel base with degree graduation. So, the tool head can be swiveled to any angle as required. The tool head has a vertical slide and apron to provide vertical and angular feed to the tool. A feed screw with graduated dial moves the vertical slide vertically to set the accurate movement.

Apron is clamped upon the vertical slide which can be titled to right or left and also clamped at a correct position. The clapper box hinges a tool block previously fixed with apron. The tool block holds a tool post to hold the tool. The tool block fits inside the clapper box rigidly. In the return stroke, the tool block lifts out of clapper box to minimizing rubbing of the tool on the job.

EXPERIMENT NO.: PC-MEP 201/ 13

AIM: Study of Mechanism of Shaper Machine

When you studying any mechanical system, it is necessary to understand what a mechanism is and how it works. As we discuss above the shaper machine works on a Quick return mechanism.

Types of Shaper:

Shapers can classified into many types based on several criteria:

1) Based on the type of driving mechanism used

a) Crank and slotted lever driving mechanism type

b) Whitworth quick return driving mechanism type

c) Hydraulic driving mechanism type

2) Based on the table design

a) Plain Shaper

b) Universal Shaper

3) Based on the position of the reciprocating ram used

a) Horizontal shaping machine (Most common type of shaper used)

b) Vertical shaping machine

c) Travelling head shaping machine

4) Based on the type of cutting stroke of the tool

a) Push out type

b) Draw cut type

Types of operations performed in a shaper

1. Machining horizontal surface.
2. Machining vertical surface.
3. Machining angular surface.
4. Cutting slots, grooves and keyways.
5. Machining irregular surface.
6. Machining splines or cutting gear.

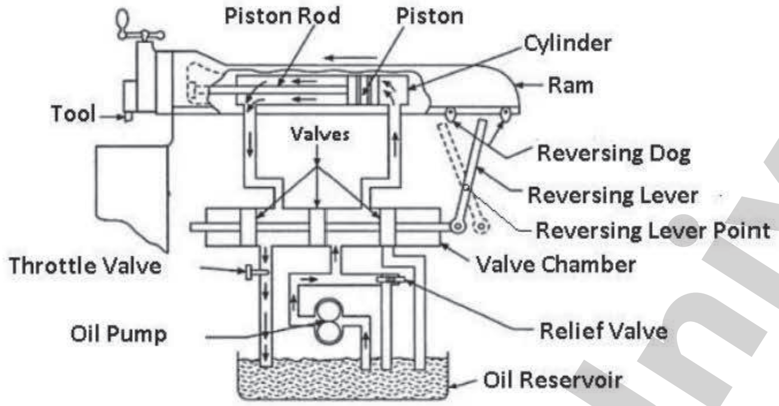
Quick Return Mechanism -Types

A quick return mechanism is an system to produce a reciprocating effect such that time taken by system in return stroke is less time taken by it in the forward stroke. In quick return mechanism, a circular motion is converted into reciprocating motion just like crank and lever mechanism but it has return stroke time is different from forward stroke time. This mechanism is used in many machines. Some of them are shaper machines, slotter machines, screw press, mechanical actuator etc.With the help of quick return mechanism, the time needed to cutting is minimized.

Types of Quick Return Mechanism:-

1 Hydraulic Drive:

Hydraulic drive mechanism is one of the mechanisms used in shaper machine. In this mechanism, the ram is moved forward and backward by a piston moving in a cylinder placed under the ram. This machine consists of a constant discharge oil pump, a cylinder, a valve chamber and a piston. The piston rod is bolted to the ram body. Hydraulic fluid is used in hydraulic quick return mechanism for the movement of ram.



Working of Hydraulic Drive:-

In hydraulic drive, there is a tank at the bottom which contains the hydraulic fluid. This tank is also known as oil reservoir. At first the oil from the reservoir. This oil is passed through the valve chamber present in the right of the oil cylinder exerting pressure on the piston. Any oil present in the left side of the piston is discharged to the reservoir through the throttle valve.

At first the fluid in the tank is pumped out and this fluid passes through the passage present in the right side of the cylinder .

This fluid exerts pressure on the piston and the ram of the machine performs forward stroke.

When the ram moves forward, the lever changes its position and hits the reversing dog. As the lever changes its position, the three valves connected to the lever also change their position and now the oil can pass through the passage present in the left side of the cylinder.

After the forward stroke is completed, the valves changes its position and now the pumped fluid from the reservoir moves from the passage present in the left side of the piston. Also, the passage through which the oil return to the reservoir opens and get connected to the right passage and the fluid present on the right side of the piston is discharge to the reservoir.

As the fluid moves towards the left side of the piston, the piston which is attached to the ram moves towards right and return stroke is performed by the ram.

At the end of the return stroke, another dog hit against the lever and the direction of the lever as well as the stroke changes. In this way, the forward and the return stroke of the ram is repeated.

The quick return takes place due to difference in the stroke volume of cylinder at both ends. The volume of passage at the left side is less than the volume of the passage on the right side. As the pump is constant discharge pump, same amount of oil will be passed on the both passage. So the pressure n the passage with less volume will be more and the return stroke will be faster than the forward stroke.

The cutting speed can be controlled by controlling the flow of oil which can be controlled by using the throttle valve.

2. Whitworth Quick Return mechanism:-

This mechanism changes the rotary motion to oscillatory motion like the crank and lever mechanism.

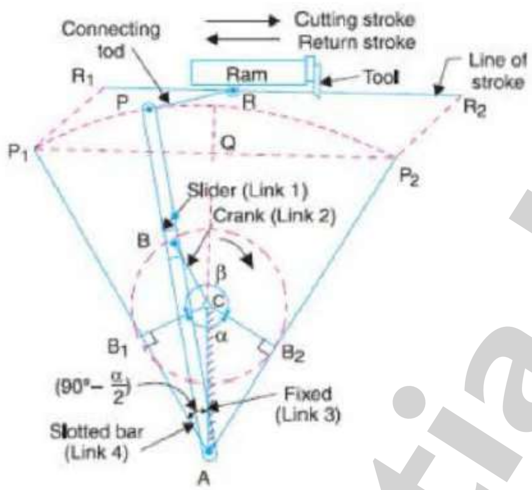
The difference between the crank and lever mechanism and Whitworth mechanism is that in whit worth mechanism the return stroke is faster than the forward stroke while in the crank and lever mechanism the forward stroke is of same speed as that of return stroke.

Parts used in Whitworth mechanism:-

1) Slotted Bar.

2) Slider

3) Crank – It will rotate.



Whitworth quick return mechanism is the second inversion of slider crank mechanism in which the crank is fixed.

In this mechanism, the Slider in slotted bar is connected to the crank. When the crank rotates, the slider will slide inside the slotter bar and the slotted bar will oscillate. As the slotted bar oscillate, the ram will move in forward and backward direction.

The return stroke or ideal is faster than the forward stroke in this mechanism.

In the above figure AP is the slotted bar and link 1, CD is link 2, AC which is crank is link 3 and link 4 is the slider.

In this mechanism the link CD i.e link 2 forming the turning pair is fixed as shown in the figure above.

The crank AC revolves with uniform velocity with its centre at A.

A sliding block attached to the crank pin at B slides along the slotted bar AP and thus causes Ap to oscillate about the pivoted pint A. A short link PR transmits the motion from AP to the ram which carries the tool and thus forward stroke and backward stroke is obtained.

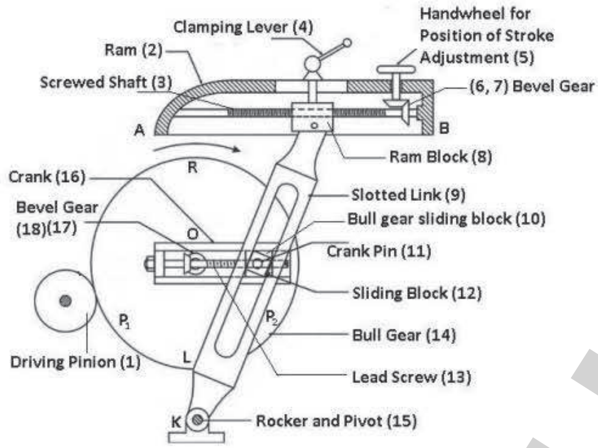
The crank needs to rotate through an angle of (β) for the forward stroke and it needs to rotate through an angle of (α) for forward stroke.

As crank moves with uniform angular velocity , time taken to cover angle α will be less than the time taken to cover angle β. Hence time taken in return stroke will be less than time taken in forwaed stroke. In this way, the quick return mechanism works.

3) Crank and Slotted Link Mechanism:-

In crank and slotted link mechanism. The power is transmitted to the bull gear by a pinion which receives its power from an individual motor.

In a two gear system, the smaller gear is called pinion and the larger gear is called bull gear.



Working of Crank and Slotted Link Mechanism:-

The radial slide is bolted to the centre of the bull gear. This radial slide carries a sliding block into which the crank pin is fitted.

As the bull gear will rotate, the crank will revolve at uniform speed.

The sliding block which is mounted upon the crank pin is fitted upon the crank pin is fitted within the slotted link. This slotted link is pivoted uponat its bottom end attached to the frame of column. The upper end of the sliding link is bifurcated and attached to the ram block by a pin.

When the bull gear rotates, the crank pin revolves at a uniform speed. The sliding block fastened to the crank pin will rotate on the crank pin circle and at the same time this slider will slide up and down in the sliding link.

As the slider will move inside the sliding link, it will provide a rocking movement to the sliding link and this movement will be transferred to the ram providing it a reciprocatory motion.

Hence the rotary motion of the bull gear is converted into reciprocatory motion of ram.

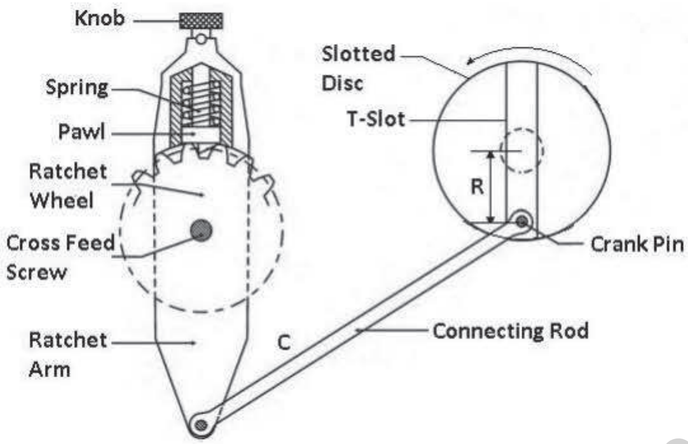
Automatic Table feeding mechanism of shaper

The automatic feed mechanism of the table is very simple. This is done by rotating a ratchet wheel, mounted at the crossfeed screw. This enables a corresponding equal rotation of the crossfeed screw after each stroke.

Arrangement of parts

It consists of a slotted disc, which carries a T-slot, as shown in the figure. In this slot is fitted an adjustable pin and to this is attached a connecting rod. The other end of the connecting rod is attached to the lower end of the rocker arm of the pawl mechanism.

The rocker arm swings about the screw C, and at its upper end carries a spring-loaded pawl, as shown.



Working

Note, that the lower end of the pawl is bevelled on one side.

This arrangement helps the power feed to operate in either direction, but the same should be set to operate during the return stroke only. If otherwise, the mechanism will be subjected to severe stress. In some latest types of shapers, can driven feed mechanisms are provided which are more efficient and provide a wider range of feed.

Variation in the feed can be provided by varying the distance R between the disc centre and the centre of the adjustable pin. Larger the said distance greater will be the feed and vice versa. The amount of feed to be given depends upon the type of finish required on the job.

For rough machining, heavier cuts are employed, and thus, a coarse feed is needed. Against this, a finer feed is employed in finishing operations.

The slotted disc at its back carries a spur gear which is driven by the bull gear. As the disc rotates through this gear the adjustable pin, being eccentric with the disc centre.

This causes the connecting rod to reciprocate. This, in turn, makes the rocker arm to swing about the screw C to move the pawl over one or more teeth. Thus transmit an intermittent motion to the crossfeed screw which moves the table.

Shaper Machine – Specifications

a. Length of Ram stroke:

b. Range of Ram speeds:

c. Working surface of table:

d. Max Table Travel

e. Max Table Travel

f. Angular movement of table on either side:

g. Maximum size of Tool Shank in Tool Head:

h. Maximum vertical travel of Tool Slide:

i. Maximum swivel of Tool Head:

j. Main Drive Motor:

CUTTING PARAMETERS OF A SHAPER

Cutting Speed

It is defined as the average linear speed of the tool during the cutting stroke in m/min, which depends on number of ram strokes (or ram cycles) per minute and length of the stroke.

Feed

Feed f is the relative motion of the work piece in a direction perpendicular to the axis of the reciprocation of the arm. In shaper, feed is normally given to the work piece and can be automatic or manual. It is expressed in mm/double stroke or simply mm/stroke because no cutting is done in return stroke.

Depth of Cut

Depth of cut d is the thickness of the material removed in one cut, in mm.

Working of Shaper Machine

The workpiece is mounted on the table and the table is rigid and box-shaped and placed in front of a machine or near the machine.

The height of the table is easily adjustable and it is adjusted to match the workpiece. The motion of the table is control manually. Have you ever thought about any other way for the motion of the table?

The table is equipped with an automatic feed mechanism and works with a feed screw. This is for cutting and the ram is adjustable for stroke.

EXPERIMENTS NO.: PC-MEP 201/ 14

AIM: Study of Portable Electric Drill Machine

I. Competencies

Given a properly adjusted portable electric drill, accessories, instruction and demonstration of use, each student will be able to:

A. Identify the major parts of the portable electric drill.

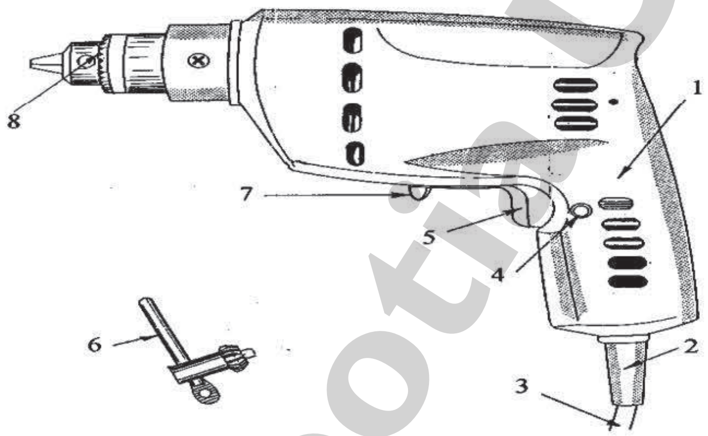
B. Study on safety and operating procedures of the portable electric drill machine.

C. Demonstrate ability to use the portable electric drill, following suggested safety rules and correct operation procedures.

II. Instructional Materials and Procedures

A. Identification of basic portable electric drill parts.

1. Piston Grip	5. Trigger Switch
2. Cord Strain Reliever	6. Chuck Wrench
3. Electrical Cord	7. Reversing Switch
4. Switch Lock	8. Chuck



B. Portable Electric Drill Safety

1. Wear safety glasses when operating with portable electric drill.

2. Disconnect the drill from the electrical supply when installing bits.

3. Clamp stock so it will not move during the drilling operation.

4. Before drilling, turn the drill on to see if the bit is centered and running true.

5. Align the bit with the desired hole location before turning the drill on.

6. Hold the drill firmly with both hands while drilling.

7. When drilling deep holes with a twist drill, move the bit up and down several times while drilling to remove cuttings and reduce overheating in the bit.

8. Do not allow the cord to become wrapped around the drill when working.

9. If the electrical cord becomes frayed or starts to separate from the drill housing, repair it immediately!

10. Remove the bit from the drill as soon as the work is completed.

11. Select the correct bit for the finish and material being drilled. Make sure the bit is securely tightened in the drill chuck.

12. Be extremely careful when using larger portable electric drills (3/8" and 1/2"). If the bit should hang or get caught the drill will twist in the operators hands causing a sprain or bruised fingers.

13. Always remove the key from the chuck before drilling.

14. To prevent seizing, reduce the feed pressure when the drill bit is about to come through the material.

C. Operating Procedures

1. Always center punch or make a starting indentation in the material being drilled to get an accurate starting point for the drill bit.

2. Tighten the drill bit by rotating the chuck key to all three holes in the chuck. This will help to keep the drill bit centered.

3. Use only straight shank or Silver and Deming drill bits in portable electric drills.

4. Apply moderate even pressure to the drill during the drilling operation. If excessive pressure is required to make the bit cut then the bit is dull and needs to be sharpened.

5. Maintain good balance at all times when drilling.

6. Use slow drill speeds for drilling metal and fast speeds for drilling wood.

7. To obtain holes that are placed accurately, drill a small pilot first then drill the final hole.

EXPERIMENT NO.: PC-MEP 201/ 15

AIM: INTRODUCTION TO FOUNDRY, PATTERNS, PATTERN ALLOWANCES, INGREDIENTS OF MOULDING SAND AND MELTING FURNACES. FOUNDRY TOOLS AND THEIR PURPOSES.

Foundry: factory produces metal castings from either ferrous or non-ferrous alloys. Equipped for making moulds, melting and handling metal in molten form, perform the casting process, and cleaning the casting products.

• Metals turn into parts by:

• Melting the metal into liquid

• Pouring the molten metal into a mould – let it solidify & cool

• Removing the mould material

• The workers who perform the casting operations in those factories are called foundry men.

Castings:

• Oldest known manufacturing process

• The only process where liquid metal is used

• Require preparation of mould cavity

• Molten metal poured into mould cavity & allowed to solidify

• The metal object is then removed from the mould

Application of Castings:

• Cylinder blocks, wheels, housings, water supply pipes, pistons, bells etc.

Advantages:

• Can cast complex part geometries including internal & external complex shapes easily

• Some casting processes capable of producing parts to net shape and near net shape

• The only method to shape metal like cast iron that can only be cast (& certain light metal alloys)

• Can adapt into mass production of components

• Large, heavy objects can only be obtained by casting

• Good machinability – less finishing

• Uniformity of the products / dimensional accuracy

• Low cost

Disadvantages:

• Limitations on mechanical properties

• Porosity

• Poor dimensional accuracy in certain cases

• Poor surface finish for some casting processes

• Safety hazards when processing hot molten metals – to human and environment

10 Types of Patterns in Casting

Casting is a very common manufacturing process to produce metal parts. It creates molds also called casting patterns where the manufacturers pour the molten metal next, and metal parts finished after the cooling of shaped metal materials.

During the casting process, the casting pattern is very crucial because of its effect on final products. Casting manufacturers should consider the casting pattern design completely according to the final products. There will have an expensive changing cost after casting.

What Is Pattern in Casting?

Generally speaking, the pattern in casting is the object for casting. Casting pattern shapes casting mold, and the mold creates metal parts, so the casting pattern is very crucial to the final parts. Therefore, the casting parts designer should consider more product details during the pattern design phrase

Making a casting pattern is not only shaping a mold cavity, accurate dimensions, scientific feeding system, and mold removing method should also be considered.

Key Considerations of Pattern in Casting

2 factors you should consider when you create casting patterns.

Materials of Casting Pattern

Your casting pattern materials should these properties:

- **Lower cost and less weight:** with the lower cost and less weight you are easier to find the balanced point of costs and returns.
- **Resistance of water:** choosing the material with resistance of water protects your casting pattern from rusting. Casting patterns with this kind of material will have a long lifetime and produce high quality patterns.
- **Durable:** durable material provides a long lifetime of your casting pattern, so you should consider the durable property of the material before you choose casting pattern materials.
- **Versatile:** various industries need casting patterns to create the casting process, so the versatile property of casting pattern material is very important. It ensures the pattern can be used in many kinds of industries, and repaired easier.

Casting Pattern Allowances

Other factors like the type of casting pattern and the properties of casting metal should also consider. Therefore, there have some casting pattern allowances you should pay attention to when you make a casting pattern.

- **Draft allowances:** draft allowances creates a taper for removing casting patter without any distortion. And the accurate angle of taper depends on the type of mold and surface, and the complexity of the casting pattern.
- **Shrinkage allowance:** usually the casting pattern has a bigger size of the mold, because most metal material contracts when it cools. The shrinkage allowance compensates for the cooling shrink of metal, and the precise parameter of the allowance depends on the metal material.
- **Distortion allowance:** casting patterns have a special design for avoiding the expected cooling distortion. We call it a distortion allowance.

- **Machining allowance:** excess material in the finishing stage for compensating some loss materials.

Casting VS.Pattern

The main difference between pattern and casting is that a pattern is a tool while casting is a kind of process.

Casting: It is a kind of process that manufacturers pour the molten metal into a mold, where the material cools and solidifies. The final shape of products was decided by the mold cavity, while the shape of the mold should be considered, and that is where the pattern appears.

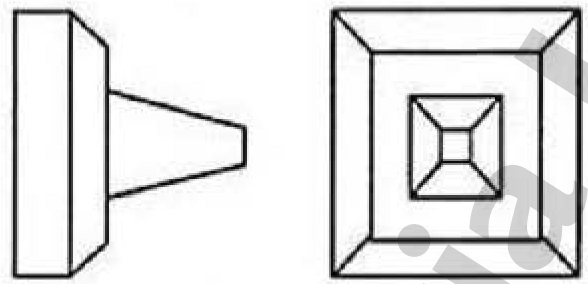
Pattern: Before you make a mold, you should design a pattern firstly. The pattern is the primary shape of the mold and finally, the product shapes according to the pattern.

10 Commonest Types of Patterns in Casting

We use 10 types of casting patterns in the casting process. Single piece pattern, two piece pattern, gated pattern, multi piece pattern, match plate pattern, skeleton pattern, sweep pattern, lose piece pattern, cope and drag pattern, shell pattern.

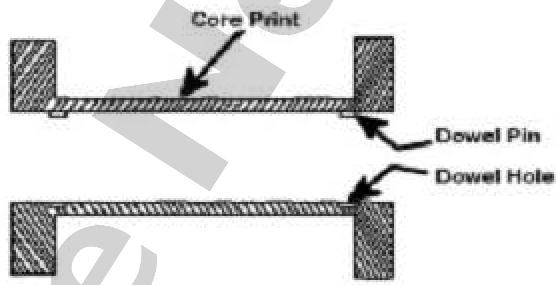
There have more details about each of the casting pattern.

Single Piece Pattern



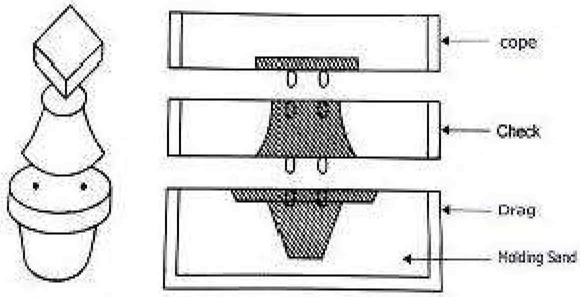
Single piece pattern, also called solid pattern is the lowest cost casting pattern. It is very suitable for simple process, and small scale production and the large casting manufacturers prefer it because this kind of casting pattern make casting process just needing simple shapes, flat surfaces like simple rectangular blocks. One flat surface is used to separate planes.

Two-Piece Pattern



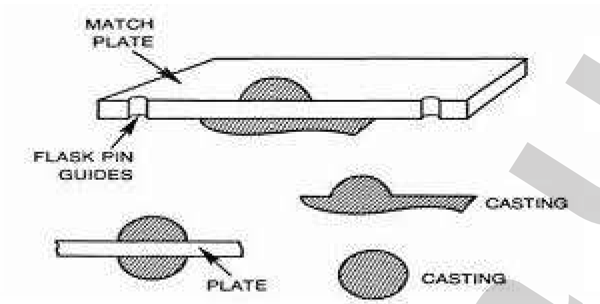
Two-piece pattern also called split piece pattern is a common casting pattern for intricate casting. This kind of pattern has parting planes which may have flat or irregular surface, and the exact position of the plane was decided by the shape of the casting. There are two pieces of the split piece pattern. One of the parts is molded in drag and another is molded in cope. And the cope part always has dowel pins. With the dowel pins, the two halves of split piece pattern can be aligned.

Multi Piece Pattern



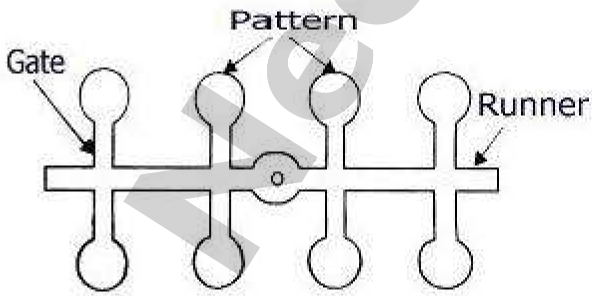
Multi piece pattern is a good solution for complex designs which is hard to make. This kind of pattern includes 3 or more pattern which helps you achieve mold making. Take the three-piece pattern as an example. The pattern is made of the top, bottom, and middle parts. The top part is cope, the bottom part drag, and the middle parts are called as checkbox.

Match Plate Pattern



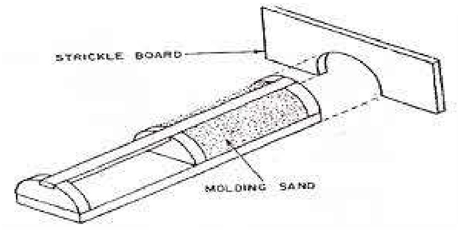
Match plate pattern has a metallic plate to divide the cope and drag areas into the opposite face of the plate. This kind of pattern nearly has no hard work and can provide high output. It is widely used in the manufacturing industry, and usually has an expensive cost, precise casting and high yield. And this kind of casting pattern is widely used in metal casting like aluminum.

Gate Pattern



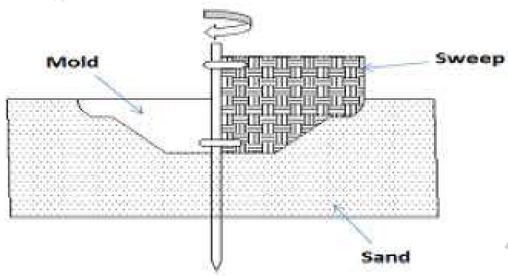
Gate pattern can consist of one or more patterns into a molding pattern. It is designed for the mold which makes multiple components at one casting process. The gates are used to combine the different patterns, and runners to create a flow way for the molten materials. When the gates and runners have already attached, the patterns are loosing. This kind of pattern is expensive, and it is usually used for small castings.

Skeleton Pattern



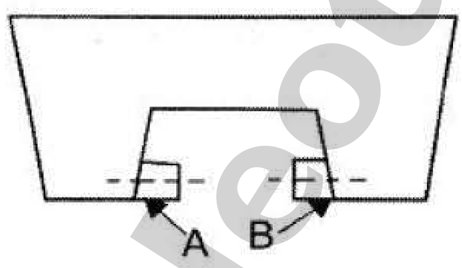
Skeleton pattern is large in size, and it is a good choice for the casting which has the simple size and shape. This kind of casting pattern is expensive and not versatile. It is not the best choice from the aspect of economic, while is very efficient in extra sand removing. If you want to use this casting pattern you should highlight the wood frames when you casting. The skeleton pattern is widely used in the industries of pit or floor welding.

Sweep Pattern



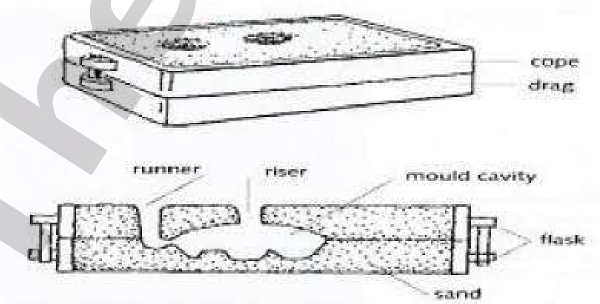
Sweep pattern uses a wooden board with proper size to rotate along one edge to shape the cavity. This kind of casting pattern creates a cavity in the vertical direction and the base of it is attached with sand, and it also creates casting in a very short time, and it has consisted of three parts: spindle, base and sweep which also called wooden board.

Loose Piece Pattern



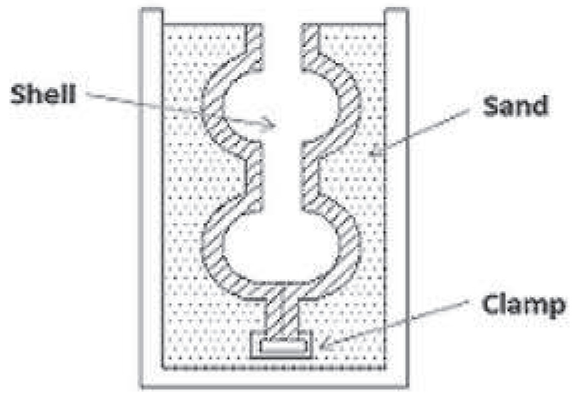
Loose piece pattern can help manufacturers remove one piece of solid pattern which is above or below the parting plane of the mold. This kind of pattern needs extra skilled labor work, so it is expensive casting pattern in castings.

Cope and Drag Pattern



Just like its name, cope and drag pattern has consisted of two separate plates, and it has two parts which can be separately molded on the molding box, and these parts create the cavity. This kind of pattern has a bit similar with the two-piece pattern and is usually used in large casting.

Shell Pattern



Shell pattern is a good choice to create hollow shaped structure. It parts along the center and dowels the resultant halves.

Conclusion

During the casting process, casting patterns are very important which decide the casting molds and the quality of castings. Before choosing the casting pattern, you should consider some factors, such as the size, shape of your casting products, and choose the best pattern for your casting business.

INGREDIENTS OF MOULDING SANDS

PRINCIPAL INGREDIENTS OF MOULDING SANDS :

The principal ingredients of moulding sands are given below :

(1) Silica sand grains

(2) Clay

(3) Moisture

(4) Miscellaneous materials

SILICA SAND GRAINS :

Silica in the form of granular quartz, itself a sand, is the chief constituent of moulding sands. Silica sand contains from 80% to 90% silicon dioxide and is characterized by a high softening temperature and thermal stability.it is a product of the breaking up of quartz rocks or the decomposition of granite, which is composed of quartz and feldspar.

CLAY :

Clay is defined as those particles of sand (under 20 microns in diameter) that fails to settle at a rate of 25mm per minute, when suspended in water.

Clay consists of two ingredients: FINE SILT and TRUE CLAY.

Fine silt is the sort of foreign matter or mineral deposit and has no bonding power. It is the true clay which imparts the necessary bonding strength to the mould sand, so that the mould does not lose its shape after rimming. Most moulding sands for different grades of work contain 5% to 20% clay.

MOISTURE :

Moisture in requisite amount, furnished the bonding action of clay. When water is added to clay, it penetrates the mixture and forms a microfilm which coats the surface of flake-shaped clay particles. The bonding quality of clay depends of the maximum thickness of water film it can maintain. The bonding action is considered best if the water added is the exact quantity required to form the film. The water should be between 2% to 8% .

MISCELLANEOUS MATERIALS :

Miscellaneous materials that are found, in addition to silica and clay in moulding sand are oxide of iron, limestone, magnesia, soda, and potash. The impurities should be below 2% .

Melting Process in a Foundry

Knowledge of furnace technology is essential when working in a foundry. Metals usually melt at very high temperatures and there are different types of furnaces for different applications. Back in time, when humans were smelting ores of lead and tin they didn't need much more heat than it would take to cook their food but as time went on, the need for something more than wood flame fires became apparent.

Few types of furnaces used in foundry.

Blast furnaces:

These very tall furnaces mostly thought of for metalworking, are injected with pressurized gasses. They're generally used for extracting iron and some other metals from their ores. The blast furnace can cast ingots of alloys for use in foundries that manufacture other products.

The foundries will use those metal alloys and additives when manufacturing-specific grades of cast metal. Cupola and crucible furnaces were the most common ways to forge metals for casting in the past and are still used today but electric arc and induction furnaces are more commonly used now.

Crucible furnaces:

A crucible is the most basic form of the metal furnace and can handle incredibly high temperatures. They are often made of ceramic and can be placed directly into the heat source/fire and filled with metal and additives. Jewelry makers and hobbyists still use crucible furnaces as well as some non-ferrous foundries, or those doing very small batch work.

Cupola furnaces:

These chimney-like furnaces which are filled with coal-coke and other additives. When the furnace is sufficiently hot, pig and scrap iron are added. This melting process adds carbon and other elements producing different grades of iron and steel. Electric arc and induction methods are more efficient and have replaced cupola furnaces for most applications. However, some foundries still keep with tradition and have cupola furnaces in operation.

Electric arc furnaces:

These furnaces became popular in the late 1800s. An electrical current runs through the metal inside the furnace by electrodes rather than adding external heat when melting high volumes at one time. These large furnaces can hold up to 400 tons when melting steel which is often made of heavy iron like slabs, pig iron, and recycling of things like car scraps. Once all the components are melted, the whole furnace is tilted discharging the liquid metal to a ladle which can sometimes be smaller furnaces that can keep the metal hot before casting.

Induction furnaces:

These furnaces work with magnetic fields rather than with electrical arcs. Metal is charged into a crucible surrounded by a powerful electromagnet made of coiled copper. This copper coil creates a reversing magnetic field by the introduction of an alternating current. As the metal melts, the electromagnet creates eddies within the liquid causing the material to be more or less self-stirred. There's no addition of oxygen or other gasses to the system so whatever goes into the crucible is what comes back out making it easier to control variables during melting. However, this means that an induction furnace can't be used to *refine* steel. Induction furnaces are simple to operate and are commonly used for high-quality input, producing as much as 65 tons of steel at each charge.

Furnaces all have one common enemy which is steam. Even the slightest amount of water can create splashing or explosions. Everything must be dry before use, from the alloys to the tools being used. Foundry workers have to carefully check scrap metal as it could have closed areas where water could get in and get trapped. Many foundries have a drying oven to make sure that scrap and tools are free of all moisture and condensation and are bone dry before touching the casting furnace.

After the metal is melted, it will be poured into the mold. In ferrous manufacturing, ladles are often used to transfer smaller portions of the melted material from the main furnace. These many types of ladles are designed to protect foundry workers from flames, sparks or splashing while pouring.

Whatever type of alloys or types of furnaces a foundry utilizes, the basics are the same. Molten metal gets cast into the voids in the mold to create the desired shape. Someone's concept, whether it's a piece of jewelry or an auto part becomes a reality when the melted metal meets the mold.

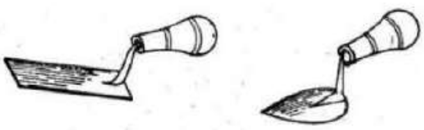
FOUNDRY SHOP HAND TOOLS

FOUNDRY SHOP HAND TOOLS :

1.Showel: It consists of iron pan with a wooden handle. It can be used for mixing and conditioning the sand.

Showel

2. Trowels: These are used for finishing flat surfaces and comers inside a mould. Common shapes of trowels are shown as under. They are made of iron with a wooden handle.

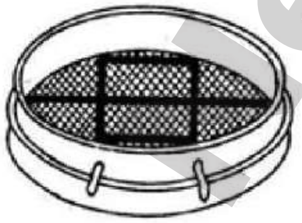


Trowels

3. Lifter: A lifter is a finishing tool used for repairing the mould and finishing the mould sand. Lifter is also used for removing loose sand from mould.

LIFTER

4. Hand riddle: It is used for ridding of sand to remove foreign material from it. It consists of a wooden frame fitted with a screen of standard wire mesh at the bottom.



Riddle

5.Strike off bar: It is a flat bar, made of wood or iron to strike off the excess sand from the top of a box after ramming.

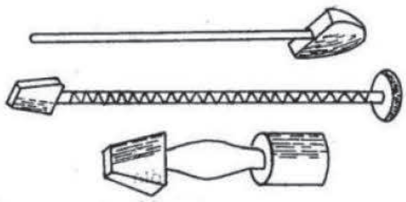
Its one edge made beveled and the surface perfectly smooth and plane.

A strike off bar

6. Vent wire: It is a thin steel rod or wire carrying a pointed edge at one end and a wooden handle or a bent loop at the other. After ramming and striking off the excess sand it is used to make small holes, called vents, in the sand mould to allow the exit of gases and steam during casting.

Vent wire

7. Rammers: Rammers are used for striking the sand mass in the moulding box to pack it closely around one pattern. Common types of rammers are shown as under.



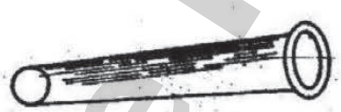
Rammers

8. Swab: It is a hemp fiber brush used for moistening the edges of sand mould, which are in contact with the pattern surface, before withdrawing the pattern. It is also used for coating the liquid blacking on the mould faces in dry sand moulds.

Swab

9. Sprue pin: It is a tapered rod of wood or iron, which is embedded in the sand and later withdrawn to produce a hole, called runner, through which the molten metal is poured into the mould.

10. Sprue cutter: It is also used for the same purpose as a sprue pin, but there is a marked difference between their use in that the cutter is used to produce the hole after ramming the mould. It is in the form of a tapered hollow tube, which is inserted in the sand to produce the hole.



Sprue cutter

EXPERIMENT NO.: PC-MEP 201/ 16

MOLD MAKING & CASTING

Objective

1. To prepare a pattern for given object for lost form casting.

2. To prepare a molasses sand mold from the prepared pattern.

3. To melt and pour iron metal into the mold.

Equipment and Materials

Pattern, core box, molding flasks, molding tools, sand muller, riddle, sand, molasses, bentonite, core baking oven, thermocole, melting furnace, fluxes, pouring ladle, pyrometer, hacksaw, file.

Procedure

Core making

(i) Prepare the core sand

(ii) Assemble (clamp) the core-box after applying some parting sand

(iii) Fill the core box cavity with core sand and ram it

(iv) Make vent holes or insert reinforcing wire as desired

(v) Tap the mold box on all sides to loosen the core from the box, unclamp the core box and carefully transfer the core on to a baking plate or stand.

(vi) Keep the core in the baking oven and bake it for desired length of the time at a

predetermined temperature. After baking take the core out of the oven and allow it to cool at room temperature.

Mold Making

(i) Place the drag part of the pattern with parting surface down on ground or molding board at the center of the drag (flask).

(ii) Riddle molding sand to a depth of about 2 cm in the drag and pack this sand carefully around the pattern with fingers.

(iii) Heap more molding sand in the drag and ram with rammer carefully.

(iv) Strike off the excess sand using strike bar.

(v) Make vent holes to within 1 cm of the pattern surface in the drag.

(vi) Turn this complete drag and place the cope portion (flask) over it.

(vii) Place the cope half of the pattern over the drag pattern matching the guide pins and apply parting sand over the parting surface. Also place the sprue pin and riser pin in proper positions.

(viii) Complete the cope half by repeating steps (ii) to (v).

(ix) Remove the sprue and riser pins and make a pouring basin. Separate the cope and drag halves, and place them with their parting faces up.

(x) Moisten sand at the copes of the pattern and remove pattern halves carefully using draw spikes.

(xi) Cut gate and runner in the drag. Repair and clean the cavities in the two mold halves.

(xii) Place the core in position, assembled the two mold halves assemble and clamp them together.

Melting and Pouring

(i) Melt the metal in the furnace. Use appropriate fluxes at proper stages and measure metal temperature from time to time.

(ii) Pour the molten metal into the pouring ladle at a higher temperature (say 100^0 C higher) than the pouring temperature. As soon as the desired pouring temperature is reached, pour the liquid metal into the mold in a steady stream with ladle close to the pouring basin of the mold. Do not allow any dross or slag to go in.

(iii) Allow sufficient time for the metal to solidify in the mold. Break the mold carefully and remove the casting.

(iv) Cut-off the riser and gating system from the casting and clean it for any sand etc.

(v) Inspect the casting visually and record any surface and dimensional defects observed.

Report The Following

1. Sketches of the product made, pattern and core.
2. Composition of molding sand and core sand used.
3. Melting and pouring temperature of the used metal.
4. List the allowances that are generally provided on a pattern.
5. Type, amount and manner of addition of fluxes, if any used.
6. Defects produced in your casting.

EXPERIMENT NO.: PC-MEP 201/ 17

GAS WELDING

Aim: To make the butt joint by using gas welding equipment

Equipment Required: Oxy-acetylene gas welding outfit

Tools Required: Wire brush, Hand gloves, chipping hammer, Spark lighter

Material Required:

MS Sheets100*50*5mm (2no.)

Theory:

Gas Welding or Oxy-fuel gas welding is a general term used to describe any welding process that uses a fuel gas combined with oxygen to produce a flame. The most commonly used fuel is acetylene (C_2H_2) gas. The heat source is the flame obtained by combustion of oxygen and acetylene. When mixed together in correct proportions within a hand-held torch or blowpipe, a relatively hot flame is produced with a temperature of about 3300ºC (6000ºF). The chemical action of the oxyacetylene flame can be adjusted by changing the ratio of the volume of oxygen to acetylene. The combustion of oxygen and acetylene (C_2H_2) is a two-stage reaction. Chemical reactions are as follows: -

Stage 1: In the first stage, the supplied oxygen and acetylene react to produce Carbon Monoxide and Hydrogen. Approximately one-third of the total welding heat is generated in this stage.

$C_2H_2 + O_2 = 2CO + H_2 + \text{heat}$

Stage 2: The second stage of the reaction involves the combustion of the CO and H_2. The remaining two-third of the heat is generated in Stage 2. The specific reactions of the second stage are:

$2CO + O_2 = 2CO_2 + \text{heat}$

$H_2 + \frac{1}{2} O_2 = H_2O + \text{heat}$

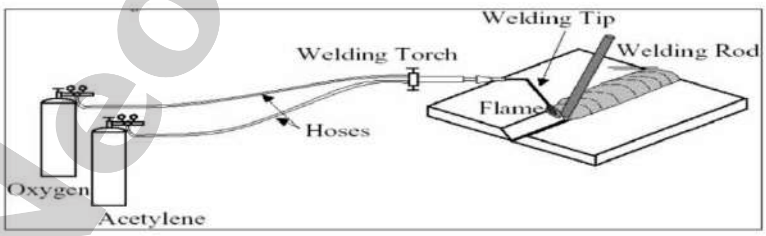
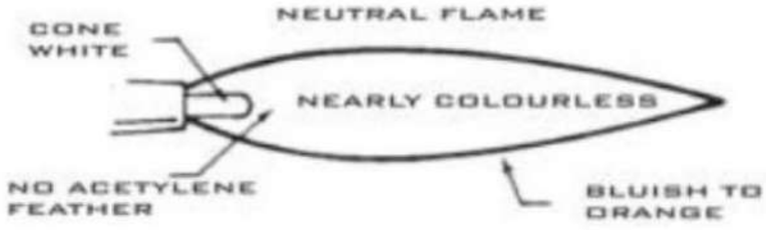


Figure: Gas Welding (Oxygen–fuel gas) process

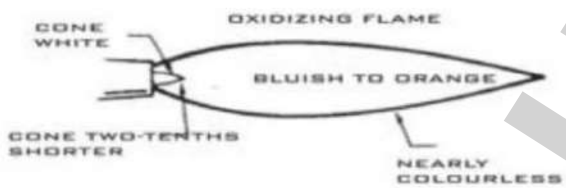
Types of flames:

Three different types of flames can be obtained by varying the oxygen–acetylene (or oxygen–fuel gas) ratio.

Neutral Flame: When the ratio of oxygen-acetylene (or oxygen–fuel gas) is between 1:1 and 1.15:1, all reactions are carried to completion and a neutral flame is produced. As the supply of oxygen to the blowpipe is increased, the flame contracts and the white cone become clearly defined, assuming a definite rounded shape. This type of flame is the one most extensively used by the welder, who should make himself thoroughly familiar with its appearance and characteristics.



Oxidizing flame: A higher ratio of oxygen-acetylene (or oxygen–fuel gas), such as 1.5:1, produces an oxidizing flame, which is hotter than the neutral flame (about 3600°C or 6000°F). With the increase in oxygen supply, the inner cone will become shorter and sharper, the flame will turn a deeper purple color and emit a characteristic slight "hiss". An oxidizing flame is only used for special applications.



Carburizing flame: Excess fuel compared to oxygen produces a carburizing flame. The excess fuel decomposes to carbon and hydrogen, and the flame temperature is not as great (about 3050°C or 5500°F). This type of flame is mainly used for hard surfacing and should not be employed for welding steel as unconsumed carbon may be introduced into the weld and produce a hard, brittle, deposit.

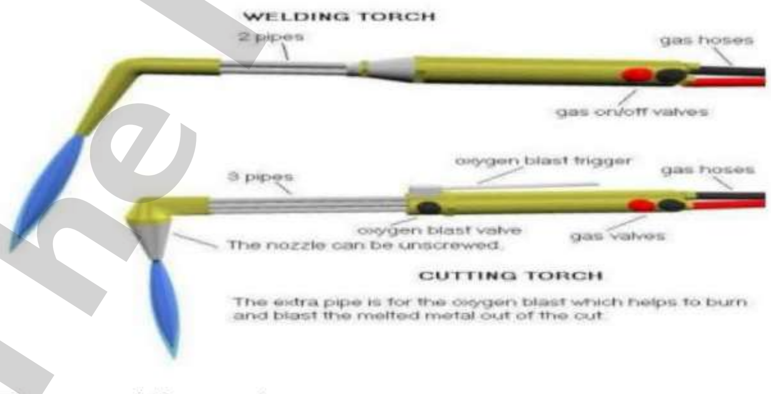


Figure: welding torch

Filler Metals & Flux

Filler metals are used to supply additional material to the weld zone during welding. These consumable filler metals maybe bare or flux coated. The purpose of flux is to retard oxidation of the surfaces of the parts being welded, by generating a gaseous shield around the weld zone.

Gas Welding/Cutting Equipment

The apparatus used in gas welding consists basically of an oxygen source and a fuel gas source,regulators, hoses, non-return valve, check valve and torches.

Regulator:

The regulator is used to control pressure from the tanks by regulating pressure and flow rate of gas. It releases the gas at a constant rate from the cylinder despite the pressure in the cylinder becoming less as the gas in the cylinder is used.

The hose is usually a double-hose design i.e. there are two hose joined together. The oxygen hose is green and the fuel hose is red.

Non-return valve:

Between the regulator and hose and ideally between hose and torch on both oxygen and fuel lines, a non-return valve and/or flashback arrestor should be installed to prevent flame/oxygenfuel mixture being pushed back into either cylinder and damaging the equipment.

Check valve:

A check valve lets gas flow in one direction only. Not to be confused with flashback arrestor, a check valve is not designed to block a shockwave. A check valve is usually a chamber containing ball that is pressed against on end by a spring. Gas flow in a particular direction pushes the ball out of the way while no flow or flow on the other way lets the spring push the ball into the inlet thus blocking it.

Torches:

The torch is the part that the welder holds and manipulates to make the weld. It has a connection and valve for Oxygen and also a connection and valve for Fuel, a handle for grasp, a mixing chamber for mixing of the fuel and oxygen, a tip where the flame forms. A welding torch head is used to weld metals and can be identified by having only two pipes running to the nozzle and no oxygen blast trigger. A cutting torch head is used to cut metals and can be identified by having three pipes that go to an around 900 nozzle and also by oxygen-blast trigger that provides oxygen to blast away material while cutting

Procedure:

1. Acetylene valve on the torch is opened slightly and lightened with the help of spark lighter.

2. Now acetylene valve is opened to get the required flow of acetylene.

3. Oxygen valve is opened till the intermediate flame feather reduces into inner cone to get a neutral flame

4. The torch tip to be positioned above the plates so that the white cone is at the distance of 1.5mm to 3mm.

5. Torch to be held at an angle of 30degrees to 45degrees to the horizontal plane.

6. Now filler rod is to be held at a distance of 10mm from the flame and 1.5 to 3mm from the surface of the weld pool.

7. As back ward welding allows better penetration, backward welding is to be used for welding.

8. After completion of welding slag is to be removed by means of chipping hammer and wire brush.

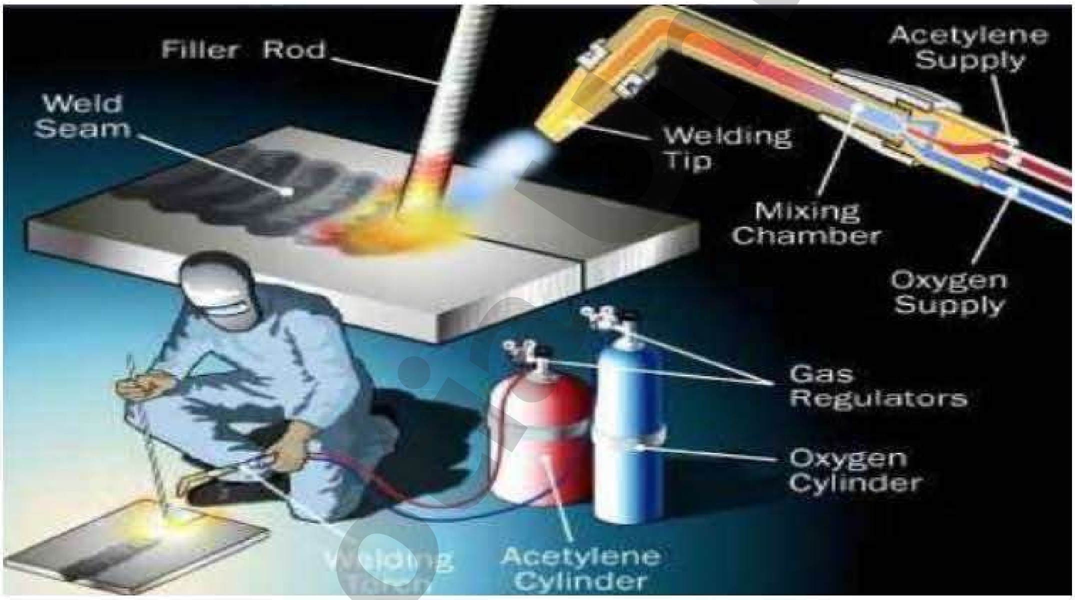
Precautions:

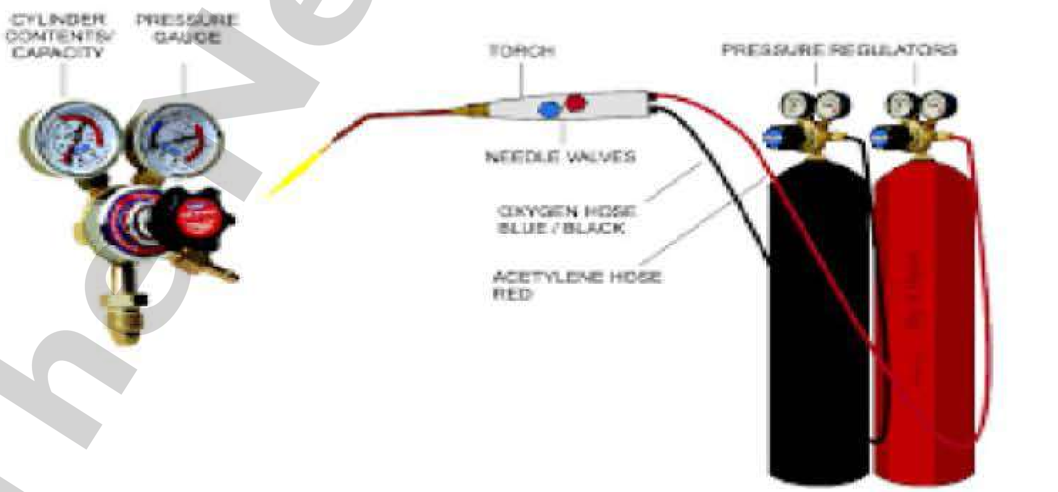
1. The use of safety equipment such as goggles with shaded with lenses, Face shields, glows and protective clothing, is essential.

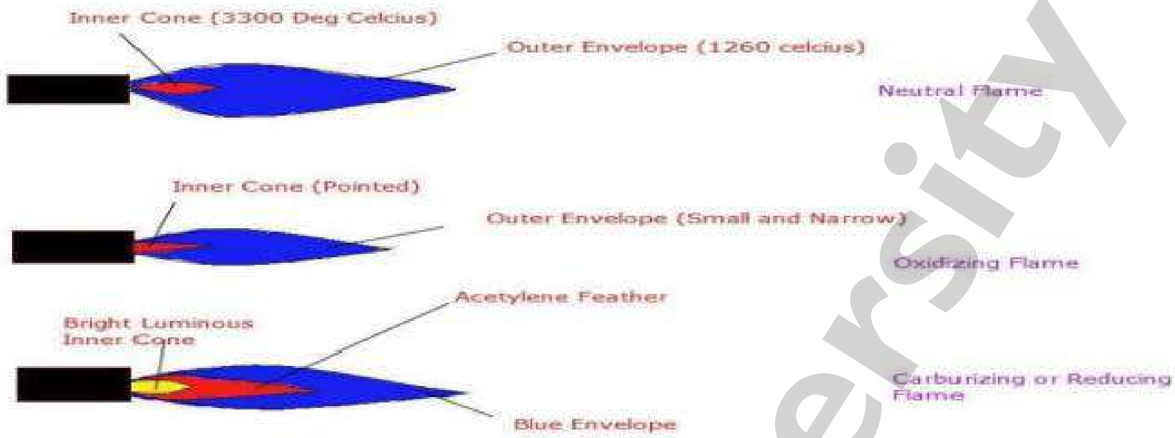
2. Proper connection of hoses to the cylinders Is also an important factor in safety.

3. Oxygen and acetylene has different threads, so that the hoses cannot be connected to the wrong cylinders.

4. Gas cylinders should be anchored securely and should not be dropped or mishandled.






Inner Cone (3300 Deg Celcius)
Outer Envelope (1260 celcius)
Neutral Flame
Inner Cone (Pointed)
Outer Envelope (Small and Narrow)
Oxidizing Flame
Acetylene Feather
Bright Luminous Inner Cone
Carburizing or Reducing Flame
Blue Envelope

EXPERIMENT NO.: PC-MEP 201/ 18

ARC WELDING JOINT

Aim: To prepare a tee joint.

Materials Required: Mild Steel Flat of 100 mm X 50 mm X 5 mm size.

Equipment Required: Flat rough file, try square, step down transformer, electric lugs, shield, goggles, gloves, electrode holder, electrode, chipping hammer, wire brush.

Procedure:

1. Filing is done on four sides of the mild steel flat and right angles are checked by using try square.

2. Repeat the same procedure for second flat also.

3. One work piece is kept horizontally on the work table, and another vertically above the first work piece, and in the middle, so that a 'Tee' is formed.

4. Tags are made at the ends of plates where two plates meet on either side.

5. Welding is carried out first on one side of the work pieces allowing sufficient amount of metal to full the weld puddle by slowly moving the electrode in weavy fashion.

6. After welding is over the slag is removed by using chipping hammer.

7. The above two steps are repeated on the other side of the work piece also.

8. The joint thus obtained is a 'tee' joint.

Precautions:

1. Tags should be made so that work pieces are not disturbed from their positions.

2. The plates should be flat, so check the right angles using the try square

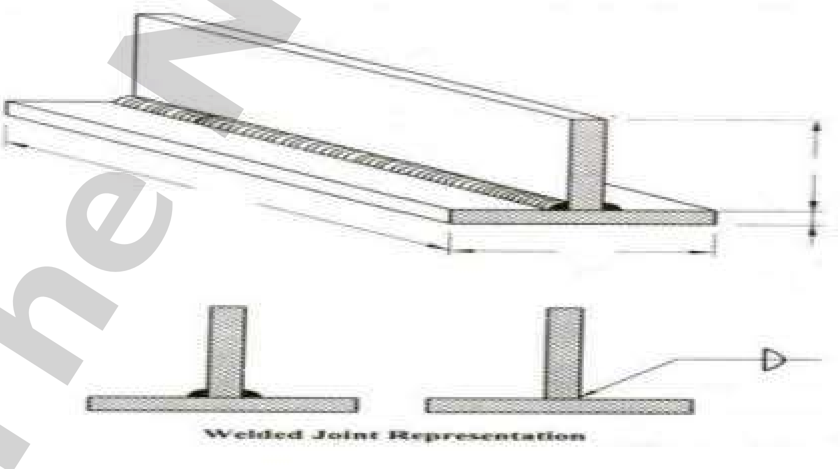
3. Never see the arc directly with naked eye.

4. Work pieces should be handled only with the tongs during and after welding.

5. Electrode should be moved slowly so that required amount of metal is in the weld puddle.

Result:

T joint has been produced by using arc welding



Welded Joint Representation

EXPERIMENT NO.: PC-MEP 201/ 19

Title: To study of Brazing, Soldering and Edge Preparation in Welding.

BRAZING:

Brazing is a metal-joining process in which two or more metal items are joined together by melting and flowing filler metal into the joint, the filler metal having a lower melting point than the adjoining metal.Brazing differs from welding in that it does not involve melting the work pieces and from soldering in using higher temperatures for a similar process, while also requiring much more closely fitted parts than when soldering. The filler metal flows into the gap between close-fitting parts by capillary action. The filler metal is brought slightly above its melting (liquidus) temperature while protected by a suitable atmosphere, usually a flux. It then flows over the base metal (known as wetting) and is then cooled to join the work pieces together.[1] It is similar to soldering, except for the use of higher temperatures. A major advantage of brazing is the ability to join the same or different metals with considerable strength.

SOLDERING:

Soldering is a process in which two or more items (usually metal) are joined together by melting and putting a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal.

Soldering differs from welding in that soldering does not involve melting the work pieces. In brazing, the filler metal melts at a higher temperature, but the work piece metal does not melt. In the past, nearly all solders contained lead, but environmental and health concerns have increasingly dictated use of lead-free alloys for electronics and plumbing purposes.

Edge Preparation:

Different edge preparation is particularly used in fusion welding processes for welding butt joints are.

1. SQUARE 2. SINGLE-V 3. DOUBLE-V 4. SINGLE-U

5. DOUBLE-U

The preparation edge depends upon the thickness of metal being used for welding.

1. Square butt weld may be used for thickness of 3 to 5 mm. single V butt welds are frequently used thick. The edge forming the joint are leveled to from an included angle

2. 70 to 90 degree depends upon the welding teaching to be used.

3. Double-V butt joint welds are used on metals over 16mm think and where welding can be performed on both sides of the plates.

4. Single and Double-U butt are used on metals over 20mm thick. They are most satisfactory and require less filler rod; but they are different to prepare.