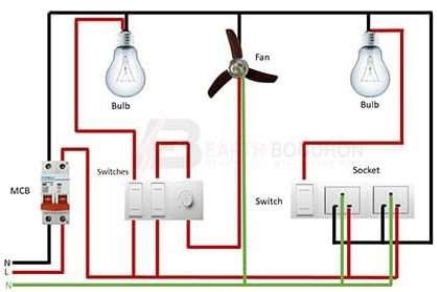
VIJAYAM INSTITUTE OF TECHNOLOGY

Sundararajapuram (V), G.D.Nellore, Opp. Heritage Dairy, Puttur Road,
Chittoor Dist-517125
(Approved by AICTE, New Delhi & Affiliated to JNTUA, Anantapuramu)

DEPARTMENT OF MECHANICAL ENGINEERING

Engineering Workshop Lab Manual (R23)




VIJAYAM INSTITUTE OF TECHNOLOGY

Sundararajapuram (V), G.D.Nellore, Opp. Heritage Dairy, Puttur Road,
Chittoor Dist-517125
(Approved by AICTE, New Delhi & Affiliated to JNTUA, Anantapuramu)

DEPARTMENT OF MECHANICAL ENGINEERING

Engineering Workshop Lab Manual (R23)

Name:_____

Reg. No:_____

Year/Semester:_____

Academic Year:_____

ENGINEERING WORKSHOP
(Common to all branches)

Course Objective:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes:

After completion of this lab the student will be able to
CO1.Identify workshop tools and their operational capabilities
CO2.Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
CO3. Apply fitting operations in various applications.
CO4. Apply basic electrical engineering knowledge for house wiring practice circuit connections.
CO5. Demonstrate soldering and brazing.

SYLLABUS:

1. Demonstration: Safety practice and precautions to be observed in workshop
2. Wood Working:
Familiarity with different types of woods and tools used in wood working and make following joints
a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. Sheet Metal Working:
Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. Fitting:
Familiarity with different types of tools used in fitting and do the following fitting exercises
a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tyre puncture and change of two-wheeler tyre.
5. Electrical Wiring:
Familiarities with different types of basic electrical circuits and make the following connections
a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light e) Three phase motor
f) Soldering of wires.
6. Foundry Trade:
Demonstration and practice on moulding tools and processes
Preparation of Green Sand Moulds for given patterns.
7. Welding Shop:
Demonstration and practice on Arc Welding and Gas Welding.
Preparation of Lap joint and Butt Joint.
8. Plumbing
Demonstration and practice of plumbing tools
Preparation of pipe joints with couplings for samediameter and with reducer for different diameters.

LIST OF EXPERIMENTS

I. DEMONSTRATION:

Safety practice and precautions to be observed in workshop

II. WOOD WORKING:

1. Half – Lap joint
2. Mortise and Tenon joint
3. Corner Dovetail joint or Bridle joint

III. SHEET METAL WORKING

1. Tapered tray
2. Conical funnel
3. Elbow pipe
4. Brazing

IV. FITTING

1. V-fit
2. Dovetail fit
3. Semi-circular fit
4. Bicycle tyre puncture and change of two-wheeler tyre.

V. ELECTRICAL WIRING

1. Parallel and series
2. Two-way switch
3. Go down lighting
4. Tube light
5. Three phase motor
6. Soldering of wires

VI. FOUNDRY TRADE

1. Single Piece Pattern
2. Split Piece Pattern

VII. WELDING SHOP

1. Lap Joint
2. Butt Joint

VIII. PLUMBING

1. Single tap connections.
2. Multi tap connections.

INDEX

Sl.No	NAME OF THE EXPERIMENT	Date	Page No	Marks obtained	Signature of the faculty

INDEX

S.No	NAME OF THE EXPERIMENT	Date	Page No	Marks obtained	Signature of the faculty

DEMONSTRATION

Safety practices and precautions to be observed in workshop.

Safety precautions:

1. Read the operator's manual and observe all safety precautions for all equipment.
2. Protect yourself from electric shock. ...
3. Keep all guards and shields in place.
4. Give the task your full attention.
5. Let each tool work at its own speed; do not force it.
6. Always wear appropriate personal protective clothing.

If everyone follows workshop rules, everyone will be safe and learn how to use tools and equipment properly and efficiently.

1. Always listen carefully to the teacher and follow instructions.
The instructions given by your teacher, his / her demonstrations on the use of equipment and tools, will help you understand how to work in a workshop safely and efficiently.

2. Do not run / rush in the workshop.
You could 'bump' into another pupil and cause an accident. You could run into a machine or bench, which could cause a serious injury.

3. Know where the emergency stop buttons are positioned in the workshop.
If you see an accident at the other side of the workshop, you can use the emergency stop button to turn off all electrical power to the machines.

4. Always wear an apron.
It will protect your clothes and hold loose clothing such as ties in place. This will prevent loose clothing getting caught in a machine, pulling the machine operator into the moving parts.

5. Wear good strong shoes. Training shoes are not suitable.
Tools and equipment can have sharp edges and are usually heavy. Good shoes prevent damage to feet, if a piece of equipment or a tool, is dropped on feet.

6. When attempting practical work, all stools should be put away.
If stools are left out in the workshop during a practical session, they will get in the way and inevitably become a trip danger.

7. Bags should be stored away, during practical sessions in the workshop.
A person can easily trip over a bag left on the floor and accidentally push into someone using a machine. This could cause a serious accident.

8. When learning how to use a machine, listen very carefully to all the instructions given by the teacher. Ask questions, especially if you do not fully understand.
It is very important to ask questions, especially when learning how to use machines and tools, if there is a need to clarify instructions. Using a machine without a full understanding of its use, could easily lead to an accident.

9. Do not use a machine, if you have not been shown how to operate it safely, by our teacher.

It is extremely dangerous (and illegal), to use a machine in the workshop, without having followed and understood, all the teacher instructions.

10. Always be patient, never rush practical work.

The most productive and efficient 'craftspeople/engineers', work patiently and never rush their work. Working at a safe, steady pace, is how skilled professions complete their tasks.

11. Always use guards, when operating machines.

The guard on a machine, protects the user, especially the users eyes, from dangerous 'debris' that is thrown out, often at high speed. The guards also ensure that hands and fingers, are not near moving parts. A good example of a machine guard, is seen in front of the chuck, of a machine drill.

12. Keep hands / hair and clothing away from moving/rotating parts of machinery.

Loose Clothing (e.g. a school tie) and long hair, can be caught in the moving parts of a machine (e.g. the chuck of a drill). Hands / clothing should must be kept away, from the moving / rotating parts. Long hair should be tied back.

13. Use hand tools carefully, keeping both hands behind the cutting edge.

Never place a hand in front of a cutting tool (e.g. a chisel). There is always a possibility, of the tool slipping and the sharp edge slicing into the hand / fingers.

14. Report any damage / faults to machines/equipment. Damage or a faulty part, could cause an accident.

A broken or damaged tool can be dangerous. For example, a hammer with a loose hammer head, should be reported to the teacher. It is always possible that the hammer head will 'fly off' the handle, when it is in use.

15. Keep your workbench tidy. When you have finished with a tool / piece of equipment, return it to its storage cupboard / rack.

A bench top, crowded with tools, will eventually lead to one or more, being knocked on to the floor, or on to feet. Tools are damaged easily and people can be injured.

16. Never distract another pupil, when they are working on a machine or using tools / equipment.

A distracted pupil could have an accident, as a distraction will take their focus and concentration away from the work they are doing. If using a tool / machine, a distraction can easily lead to an accident.

WOOD WORKING

- **Introduction:**

Wood working or Carpentry may be defined as the process of making wooden components. It starts from a marketable form of wood and ends with finished products. It deals with the building work, furniture, cabinet making etc. Joinery, i.e., preparation of joints is one of the important operations in all woodworks. It deals with the specific work of carpenter like making different types of joints to form a finished product.

- **Timber:**

Timber is the name given to the wood obtained from well grown trees. The trees are cut, sawn into various sizes to suit building purposes. The word, 'grain', as applied to wood, refers to the appearance or pattern of the wood on the cut surfaces. The grain of the wood is a fibrous structure and to make it strong, the timber must be so cut, that the grains run parallel to the length.

- **Timber sizes:**

Timber sold in the market is in various sizes and shapes. The following are the common shapes and sizes.

a. Log: The trunk of the tree which is free from branches.
b. Balk: The log, sawn to have roughly square cross section.
c. Post: A timber piece, round or square in cross section, having its diameter or side from 175 to 300mm.
d. Plank: A sawn timber piece, with more than 275 mm in width, 50 to 150 mm in thickness and 2.5 to 6.5 meters in length.
e. Board: A sawn timber piece, below 175 mm in width and 30 to 50 mm in thickness.
f. Reapers: Sawn timber pieces of assorted and non- standard sizes, which do not confirm to the above shapes and sizes.

- **Classification of Timber:**

Wood suitable for construction and other engineering purposes is called timber. Woods in general are divided into two broad categories: Soft woods and Hard woods. Soft woods are obtained from conifers, kair, deodar, chir, walnut and seemal. Woods obtained from teak, sal, oak, shisham, beach, ash mango, neem and babul are known as hard wood, but it is highly durable. Another classification of woods is based on the name of the trees like teak, babul, shisham, neem, kair, chir, etc.

- **Seasoning of Wood:**

A newly felled tree contains considerable moisture content. If this is not removed, the timber is likely to wrap, shrink, crack or decay. Seasoning is the art of extracting the moisture content under controlled conditions, at a uniform rate, from all the parts of the timber. Only seasoned wood should be used for all carpentry works. Seasoning makes the wood resilient and lighter. Further, it ensures that the wood will not distort after it is made into an object.

- **Characteristics of Good Timber:**

The good timber must possess the following characteristics

a. It should have minimum moisture content, i.e., the timber should be well seasoned.
b. The grains of wood should be straight and long.
c. It must retain its straightness after seasoning.
d. It should produce near metallic sound on hammering.
e. It should be free from knots or cracks.
f. It should be of uniform color, throughout the part of the wood.

g. It should respond well to the finishing and polishing operations.
h. During driving the nails and screw, it should not split easily.

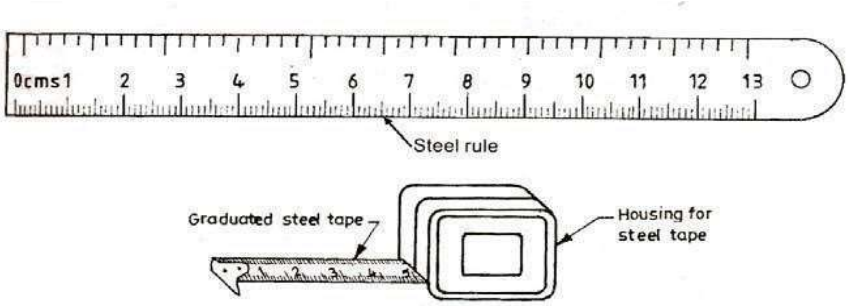
Carpentry Tools:

- **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.

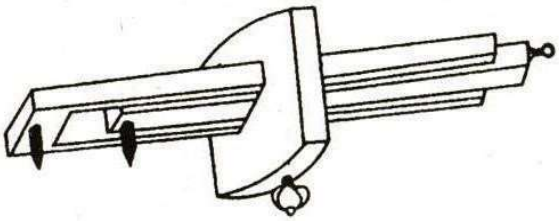
- **Steel rule and Steel tape**

Steel rule is a simple measuring instrument consisting of a long, thin metal strip with a marked scale of unit divisions. It is an important tool for linear measurement. Steel tape is used for large measurements, such as marking on boards 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 projects through the stem, about 3 mm and the end are 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 squareness and straightness of planed surfaces. It consists of a steel blade, fitted in a cast iron stock. It is also used for checking the planed surfaces for flatness. Its size varies from 150 to 300 mm, 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**

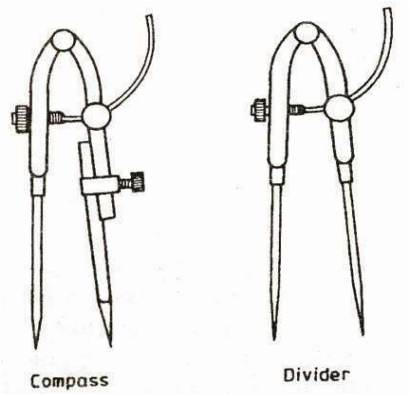
Compass and divider, are used for marking arcs and circles on the planed surfaces of the wood.

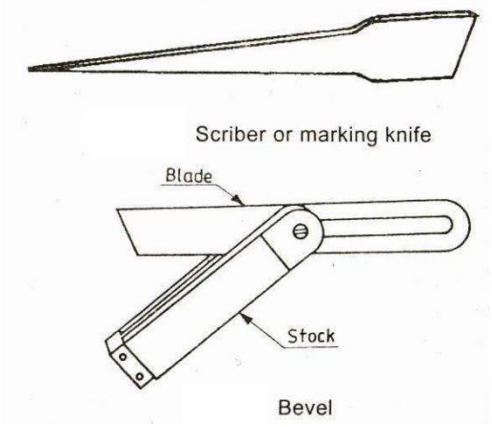
- **Scriber or marking knife**

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

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

Carpenters vice

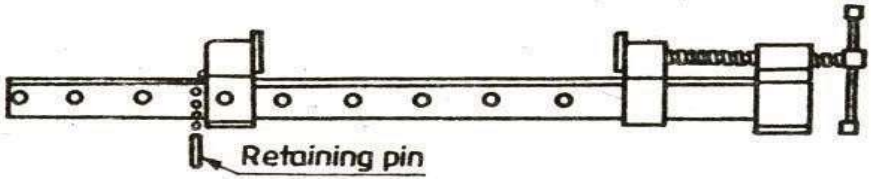
C- clamp

C- clamp

Figure shows a C- clamp, which is used for holding small works.

Bar cramp

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



Planning Tools:

Planning is the operation used to produce flat surfaces on wood. A plane is a hand tool used for this purpose. The cutting blade used in a plane is very similar to a chisel. The blade of a plane isfitted 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

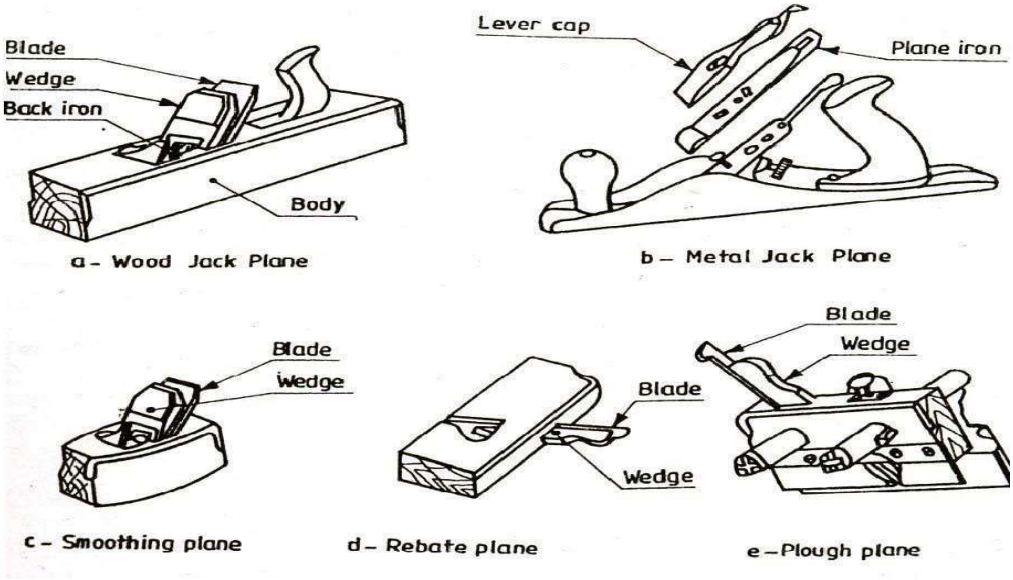
It is used for finishing work and hence, the blade should have a straight cutting edge. It is about 20 to 25 cm long. Being short, it can follow even the slight depressions in the stock, better than the jack plane. It is used after using the jack plane.

Rebate plane

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

Plough plane

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



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 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

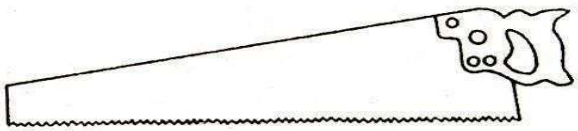
It is used for cutting the stock along the grains. The cutting edge of this saw makes a steeper angle, i.e., about 60° whereas that of crosscut saw makes an angle of 45° with the surface of the stock.

Tenon saw

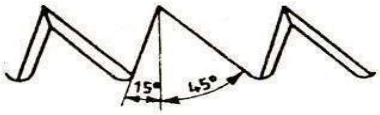
It is used for cutting the stock either along or across the grains. It is used for cutting tenons and in fine cabinet work. However, it is used for small and thin cuts. The blade of this saw is very thin and so it is stiffened with a thick back steel strip. Hence, this is sometimes called as back-saw.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

Compass saw

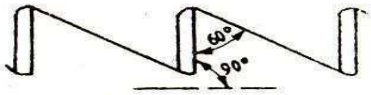
It has a narrow, longer and stronger tapering blade, which is used for heavy works (Fig.). It is mostly used in radius cutting. The blade of this saw is fitted with an open type wooden handle.



a – Cross cut saw

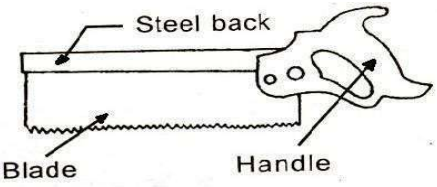


b – Cross cut saw teeth

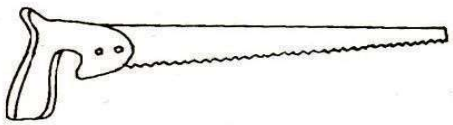


c – Rip saw teeth

Cross-cut and rip saw



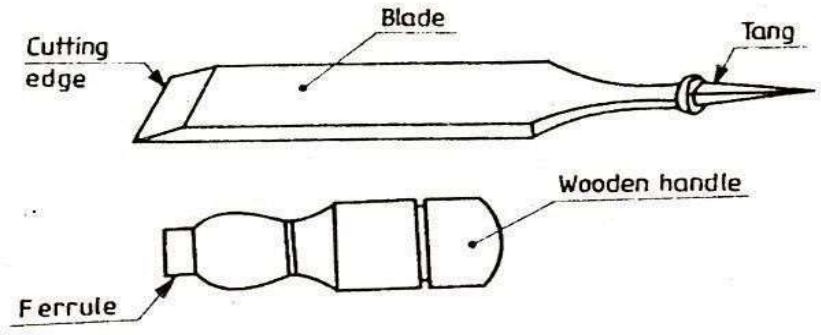
Tenon saw



Compass saw

Chisels

Chisels are used for cutting and shaping wood accurately. Wood chisels are made in variousblade 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 word 'firmer' means 'stronger' and hence firmer chisel is stronger than other chisels. It isa general-purpose chisel and is used either by hand pressure or by a mallet. The blade of a firmer chisel is flat, as shown in Figure.

Dovetail chisel

It has a blade with a beveled back, as shown in Figure, due to which it can enter sharp comers 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.

a. Firmer **b. Dovetail** **c.**

MortiseDrilling and Boring Tools:

Carpenter's brace

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

Auger bit

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

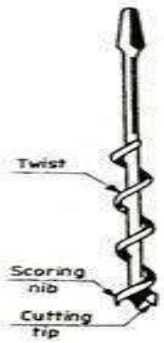
Hand drill

Carpenter's brace is used to make relatively large size holes; whereas hand drill is used for drilling small holes. A straight shank drill is used with this tool. It is small, light in weight and may be conveniently used than the brace. The drill bit is clamped in the chuck at its end and is rotated bya handle attached to gear and pinion arrangement.

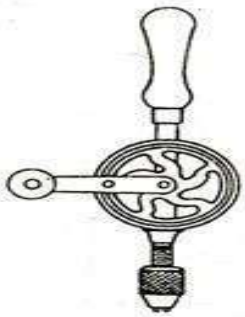
Gimlet

It has cutting edges like a twist drill. It is used for drilling large diameter holes with thehand pressure.

Carpenter's brace



Auger bit



Hand drill

Gimlet

Miscellaneous

Tools:Mallet

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

Pincer

It is made of two forged steel arms with a hinged joint and is used for pulling out small nails from wood. The inner faces of the pincer jaws are beveled and the outer faces are plain. The end of

one arm has a ball and the other has a claw. The beveled jaws and the claw are used for pulling out small nails, pins and screws from the wood.

Claw hammer

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

Screw driver

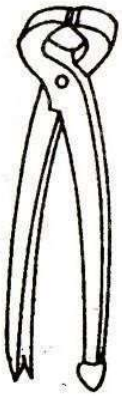
It is used for driving screws into wood or unscrewing them. The screw driver of a carpenter is different from the other common types, as shown in figure. The length of a screw driver is determined by the length of the blade. As the length of the blade increases, the width and thickness of the tip also increase.

Wood rasp file

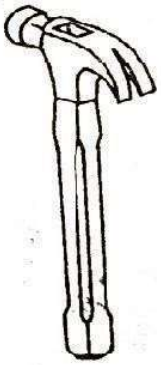
It is a finishing tool used to make the wood surface smooth, remove sharp edges, finish fillets and other interior surfaces. Sharp cutting teeth are provided on its surface for the purpose. This file is exclusively used in wood work.

Bradawl

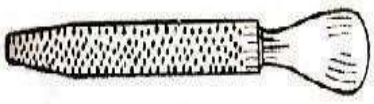
It is a hand operated tool, used to bore small holes for starting a screw or large nail.



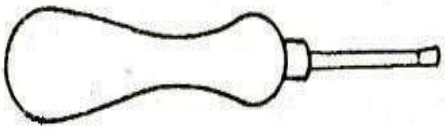
Pincer



Claw hammer



Wood rasp file



Bradawl

HALF-LAP JOINT

EXPERIMENT NO: **DATE:**

Aim: To make a Half- lap joint from the given wooden piece for the desired dimensions.

Tools required:

Carpenter's vice, steel Rule, try square, jack plane, scriber, cross cut saw, marking gauge, firmer chisel, mallet, wood rasp file and smooth file.

Material required: Wooden piece of size 300 x 50 x 35 mm.

Sequence of operations:

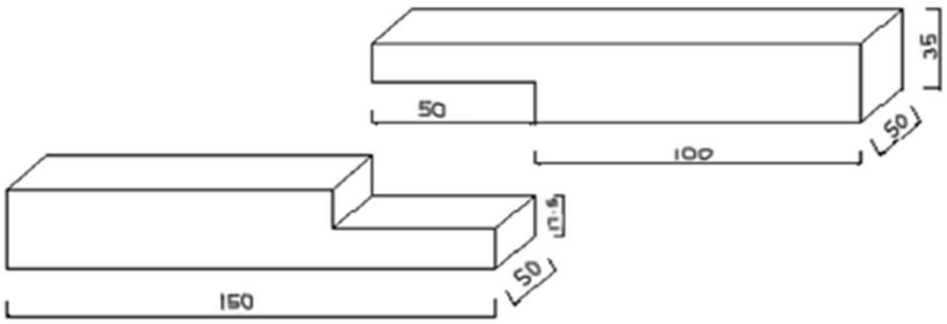
1. Rough Planning
2. Check for squareness
3. Measuring and Marking
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing

Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the work piece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut by using rip saw then proper marking is done for half lap joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using cross-cut saw and firmer chisel, the unwanted portions are removed as per the drawing.
7. The above procedure is repeated for the other half of the work piece.
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. 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 chiseling, sawing and planning processes with care.



All Dimensions are in mm

Result:

Thus, the half-lap joint is made as per the required dimensions.

Staff Signature

MORTISE AND TENON JOINT

EXPERIMENT NO: **DATE:**

Aim: To make a Mortise-Tenon joint from the given wooden piece for the desired dimensions.

Tools required:

Carpenter's vice, steel Rule, try square, jack plane, scriber, cross cut saw, marking gauge, firmer chisel, mallet, wood rasp file and smooth file.

Material required: Wooden piece of size 300 x 50 x 35 mm.

Sequence of operations:

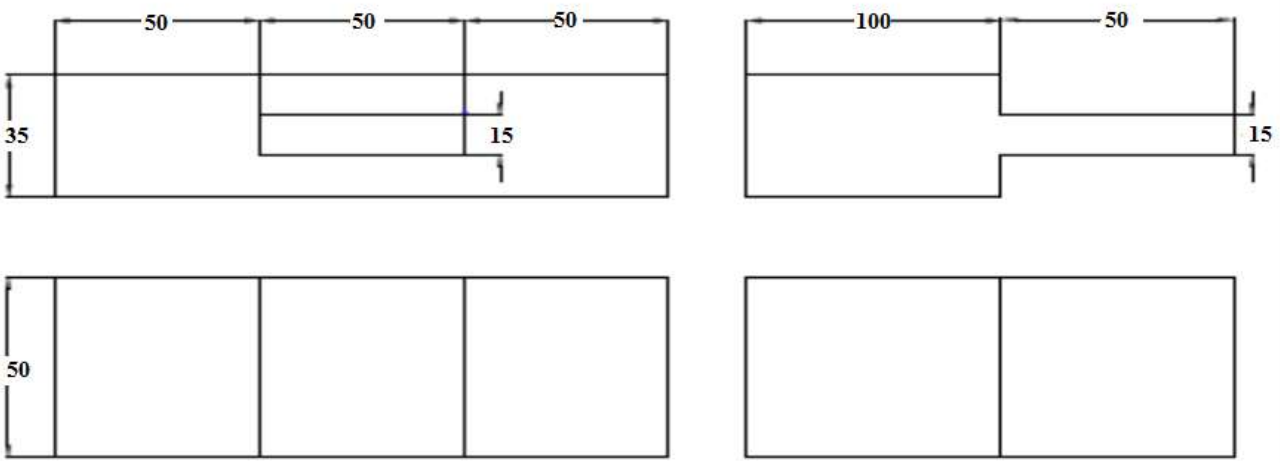
1. Rough Planning
2. Check for squareness
3. Measuring and Marking
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing

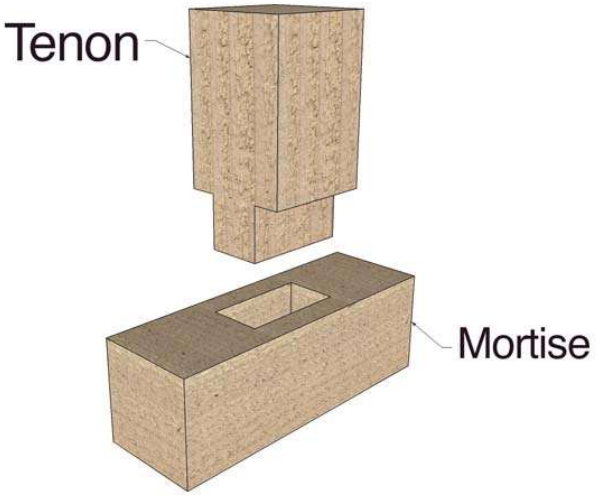
Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the work piece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut by using rip saw then proper marking is done for mortise and tenon joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using cross-cut saw and firmer chisel, the unwanted portions are removed as per the drawing.
7. The above procedure is repeated for the other half of the work piece.
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. 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 chiseling, sawing and planning processes with care.





All Dimensions are in mm

Result:

Thus, the mortise and tenon joint is made as per the required dimensions.

Staff Signature

CORNER BRIDLE JOINT

EXPERIMENT NO: **DATE:**

Aim: To make a corner bridle joint from the given wooden piece for the desired dimensions.

Tools required:

Carpenter's vice, steel Rule, try square, jack plane, scriber, cross cut saw, marking gauge, firmer chisel, mallet, wood rasp file and smooth file.

Material required: Wooden piece of size 300 x 50 x 35 mm.

Sequence of operations:

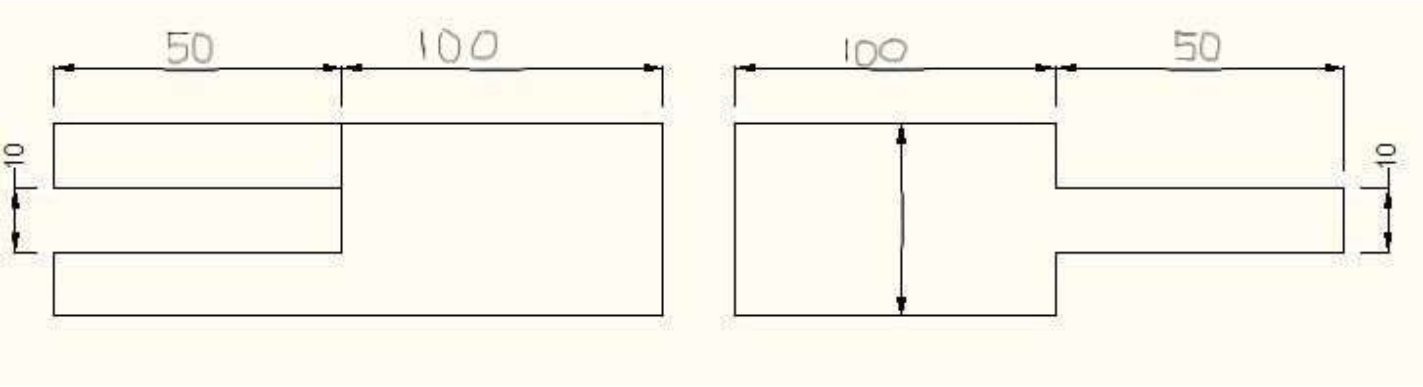
1. Rough Planning
2. Check for squareness
3. Measuring and Marking
4. Removal of extra material
5. Sawing
6. Chiseling
7. Finishing

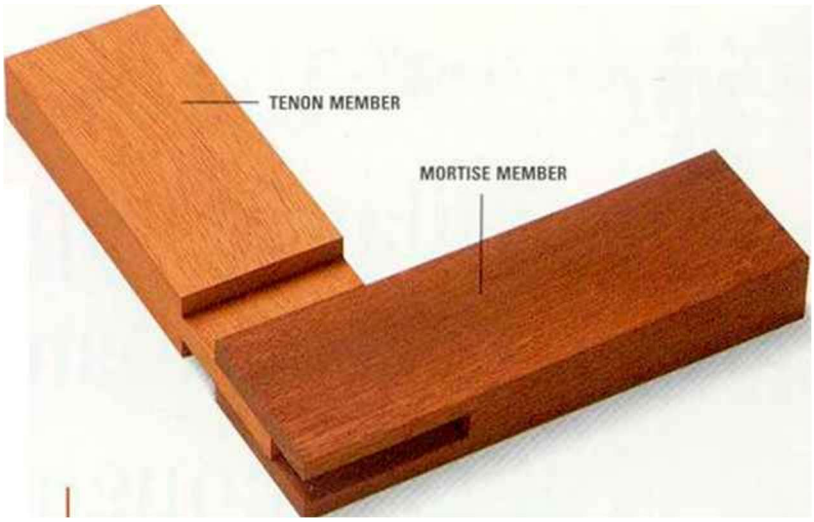
Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the work piece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut by using rip saw then proper marking is done for corner bridle joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using cross-cut saw and firmer chisel, the unwanted portions are removed as per the drawing.
7. The above procedure is repeated for the other half of the work piece.
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. 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 chiseling, sawing and planning pro





All Dimensions are in mm

Result:

Thus, the corner bridle joint is made as per the required dimensions.

Staff Signature

WOOD WORKING SAMPLE VIVA QUESTIONS

1. Name the commonly available shapes of timber in the market.
2. What is the sequence of operations in carpentry?
3. What is the difference between marking gauge and marking knife?
4. What is the difference C-clamp and bar cramp?
5. What for a plane is used in a carpentry shop?
6. Classify the planning tools.
7. Classify the chisels and their applications.
8. Name the tools used for pulling nails.
9. Name the various joinery materials used in carpentry.
10. Name the various types of joints.
11. Name some holding tools.
12. Name some marking tools.
13. Name some measuring tools.
14. Name some cutting tools.
15. Name some planning tools.
16. Name some finishing tools.

SHEET METAL WORKING

Introduction:

Sheet metal work is working on the metal of 16 gauge to 30 gauge with hand tools and simple machines into different forms by cutting, forming into shape and joining. It is one of the major applications in engineering industry.

(i) Sheet metal materials:

- **Black Iron:**

It is also known as uncoated sheet since it carries no artificial coating on its surfaces. However, it is probably the cheapest of all types of sheets used in sheet metal work. Being uncoated, it is prone to corrosion. Consequently, its use is confined mostly to the manufacture of such items which are to be painted before shipment, e.g. block iron is used in tanks, pans, trunks, stove pipes, etc.

- **Galvanized Iron:**

Zinc coated iron is called 'Galvanized iron'. This soft steel sheet is popularly known as GI sheet. The zinc coating resist rust, improves the appearance of the metal and permits it to be soldered with greater ease; but welding is not so easy as zinc gives toxic fumes and residues. Because of zinc it can with stand contact with water and exposure to weather, e.g. articles like cabinets, trunks, buckers, pans, etc. are made of galvanized iron sheets

- **Copper Sheets:**

These sheets are relatively costlier but having specific advantages in being good corrosion resistant and good in appearance. They are reddish in color and their cold rolled variety, which is vastly used in sheet metal work, is highly ductile and malleable and therefore can be easily worked. Some representative examples are automobiles, various applications in chemical plants, domestic heating appliance, etc.

- **Aluminum Sheets:**

On account of its inherited weakness, it is not used in its pure form. The useful variety of aluminum alloy which is rolled into sheet form carries additions of suitable amount of silicon, manganese copper and iron. It is whitish in color and light in weight. It offers very high resistance to corrosion and abrasion. Its common applications are aero plane bodies, kitchen ware, etc.

(ii) Tools used in Sheet metal shop:

- **Steel Rule:**

It is useful in measuring and laying out small work. It can be measure with accuracy of 0.5 mm.

- **Scriber:**

This is sometimes called the metal workers pencil. It is a long wire of steel with its one end sharply pointed and hardened to scratch lines on sheet metal in laying out patterns.

- **Dividers:**

Dividers are used for drawing circles or arcs on sheet metal. They are also used to mark a desired distance between points and to divide lines into equal.

- **Punches:**

A Punch is used in sheet metal work for marking out work, locating centers, etc. in a more permanent manner. Two types of punches are generally used:

Prink Punch: It is used to make small marks on layout lines in order to mark the prick punch marks longer.

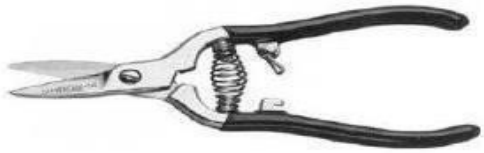
Center Punch: It is used only to make the prick punch marks larger at the centers of holes that are to be drilled. Solid and hollow punches are very similar the other two puncher the inner and outer faces of the punch meeting at an angle of 40. These are used for making small holes from 2.5 mm to 10 mm.

- **Mallet:**

These are soft hammers and made of saw hide, hard rubber, copper brass, lead or mostly of wood, used to strike a soft and light blow on the metal.

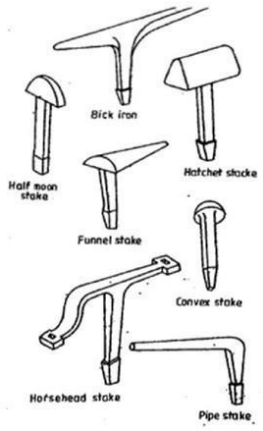
- **Snips or Shears:**

A snip, also called a hand shear is used like a pair of scissors to cut thin, soft metal. It should be used only to cut 20 gauge or thinner metal. There are several types of snips available for making straight or circular cuts, the most common being straight snip have straight blade for straight line cutting while curved or bent snips have curved blades for making circular cuts. Both these snips are very light and can be easily handled by one hand. These are also double cutting shear, squaring shear, ring shear and circular shear used for particular requirements as the name indicates. The heavier classes are known as bench shears and block shears where one handle may be held in vice bench plate while the other handle is moved up and down to do the cutting.



- **Stakes:**

Stakes are the sheet metal workers evils used for bending, seaming or forming, using a hammer or mallet. They actually work as supporting tools as well as forming tools. They also help in bending operation. They are made in different shape and sizes to suit the requirements of the work.



TAPERED TRAY

EXPERIMENT NO: **DATE:**

Aim: To make a tapered tray using the given G.I. Sheet.

Material Supplied:

Galvanized Iron (G.I) sheet.

Tools required:

Steel rule, mallet, scriber, divider, protractor, snips, stakes, try square, ball peen hammer and cross peen hammer.

Sequence of Operations:

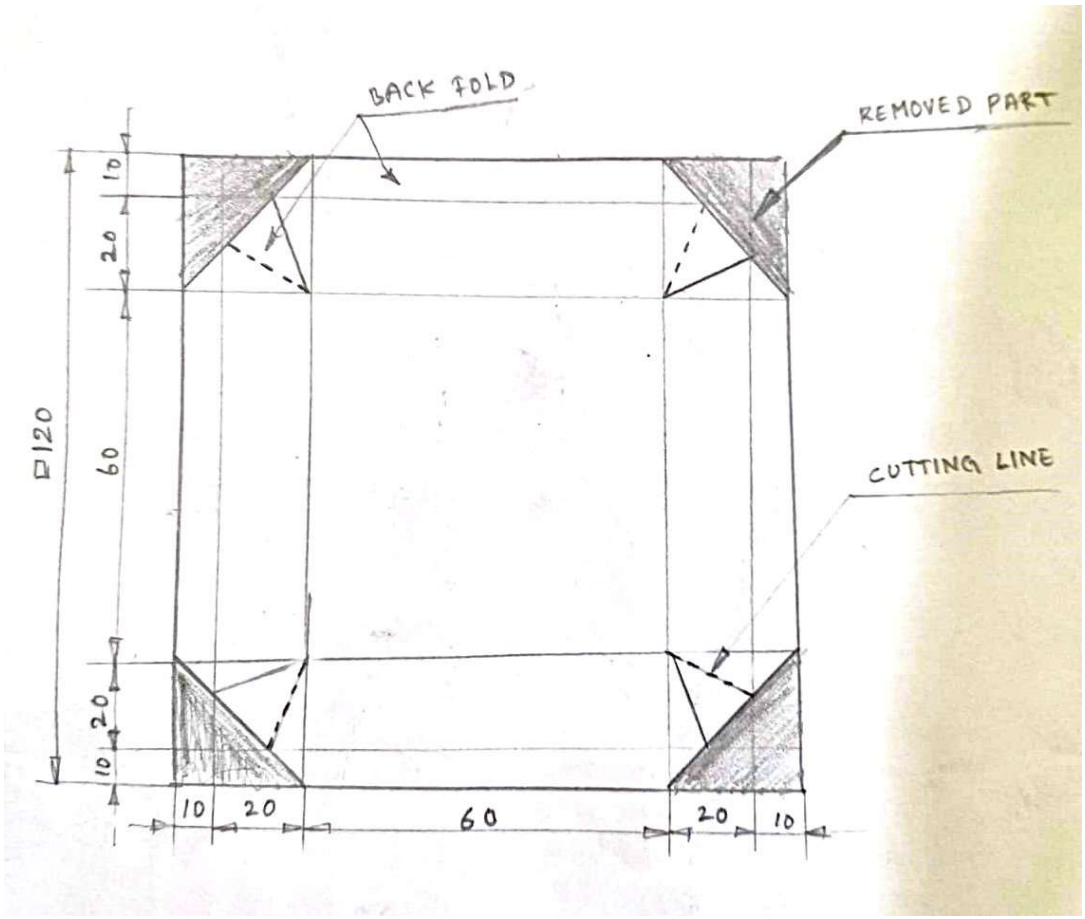
1. Checking
2. Leveling
3. Marking
4. Cutting
5. Bending
6. Hemming

Working Steps:

1. The size of the given sheet is checked for its dimensions using a steel rule.
2. Then the sheet is leveled on the leveling plate using a mallet.
3. The development procedure is followed; the dimensions are marked as shown in figure.
4. The sheet is cut as per the marked dimensions by straight snips.
5. Then a single hemming is made on the four sides of the tray as shown in figure.
6. Fold the given sheet by using stakes and ball peen hammer to the required shape.

Safety Precautions:

1. Sufficient care is to be taken while cutting and folding of G.I. sheet.
2. Remove the waste pieces immediately from the work place.



All Dimensions are in mm

Result:

Thus, tapered tray is made as per the required dimensions.

Staff Signature

CONICAL FUNNEL

EXPERIMENT NO: **DATE:**

Aim: To make Conical funnel using the given G.I. Sheet.

Material Supplied:

Galvanized Iron (G.I) sheet.

Tools required:

Steel rule, mallet, scriber, divider, protractor, snips, stakes, try square, ball peen hammer and cross peen hammer.

Sequence of Operations:

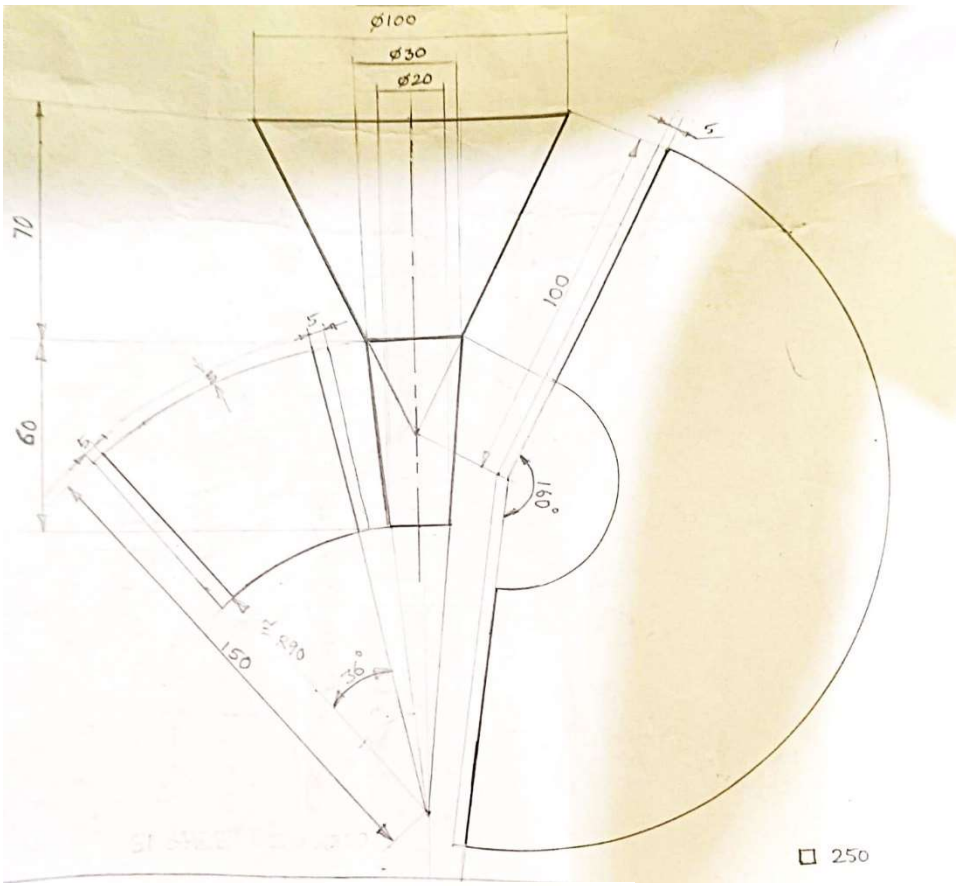
1. Checking
2. Leveling
3. Marking
4. Cutting
5. Bending
6. Seaming

Working Steps:

1. The size of the given sheet is checked for its dimensions using a steel rule.
2. Then the sheet is leveled on the leveling plate using a mallet.
3. Mark all the measuring lines on the given sheet with scriber and mark out development of the sheet by the Radial line development as per size.
4. Remove the unwanted materials using snips.
5. Fold the given sheet by using stakes and ball peen hammer to the required shape.
6. Both the closing edges are joined together by seaming process.

Safety Precautions:

1. Sufficient care is to be taken while cutting and folding of G.I. sheet.
2. Remove the waste pieces immediately from the work place.



All Dimensions are in mm

Result:

Thus, conical funnel is made as per the required dimensions.

Staff Signature

ELBOW PIPE

EXPERIMENT NO: **DATE:**

Aim: To make Elbow pipe using the given G.I. Sheet.

Material Supplied:

Galvanized Iron (G.I) sheet.

Tools required:

Steel rule, mallet, scriber, divider, protractor, snips, stakes, try square, ball peen hammer and cross peen hammer.

Sequence of Operations:

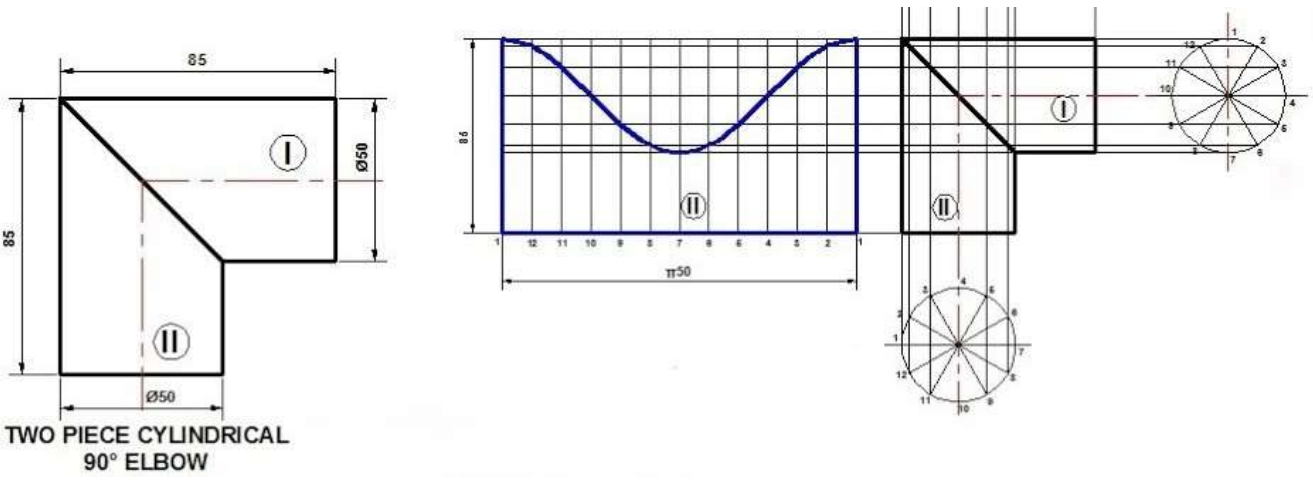
1. Checking
2. Leveling
3. Marking
4. Cutting
5. Bending
6. Seaming

Working Steps:

1. The size of the given sheet is checked for its dimensions using a steel rule.
2. Then the sheet is leveled on the leveling plate using a mallet.
3. Any suitable size is chosen for diameter and height and mark out development of the sheet by the parallel line development as per size.
4. Remove the unwanted materials using snips.
5. Then the folding is done in such a way to get the pipe shape.
6. Both the closing edges are joined together by seaming process.

Safety Precautions:

1. Sufficient care is to be taken while cutting and folding of G.I. sheet.
2. Remove the waste pieces immediately from the work place.



All Dimensions are in mm

Result:

Thus, elbow pipe is made as per the required dimensions.

Staff Signature

BRAZING

EXPERIMENT NO: **DATE:**

- **Brazing**:

Brazing is defined as the technique of joining two similar or dis-similar materials, by addition of special filler metal. Brazing is also called as hard soldering and it results in a stronger joint than soldering. It can withstand temperatures up to 800°C and higher pressures. The filler metal, i.e. solder used in brazing is known as spelter, a non-ferrous metal or alloy. The following are the stages involved in brazing:

1) Make a tight-fitting joint. Where necessary, file a groove along the joint for the solder to run into.
2) Clean the surface of the joint, free from oil, dirt, grease, rust, etc.
3) Apply flux with a brush
4) Preheat the area until the flux dries out. Then, heat the joint until it is bright red.
5) Apply the solder when it begins to melt; move the torch along the joint for the solderto flow evenly.
6) Clean, file and smoothen the joint.

- **Advantages:**

1. Produce leak-proof joints, which are superior to soldered joints.
2. Produce corrosion resistant joints.
3. Brazing can be performed on similar or dis-similar metals.

- **Disadvantages:**

1. Large areas cannot be brazed easily due to the possibility of lack of uniform heatingof internal surfaces.
2. Joints have poor strength compared to welded joints.
3. Require tightly mating parts.
4. Brazing fluxes may produce toxic fumes.
5. It cannot be performed on hardened steel.

- **Precautions:**

Avoid the inhalation of fumes produced because of fluorides and fluorine compounds that are present in brazing fuses, particularly those used with silver, magnesiumand aluminum silicon brazing filler metals.

Staff Signature

SHEET METAL WORKING SAMPLE VIVA QUESTIONS

1. What is the raw material used in Tin smithy for doing experiments
2. Classify the tools used in Tin smithy
3. Name some measuring tools
4. Name some marking tools
5. Name some cutting tools
6. Name some finishing tools
7. What is the use of Nylon mallet
8. What is the purpose of given tool
9. Differentiate between mallet and Hammer
10. Differentiate between straight snip and curved snip
11. What is the purpose of snip
12. What is the use of anvil
13. What is the purpose of Stake
14. What is the use of scriber
15. What is use of cutting plier
16. What is the supporting tool used to obtain the final shape of the model
17. What type of development is applied for Plain Pipe
18. What type of development is applied for rectangular tray
19. What type of development is applied for Funnel
20. What is the full form of SWG

FITTING

Introduction:

Fitting is the assembling together of parts and removing metals to secure the necessary fit and it may not be carried out at the bench. An operator who does the fitting job is called fitter.

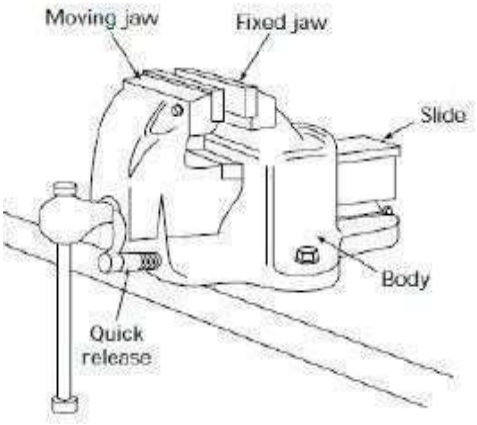
i. Safety precautions in fitting shop:

- Use a file with a properly fitted, tight handle.
- Check the hammer each time before it is used. The handle must be securely welded.
- Select the type, shape and size of wrench opening most suitable for the application.
- Position the jaws as close to the work as possible to prevent slipping.
- Start a new blade in another place when a blade breaks during cut. This prevents binding and blade breakages.
- Apply force onlyon the forward (cutting) stroke; relieve the force on return stroke.
- Position the work piece area such that the cut to be making is close to the vice.

ii. Tools used in Fitting Shop

➢ **Bench vice:**

The wise is common tools used for holding jobs. It consists if a cast iron body and cast iron jaws. Two jaws plates are fitted on both the jaws. Jaw plates are made up of high carbon steel and are wear resistant. One jaw is fixed to the body and the second slides on a square threaded screw with the help of the handle. The jaws are opened up to required length; job is placed in the two is fully tightened with handle.

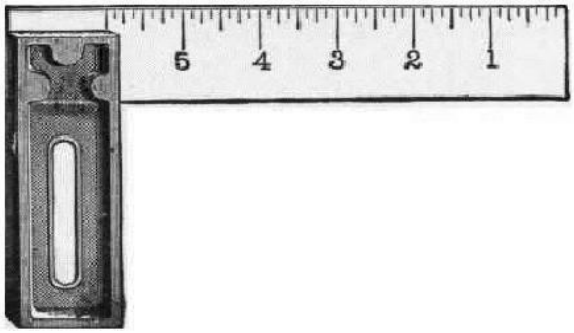


➢ **Hacksaw:**

The hacksaw is used for cutting metal by handle. It consists of frame which holds a thin blade, firmly in the position. The blade has a number of cutting teeth. The number of teeth per 25 mm of the blade length or teeth inch (TPI) is selected on the basis of the work material and thickness being cut.

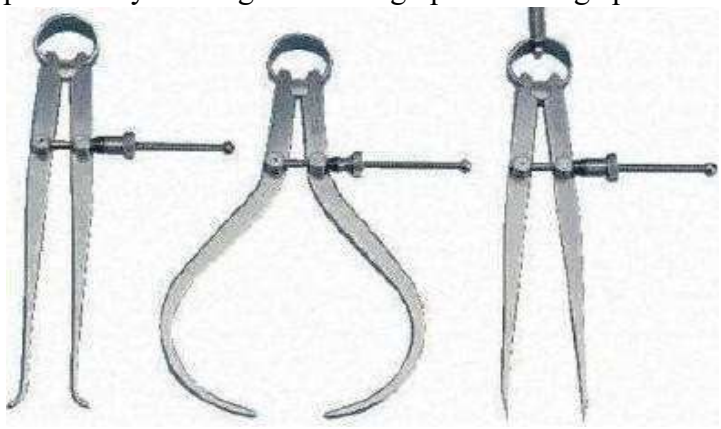
- **Try square**:

It is used for checking squareness of surface. It consists of a blade made up of steel which is attached to base at 90 degree. The base is made up of cost iron steel. Try square is also used for marking right angles and measuring straightness of surface.



- **Jenny Caliper or Odd Leg Caliper:**

This is used for marking parallel lines a finished edge and also for locating the center of round bars. They are specified by the height of the leg up to the hinge point.



- **Scriber:**

This is the basic marking out tool. It consists of a handle with a sharp point. The pointed end is made from hardened steel so that it will stay sharp in use.

- **Centre punch:**

It is like a dot punch except the angle of punching end is 90°. It is used to mark the center of the hole before drilling.

- **Chisels:**

There are used for chipping away the material from the work piece. These are made up of high carbon steel. Generally 6" to 8" long. The top is flattened and sharp cutting edge is made on the bottom side. Chisels are classified on the bottom side. Commonly used forms of chisels are flat,

cross cut, half round and diamond point chisels. Flat chisel is used for general work, cross cut chisel and half round chisels are used for grooving and diamond point chisel is for precision work.

- **Steel rule:**

It is made up of stainless steel and marked with graduation of scales.

- **Hammer:**

Hammer are named depending on their shape and material and specified by their weight. A ball peen hammer has a flat which is used for riveting. They weight from 200gm to 1.5kg.The different types of hammer are Ball peen hammer, Cross peen hammer, chipping hammer etc.,

- **Files:**

A file is hardened steel tool, having slant parallel rows of cutting edges or teeth on its surfaces. On the faces the teeth are usually diagonal to the edge. One end of the file is shaped to fit into wooden handle. The hand file is parallel in which in width and tapering slightly in thickness towards the top. It is provided with cut teeth on the face, single cut on one edge and no teeth on the other edge, which is known as safe edge.

- **Types of files:**

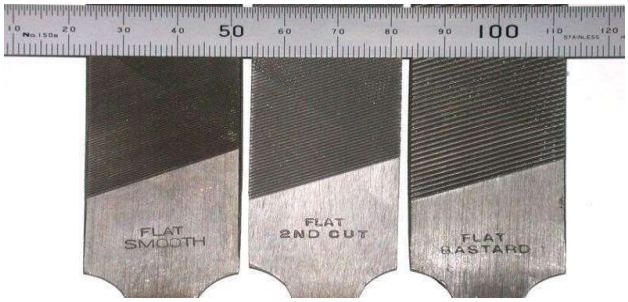
Files are classified according to their shape, cutting teeth and pitch or grade of the teeth.

- **Flat File:**

It has double cut on both sides and single on both edges. It is mostlyused for general work and filing flat surfaces. A large amount of metal can be removed with this file, and they don't produce smooth surfaces.

- **Square file:**

It is double cut file on all sides, and used for enlarging square holes and filing of slot and keys.



- **Triangular file:**

Its section is triangular and faces are double cut and edges are single cut. It's each side on60^0. It is used for filing internal angles, shoulders or corners and for sharpening wood working saws.

- **Round file:**

It is also a double cut file. It is used for enlarging holes, slots, and concave.

- **Half round file:**

It has one side flat and other side is half round. The flat side is double cut and curved side issingle cut. It is used for filing curved surfaces.

Different Types of Files used for different profiles:

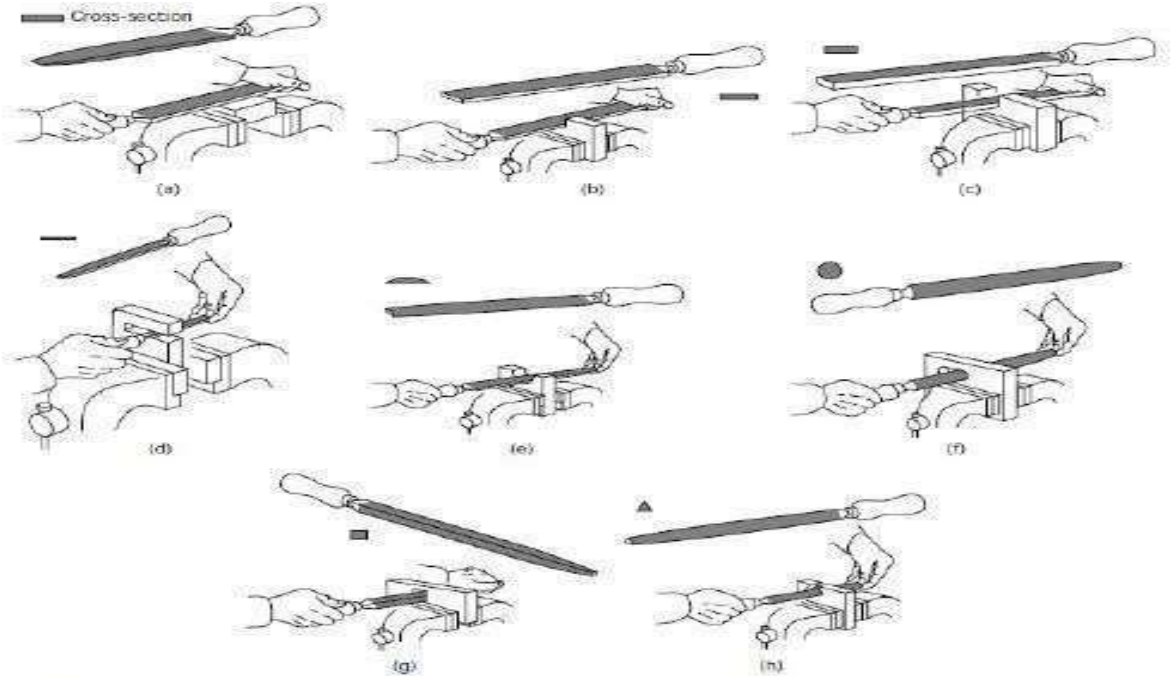


Figure *Types of file and their applications: (a) flat file; (b) hand file; (c) pillar file; (d) ward file; (e) half-round file; (f) round file; (g) square file; (h) three-square file*

V-FIT

EXPERIMENT NO: **DATE:**

Aim: To make a V- fit from the given mild steel flat pieces.

Material Supplied:

50 x 50 x 5 mm mild steel plate – 2 nos.

Tools Required:

Bench vice, try square, steel rule, scriber, filling tools set, vernier height gauge, surfaceplate, angle plate, dot punch, hammer and fixed saw.

Sequence of Operations:

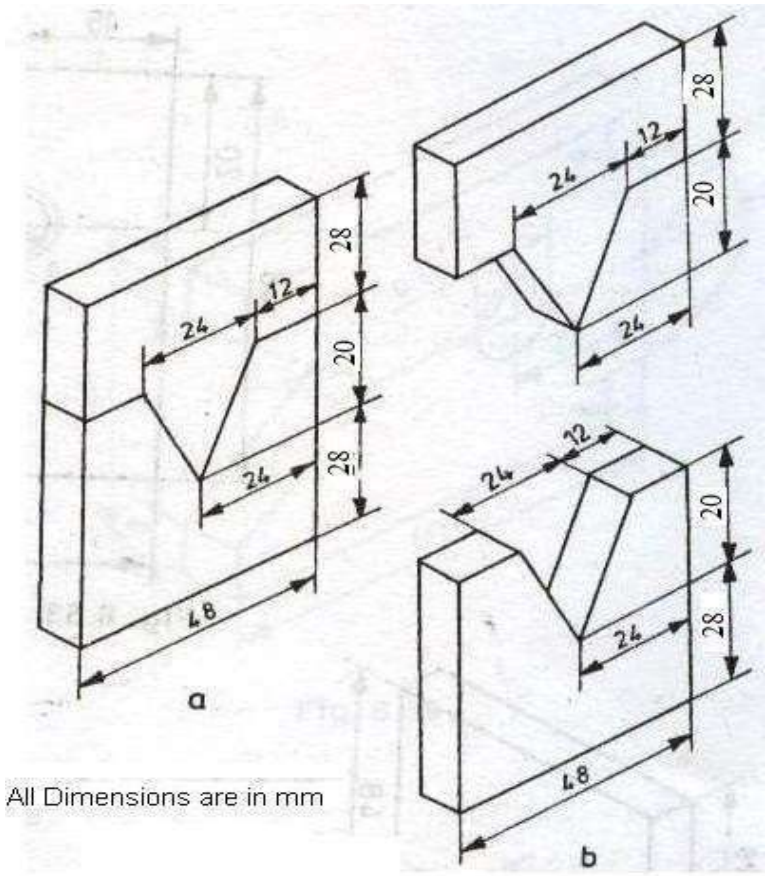
1. Filing
2. Checking flatness and squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the bench vice and any two adjacent sides are filed byusing flat file so those work pieces are made at right angle.
3. Then chalk is applied uniformly on the surfaces of the job.
4. The given dimensions are marked by using surface plate and vernier height gauge.
5. Now using dot punch, dots are punched over the marked line.
6. Then using fixed hacksaw, the unwanted portions are removed.
7. Cutting edges are filed by using flat file and triangular files.
8. Finally, the assembly is checked to ensure the correctness of the fit.

Precautions:

1. Care should be taken while marking,
2. Care should be taken while using the cutting tools.
3. Use cleaning brush while removing chips.



V - FITTING

Result:

The required V-fit is thus obtained as per the required dimensions.

Staff Signature

DOVETAIL FIT

EXPERIMENT NO: **DATE:**

Aim: To make a Dovetail fit from the given mild steel flat pieces.

Material Supplied:

50 x 50 x 5 mm mild steel plate – 2 nos.

Tools Required:

Bench vice, try square, steel rule, scriber, filling tools set, vernier height gauge, surfaceplate, angle plate, dot punch, hammer and fixed saw.

Sequence of Operations:

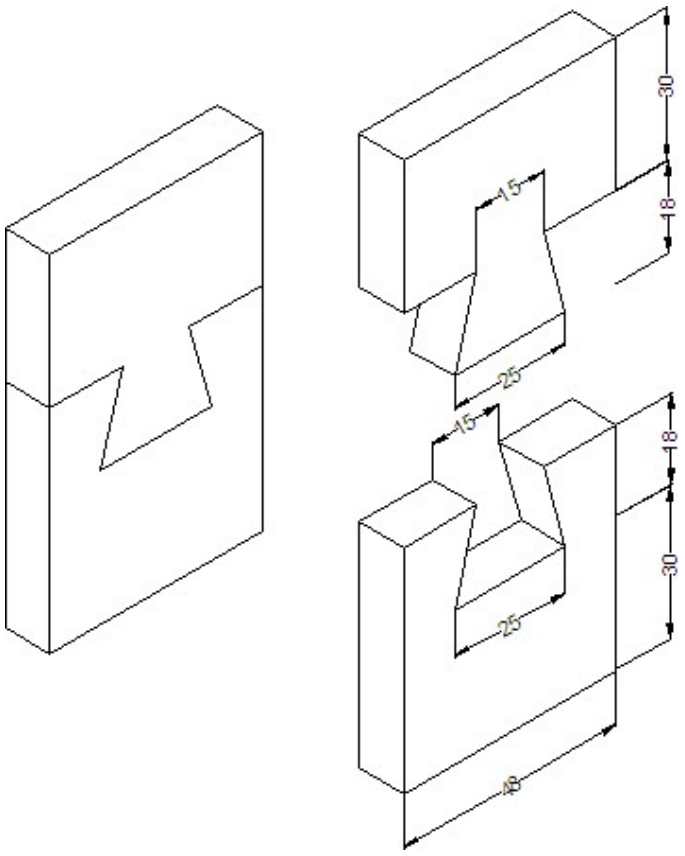
1. Filing
2. Checking flatness and squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the bench vice and any two adjacent sides are filed byusing flat file so those work pieces are made at right angle.
3. Then chalk is applied uniformly on the surfaces of the job.
4. The given dimensions are marked by using surface plate and vernier height gauge.
5. Now using dot punch, dots are punched over the marked line.
6. Then using fixed hacksaw, the unwanted portions are removed.
7. Cutting edges are filed by using flat file and triangular files.
8. Finally, the assembly is checked to ensure the correctness of the fit.

Precautions:

1. Care should be taken while marking,
2. Care should be taken while using the cutting tools.
3. Use cleaning brush while removing chips.



All Dimensions are in mm

Result:

The required Dovetail-fit is thus obtained as per the required dimensions.

Staff Signature

SEMI-CIRCULAR FIT

EXPERIMENT NO: **DATE:**

Aim: To make a Semi-Circular fit from the given mild steel flat pieces.

Material Supplied:

50 x 50 x 5 mm mild steel plate – 2 nos.

Tools Required:

Bench vice, try square, steel rule, scriber, filling tools set, vernier height gauge, surfaceplate, angle plate, dot punch, hammer and fixed saw.

Sequence of Operations:

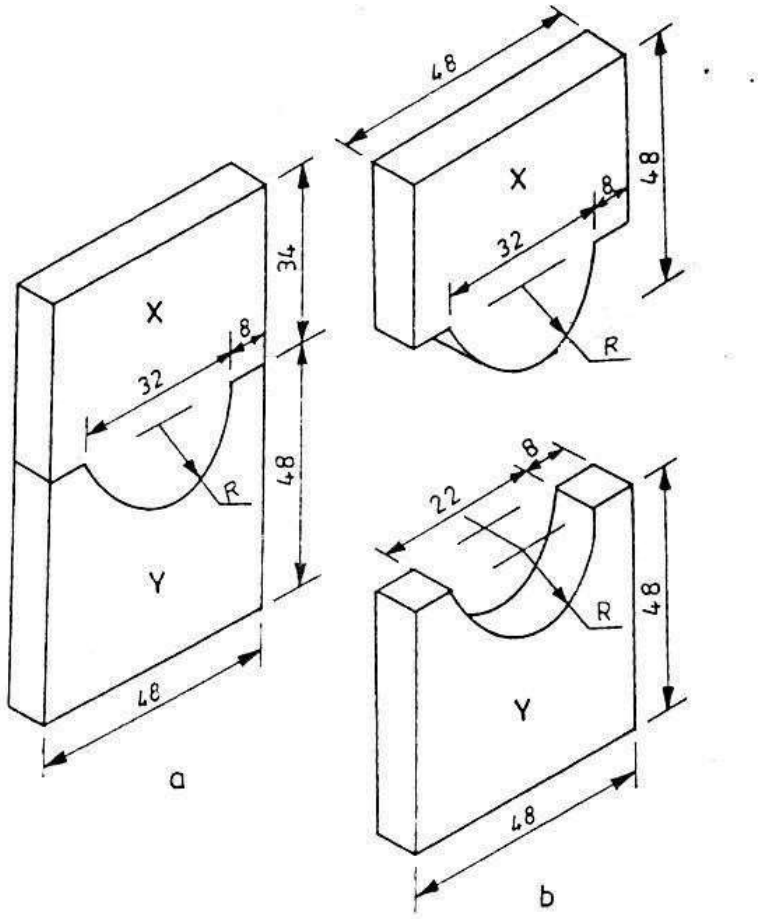
1. Filing
2. Checking flatness and squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the bench vice and any two adjacent sides are filed byusing flat file so those work pieces are made at right angle.
3. Then chalk is applied uniformly on the surfaces of the job.
4. The given dimensions are marked by using surface plate and vernier height gauge.
5. Now using dot punch, dots are punched over the marked line.
6. Then using fixed hacksaw, the unwanted portions are removed.
7. Cutting edges are filed by using flat file and half-round files.
8. Finally, the assembly is checked to ensure the correctness of the fit.

Precautions:

1. Care should be taken while marking,
2. Care should be taken while using the cutting tools.
3. Use cleaning brush while removing chips.



All Dimensions are in mm

Result:

The required Semi-Circular fit is thus obtained as per the required dimensions.

Staff Signature

BICYCLE TYRE PUNCTURE AND CHANGE OF TWO-WHEELER TYRE

EXPERIMENT NO: **DATE:**

Aim: To repair bicycle tyre puncture and change of two-wheeler tyre.

Tools Required:

Rim protector, Tyre Irons, Valve core tool, Air compressor, Bead breaker, Silicone lubricant, Tyre pressure gauge, Hand gloves.

Materials Required:

Bicycle tyre puncture kit

BICYCLE TYRE PUNTCURE:

Procedure:

Finding the puncture:

1. Remove the wheel from the bicycle.
2. Use tyre levers to remove the tyre.
3. Locate the hole that's causing the leak.
4. Mark the hole in the tube.

Patching the hole:

1. Remove any foreign objects from the hole.
2. Sand around the hole if necessary.
3. Apply the patch.
4. Know when replacing the tube is a smarter choice.

Putting the wheel back together:

1. Replace the tube in the tyre.
2. Work the tyre and tube back onto the wheel.
3. Inspect the bead and pump up the tube gradually to let the tube and tyre settle.
4. Replace the wheel on the bicycle.
5. Consider buying a new tube when you can

CHANGE OF TWO WHEELER TYRE:

Procedure:

Taking off the wheel:

1. Put your bike on its side with the chain facing up.
2. Adjust your gears to the smallest ring if you are removing the back tyre.
3. Open and remove the quick release lever, if your bike has one.
4. Use a wrench to loosen the nuts if you don't have a quick release lever.
5. Detach the brake cables if necessary.
6. Lift the wheel off the frame.

Removing the tyre and tube:

1. Shift down and hang the bike from workstand to work on it.
2. Disengage the brakes if they get in the way of removing the wheel.
3. Loosen the nuts that attach the wheel axle to the bike.
4. Pull the chain clear of the gear discs if you are removing the rear wheel.
5. Pull the wheel clear of the bike frame.

Pulling out the old tube:

1. Deflate the tyre fully while it's still on the removed wheel.
2. Pry out a section of the outer tyre with two simple levers.
3. Pop out the rest of the tyre from the wheel rim.
4. Pull the tube out from between the outer tyre and wheel rim.

Installing the new tube:

1. Pump up the replacement tube just until it has a basic circular shape.
2. Feed the new tube between the outer tyre and wheel rim.
3. Work the tyre back onto the inner rim of the wheel frame.
4. Fill the new tube with air to the recommended tyre pressure.

Reattaching the wheel:

1. Follow the same procedure you used to remove the wheel, only in reverse.
2. Guide the wheel onto the fork on the bike frame.
3. Re-engage the brakes.
4. Tighten the nuts to secure the wheel in place.

Result:

Thus, the punctured bicycle tyre is repaired and change of two-wheeler tyre is done successfully.

Staff Signature

FITTING SAMPLE VIVA QUESTIONS

1. What is meant by fitting?
2. What is the use of vice and give the various types of vice?
3. State the different types of hammers used in fitting work?
4. What is the use of V-block?
5. What is the material used for files?
6. What are the methods of filing?
7. What is the composition of high speed steel?
8. What is meant by peening or swaging?
9. What are the different types of punches?
10. What is the use of pilers?
11. What are the causes of breaking of hacksaw blades?
12. How to specify a vice?
13. Name the material out of which the vice is made?
14. Name the different types of drills used in fitting shop?
15. How can a tap drill step be determined?
16. What is meant by reaming?
17. Name the files which are classified based on longitudinal shape and cross section.
18. What is meant by scraping?
19. What is meant by chipping?

ELECTRICAL WIRING

Introduction:

Power is supplied to domestic installations through a phase and a neutral, forming a single phase. A.C 230V, 2- wire system for industrial establishments. Power is supplied through three phase four wire system to give 440V. Figure shows the power tapping for domestic and industrial purposes. The neutral is earthed at the distribution sub-station of the supply.

When supplied to domestic utilizes power is fed to a kilowatt meter and then to a distribution panel. The panel distributes power along several circuits' breakers. Thepanel also serves as a main switch.

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

ELEMENTS OF HOUSE WIRING:

Fuses & circuit Breakers:

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

Electric switch:

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

Plug:

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

Socket outlet:

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

Lamp holder:

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

Ceiling rose:

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

Main switch:

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

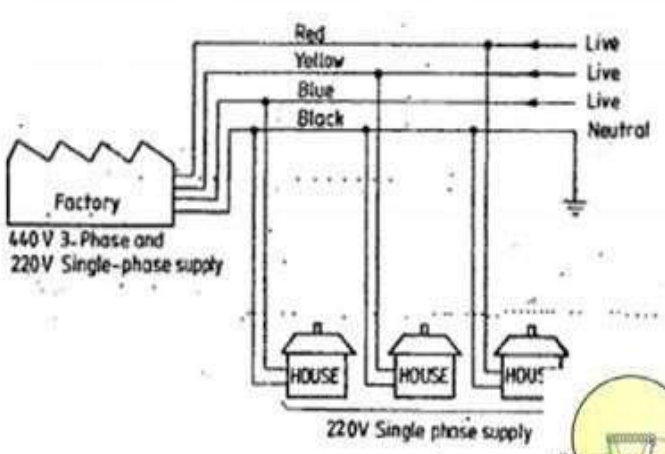
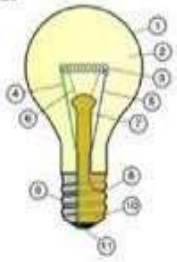
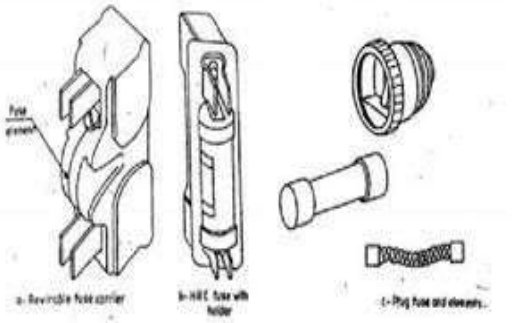


Fig. 3.1 3 phase-4 wire supply





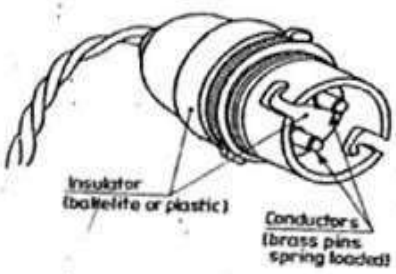
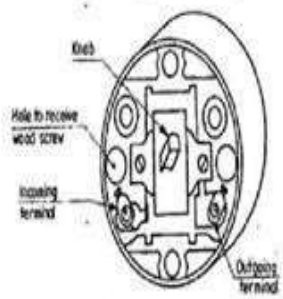


Fig. 3.6 Pendant lamp holder



One-way switch

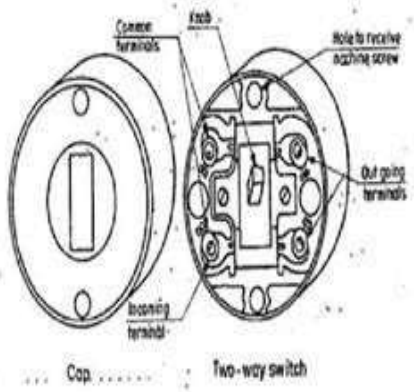


Fig. 3.4 Electric switches

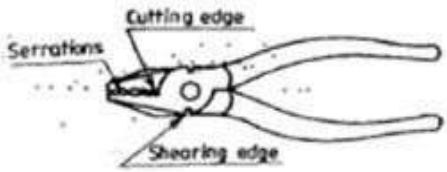


Fig. 8.22 Combination plier

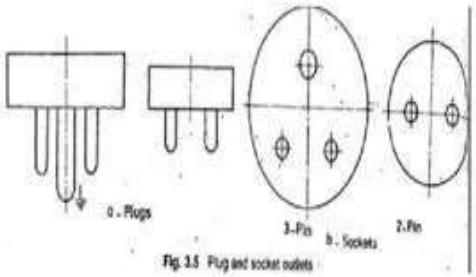


Fig. 3.5 Plug and socket outlets

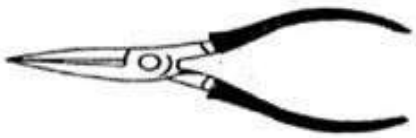


Fig. 8.23 Nose plier

NOTE: Parts of bulb

1) Glass bulb 2) Low-pressure inert gas 3) Tungsten-filament 4) Contact wire (out of stem) 5) Contact wire (into stem) 6) Support wires7) Stem Glass mount 8) Contact wire (out of stem) 9) Cap (Steeve) 10) Insulation 11) Electrical contact.

Incandescent light:

Incandescent means ‘glowing at white heat’. A lamp actually works like heating elements that it gives off light by becoming white hot, the amount of power it consumes is stamped on the bulb. Higher the wattage, brighter the light. The bulbs have filaments made of tungsten.

Interior wiring:

Wires:

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

PARALLEL AND SERIES
(WIRING FOR TWO LAMPS CONTROL BY ONE SWITCH)

EXPERIMENT NO: **DATE:**

Aim: To give connection to two lamps, controlled With Independent Switch Control swith or without Looping.

Tools Required:

Screw driver, Cutting pliers, Ball peen hammer, Insulation remover, Tester

Material Required:

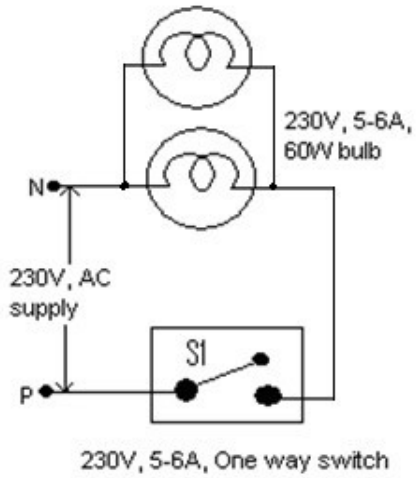
1. Wooden wiring board
2. Silk wire
3. Electrical bulbs - 2 No
4. One-way switch - 1 No
5. Wooden round blocks - 1 No
6. Batten lamp holders - 1 No
7. Wire clips
8. Nails
9. Screws

Working Steps:

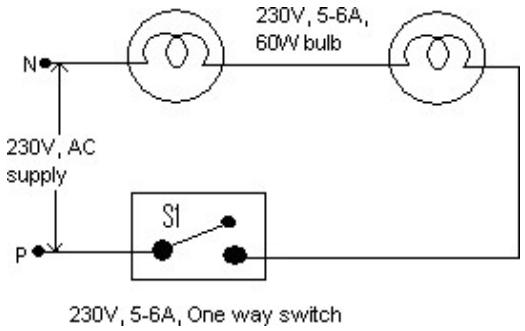
1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wiring diagram.
3. Wires are stretched and clamped with the clips.
4. Round blocks are screwed on to the board, as per the diagram.
5. Wires are connected to the holders and the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

Safety Precautions:

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



Parallel Connection



Series Connection

Result:

The electrical circuit, for two lights controlled by one switch in parallel and series is thus connected.

Staff Signature

TWO WAY SWITCH

EXPERIMENT NO: **DATE:**

Aim: To give connections to one light controlled by 2 two-way switches.

Tools Required:

Screw driver, Cutting pliers, Ball peen hammer, Insulation remover, Tester

Material Required:

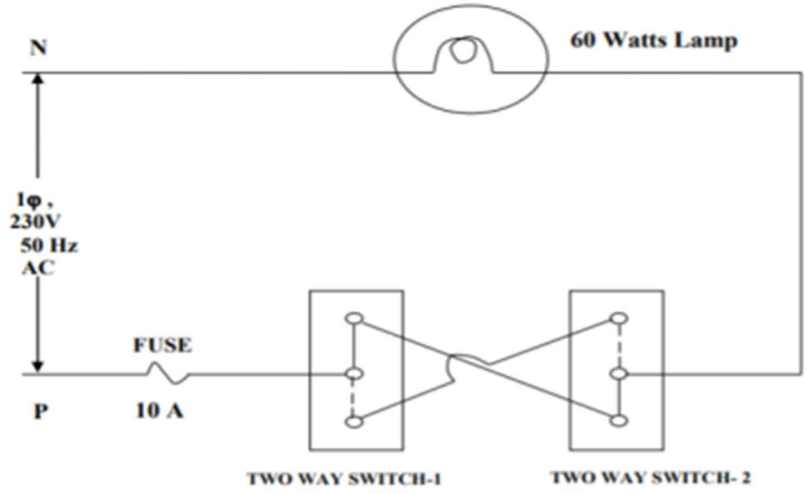
1. Wooden wiring board
2. Silk wire
3. Electrical bulbs - 1 No
4. Two -way switch - 2 No
5. Wooden round blocks - 3 No
6. Batten lamp holders - 1 No
7. Wire clips
8. Nails
9. Screws

Working Steps:

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

Safety Precautions:

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



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

Result:

The electrical circuit, for one bulb controlled by two two-way switches is thus connected.

Staff Signature

GODOWN LIGHTING

EXPERIMENT NO: **DATE:**

Aim: To give connections to godown lighting.

Tools Required:

Screw driver, Cutting pliers, Ball peen hammer, Insulation remover, Tester

Material Required:

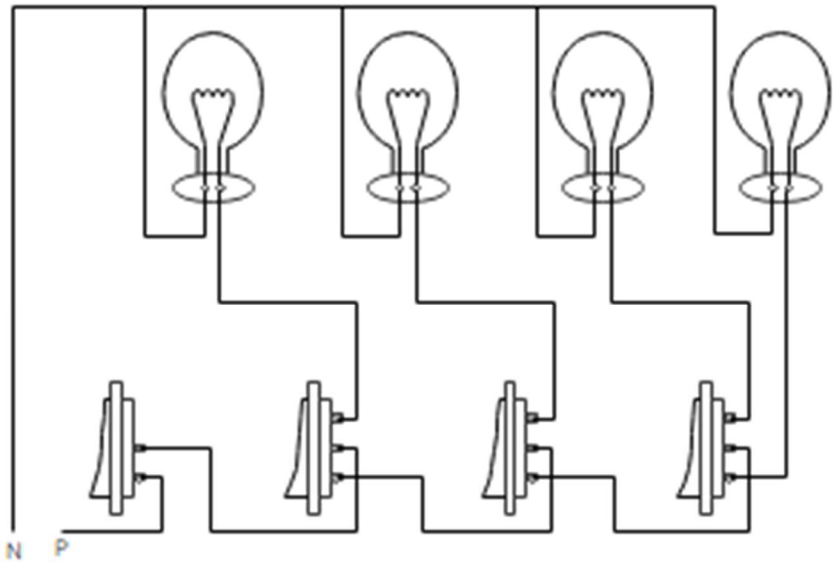
1. Wooden wiring board
2. Silk wire
3. Electrical bulbs - 4 No
4. One-way switch - 1 No
5. Two-way switch - 3 No
6. Wooden round blocks - 8 No
7. Batten lamp holders - 4 No
8. Wire clips
9. Nails
10. Screws

Working Steps:

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

Safety Precautions:

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



4 Lights Godown Wiring Diagram

Result:

The electrical circuit, for godown using four bulbs is thus connected.

Staff Signature

TUBE LIGHT

EXPERIMENT NO: **DATE:**

Aim: To give connections to tube light.

Tools Required:

Screw driver, Cutting pliers, Ball peen hammer, Insulation remover, Tester

Materials required:

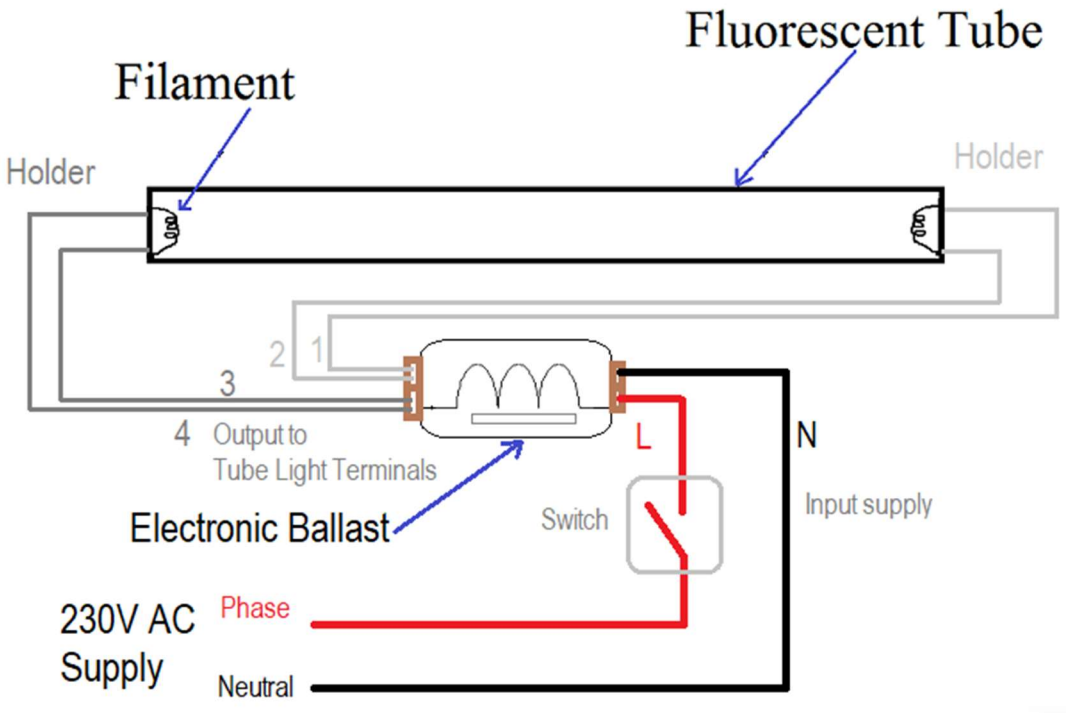
1. Wire of sufficient length 5-no
2. One-wayswitch-1
3. Starter-1
4. Choke-1
5. Fluorescent lamp
6. Holders with frame

Working Steps:

1. Wire pieces are taken and insulation is removed at the ends by using wire stripper.
2. A phase wire is connected to one point on the switch.
3. The other point of the switch is connected to Electronic Ballast.
4. The Electronic ballast is connected to output terminals of lamp holder as shown in the figure.
5. A neutral wire taken and connected to second point of electronic ballast.
6. After checking proper circuit connections, the power supply is given. Now the lamp is ready to glow.

Safety Precautions:

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



Result:

Thus, tube light is connected to power supply through an electronic ballast.

Staff Signature

THREE PHASE MOTOR

EXPERIMENT NO: **DATE:**

Aim: To give connections to three phase motor.

Tools Required:

Screw driver, Cutting pliers, Ball peen hammer, Insulation remover, Tester, series testing board, Multimeter.

Materials required:

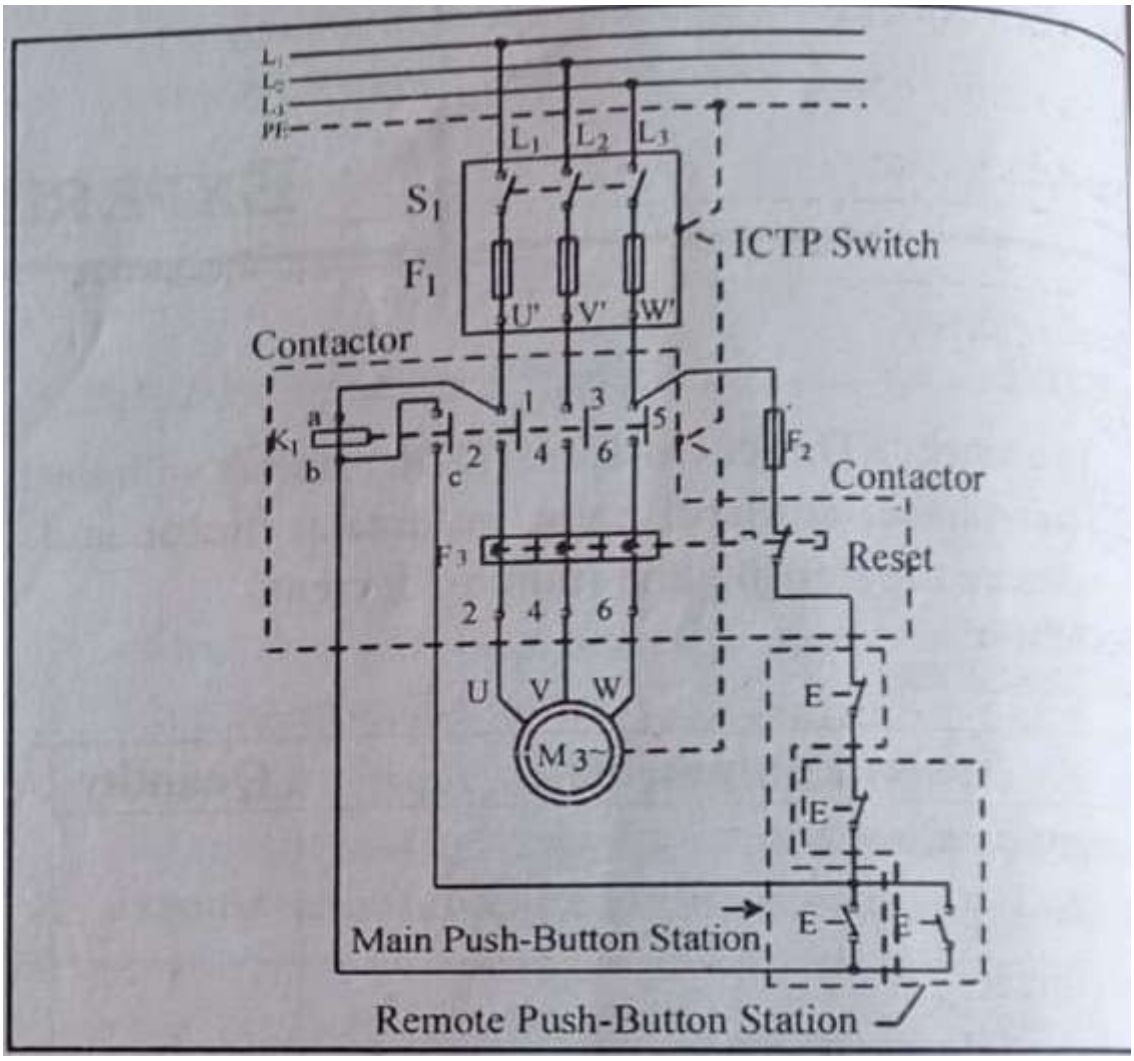
1. Wire – 5 mts
2. ICTP switch-1
3. DOL Starter-1
4. Three phase induction motor.

Working Procedure:

1. Firstly, arrange the ICTP switch-starter.
2. As per the figure, the wires are to be connected to the motor and the starter.
3. The circuit is tested using series testing board.
4. The ICTP switch is switched on. The motor is switched on by switching on the main push button of DOL Starter.
5. Switch off the motor by pushing the off-push button.
6. Alternatively, the motor could be switched on using remote push button.
7. Switch off the ICTP switch.

Safety Precautions:

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



Result:

The electrical circuit, for three phase induction motor using DOL starter is thus connected.

Staff Signature

SOLDERING

Soldering is one method of joining two or more pieces of metals by means of fusible alloy, called solder, applied in the molten state. The melting temperature of the solder should be lower than that of the base metals being joined.

Method of soldering:

The following are the stages involved in soldering work.

1. Clean the surfaces to be soldered.
2. Keep the surfaces to be joined, close together.
3. Apply a thin layer of flux with a brush.
4. Heat the soldering copper to proper temperature.
5. Tack the seam by applying solder at several points.
6. Begin at one end and move the copper bit slowly, adding solder as needed.
7. Allow the joint to cool.
8. Clean the joint and then test the joint for strength.

Advantages:

1. It is the most economical method of joining.
2. It produces leak-proof joint quickly.
3. The temperature involved is very low, when compared to welding. The cost of the equipment ischeap.
4. Soldering can be performed on similar or dis-similar metals.

SOLDERING OF LED TO PCB

EXPERIMENT NO: **DATE:**

Aim:

To solder the LED to printed circuit board.

Material required:

LED, Printed Circuit Board, Resistor(1kΩ), Connecting Wires, Regulated Power supply.

Tools required:

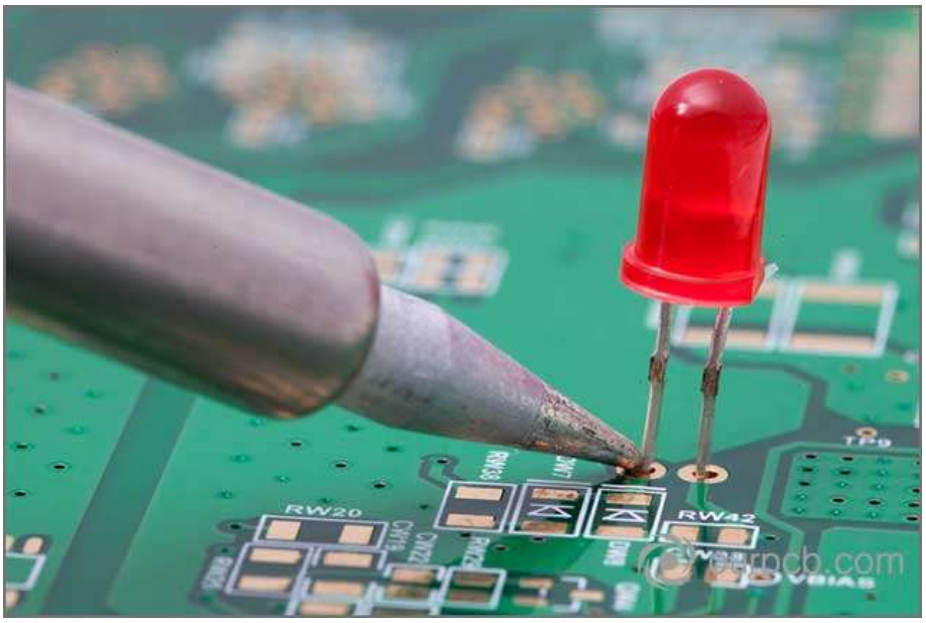
1. Soldering iron.
2. Flux.
3. Lead.

Working procedure:

1. Clean the surfaces to be soldered.
2. Place the LED over PCB and hold it in position.
3. Apply a thin layer of flux using soldering iron/gun.
4. Heat the soldering gun to proper temperature.
5. Tack the seam by applying solder at several points.
6. Now place the resistor in series and hold it in position and tack it using soldering gun.
7. Begin at one end and move the gun bit slowly, adding solder as needed.
8. Allow the joint to cool.
9. Clean the joint and then test the joint for strength.
10. Now connect regulated power supply to PCB using connecting wires.
11. The wiring connections are tested, by giving power supply.
12. The LED should glow between the voltage 2.2-2.8 volts.

Safety Precautions:

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



Result:

Thus, the LED is successfully soldered to PCB and connection is given.

Staff Signature

ELECTRICAL WIRING SAMPLE VIVA QUESTIONS

1. Name the three fundamental terms related to electricity?
2. What is the relation between current, voltage and resistance?
3. State ohm's law.
4. What are the units of current, voltage and resistance?
5. Write the symbol of ohm?
6. Draw the circuit diagram of given connection
7. What is the value of voltage of single-phase supply?
8. What is the value of voltage of three phase supply?
9. What is the unit of power?
10. State the relation between HP and Watts.
11. What do you mean by SPT and DPT?
12. Why fluorescent lamp is white
13. What is the use of choke in fluorescent lamp connection?
14. Once the fluorescent lamp glows, one item is not necessary in the circuit. What is that and why?
15. What is the purpose of stair case connection?
16. What is the purpose of godown connection?
17. The electricity department gives the bill in units. What is meant byunit?
18. What do you mean by KWH?
19. In circuit diagram what is the significance of R, Y, and B?
20. What is the different color wires used in electric circuit?
21. How will you represent SPT in circuit diagram?
22. State the difference between single phase and three phase connection.
23. What is the equivalent resistance when two resisters R1 and R2 connected in series?
24. What is the equivalent resistance when two resisters R1 and R2 connected in parallel?
25. What is the disadvantage in series lamp connection?
26. What type of connection is provided in domestic electric wiring?
27. What are the various tools used in house wiring?
28. State the function of given tool.
29. What is the relation between power, voltage and current?

FOUNDRY PRACTICE

Introduction: -

Foundry practice deals with the process of making casting in moulds, formed in either sand or other material. This is found to be the cheapest method of metal shaping. The process involves the operations of pattern making, sand preparation, molding, melting of metals, pouring in moulds, cooling, shake out, fettling, heat treatment, finishing, and inspection.

Mould is a cavity in a molding core, formed by a pattern. It is similar in shape and size that of theactual casting plus some allowance for shrinkage, machining etc., molding is the process of making molds.

Moulds are classified as:

1. Temporary moulds are made of sand and other binding materials and may be produced either through handmolding (or) machine molding.
2. Permanent moulds are made of ferrous materials and alloys i.e., cast iron, steel etc.,

Molding Sand: -

Sand is the principal material used in foundry. The principal ingredients of molding sands are 1) Silicon sand 2) Clay 3) Sand

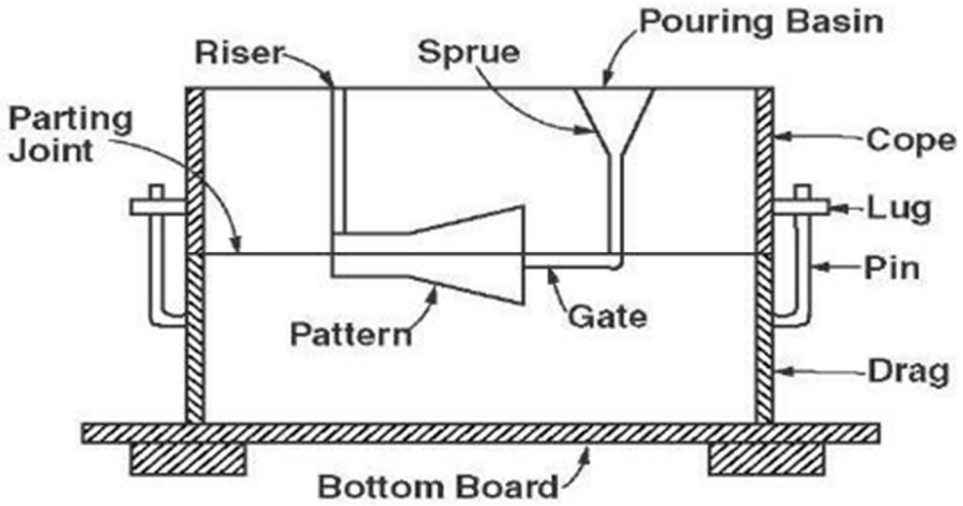
Clay imparts the necessary bonding strength to the molding sand, moisture when added to correct preparation provides the bonding action to the clay sand can withstand high temperature anddoesn't react with molten metal.

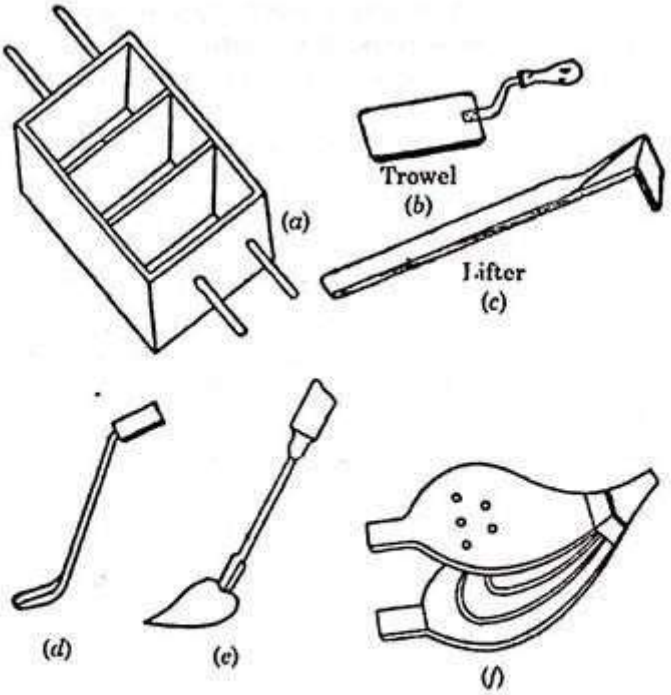
Natural molding sand is either available in river beds are dug from pits. It possesses and appreciable amount of clay and are used as received with the addition of water. Synthetic sands are prepared by adding clay. Water and other materials to silica sand so that the desirable strength and banding properties are achieved.

Most of molding is done with green sand i.e.; sand containing 6 to 8%, moisture and 10% clay contentto give it sufficient bond. Green sand moulds are used for pouring the molten metal – immediately after preparing the moulds. Green sand moulds are cheaper and take less time to prepare. These are used for small and medium size casting.

Parting sand, which is clay tree, fence grained silica sand, is used to keep the green sand from stickingto the pattern and also to prevent the cope and drug from cleaning. Core sand is used for making cores.

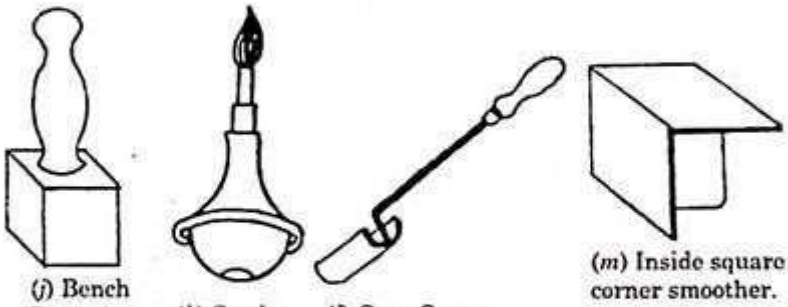
This is silica missed with core oil and other oddities.



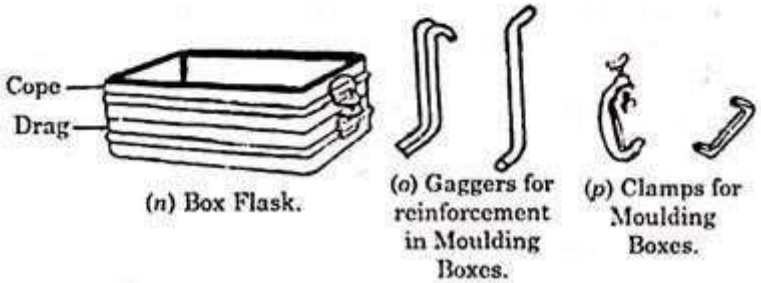


(a) Moulding flask with strengthening cross bars. (b) Trowel
(c) Lifter. (d) Slick. (e) Double Ender. (f) Bellows.

(g) Shovel. (h) Riddle. (i) Floor Rammers.



(j) Bench Rammer. (k) Swab. (l) Gate Cutter. (m) Inside square corner smoother.



(n) Box Flask. (o) Gaggers for reinforcement in Moulding Boxes. (p) Clamps for Moulding Boxes.

Pattern:

A pattern is the replica of the desired coasting, which when packed in a suitable material produces a cavity called mould. This cavity when filled with molten metals, produces their desired coasting of the solidification.

Types of patterns:

Wood or metal patterns are used in foundry practice. Single piece, split loose piece and cored patterns are some of the common types.

Tools and equipment:

The tools are equipment needed for molding are; -

Molding board:

It is wooden board with smooth surfaces. It supports the flasks and the pattern, while the mould is being made.

Molding Flask: -

It is a base, made of wood or metal, open at both ends. The sand is rammed in after placing the pattern to produce a mould it is made of 2 parts; cope is the top half of the flask, having guides for the aligning paints to enter. Drag is the bottom half of the flask having aligning pins.

Shovel: -

It is used for mixing and tempering molding sand and for transferring the sand in to the flask. It is made of steel blade with a wooden handle.

Rammer: -

It is used for pocking or ramming the sand, around the pattern one of its ends called the peen end, is wedge shaped and is used for packing sand in spaces, pockets and corners in the early stages of ramming. The other end called the but – end has a surface and is used for computing the sand towards the end of molding.

Strike of edge / strike of bar: -

It is a piece of metal or wood with straight edge. It is used remove the excess sand from the mould after ramming to provide a level surface.

Sprue pin: -

It is tapered wooden pin used to make a hole in the cope sand through which the molten metal is poured into the mould.

Riser pin: -

It is tapered wooden pin used to make a hole in the cope sand over the mould cavity for the molten metal to rise and feed the casting to compassable the shrinkage that take place during solidification.

Trowel: -

It is used to smoothen the surface of the mould. It may also be used for reproducing the damaged portion of the mould. A trowel is made in many different styles and sizes each one recallable for a particular hole.

ONE STEPPED PATTERN (SINGLE PIECE PATTERN)

EXPERIMENT NO: **DATE:**

Aim: To prepare a sand mould cavity using One Stepped Shaft (single piece pattern).

Tools required:

Molding board, Molding flask, Shovel, Riddle, Rammer, Strike-off bar or Strike Edge, Sprue pin, Riser pin, Trowel, Spike or Draw pin, Slick, Lifters, Gate cutter, Bellows, Vent rod.

Material required:

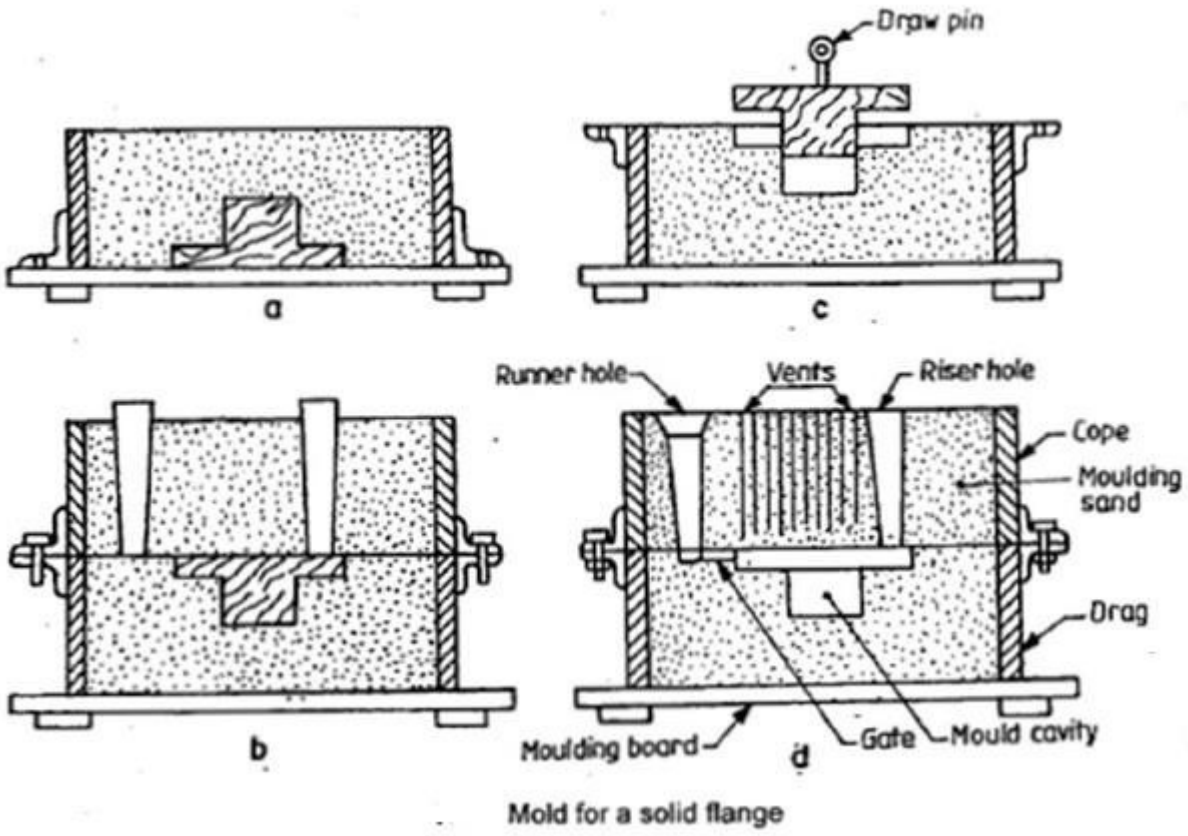
1. Molding sand
2. Parting sand
3. Pattern

Sequence of operation:

1. Sand preparation
2. Sand mixing
3. Pouring
4. Finishing

Working Steps:

1. Place the pattern on the molding board, with its flat side on the board.
2. Place the drag over the board, after giving a clay wash inside.
3. Sprinkle the pattern and molding board, with parting sand.
4. Allow loose sand, preferably through a riddle over the pattern, unit it is covered to a depth of 2to 3 cm.
5. Pack the molding sand around the pattern and into the corners of the flask, with fingers.
6. Place some more sand in the flask and pack the pattern with a rammer, using first the peen endand then butt end.
7. Strike-off the excess sand from the top surface of the drag with the strike-off bar.
8. Turn the drag upside down.
9. Blow-off the loose sand particles with the bellows and smoothen the upper surface.
10. Place the cope on to the drag in position. Locate riser pin on the highest point of the pattern.
11. Place the sprue pin at about 5 to 6 cm from the pattern on the other side of the riser pin.
12. Sprinkle the upper surface with parting sand.
13. Repeat steps 3 to 7, approximately.
14. Make holes with the vent rod to about 1 cm from the pattern.
15. Remove the sprue and riser pins by carefully drawing them out. Funnel shaped hole is made atthe top of the sprue hole, called the pouring cup.
16. Lift the cope and place it aside on its edge.
17. Insert the draw pin into the pattern. Wet the edges around the pattern. Loosen the pattern byrapping. Then draw the pattern straight up.
18. Adjust and repair the mold by adding bits of sand, if necessary.
19. Cut gate in the drag from the sprue to the mold. Blow off any loose sand particles in the mold.
20. Close the mold by replacing the cope and placing weights on it.



Mold for a solid flange

Safety Precautions:

1. Do not get the sand too wet. Water is an enemy of molten metals.
2. Provide adequate ventilation to remove smoke and fumes.
3. Never stand near or look over the mold during the pouring because of the molten metal might be too hot.
4. Do not shake out a casting too hastily, which may result in second and third-degree burns.

Result:

A sand mold cavity is prepared by using one Stepped Shaft.

Staff Signature

DUM-BELL (SPLIT PIECE PATTERN)

EXPERIMENT NO: **DATE:**

Aim: To prepare a sand mould using given split pattern with core for a Dum-Bell (split piece pattern).

Tools required:

Molding board, Molding flask, Shovel, Riddle, Rammer, Strike-off bar or Strike Edge, Sprue pin, Riser pin, Trowel, Spike or Draw pin, Slick, Lifters, Gate cutter, Bellows, Vent rod.

Material required:

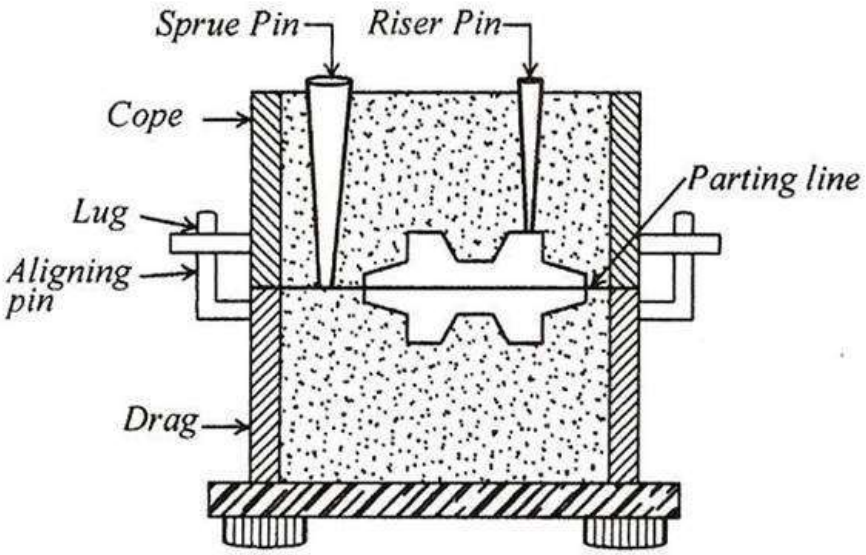
1. Molding sand
2. Parting sand
3. Pattern

Sequence of operation:

1. Sand preparation
2. Sand mixing
3. Pouring
4. Finishing

Working Steps:

1. Place the pattern on the molding board, with its flat side on the board.
2. Place the drag over the board, after giving a clay wash inside.
3. Sprinkle the pattern and molding board, with parting sand.
4. Allow loose sand, preferably through a riddle over the pattern, unit it is covered to a depth of 2 to 3 cm.
5. Pack the molding sand around the pattern and into the corners of the flask, with fingers.
6. Place some more sand in the flask and pack the pattern with a rammer, using first the peen endand then butt end.
7. Strike-off the excess sand from the top surface of the drag with the strike-off bar.
8. Turn the drag upside down.
9. Blow-off the loose sand particles with the bellows and smoothen the upper surface.
10. Place the cope on to the drag in position. Locate riser pin on the highest point of the pattern.
11. Place the sprue pin at about 5 to 6 cm from the pattern on the other side of the riser pin.
12. Sprinkle the upper surface with parting sand.
13. Repeat steps 3 to 7, approximately.
14. Make holes with the vent rod to about 1 cm from the pattern.
15. Remove the sprue and riser pins by carefully drawing them out. Funnel shaped hole is made atthe top of the sprue hole, called the pouring cup.
16. Lift the cope and place it aside on its edge.
17. Insert the draw pin into the pattern. Wet the edges around the pattern. Loosen the pattern byrapping. Then draw the pattern straight up.
18. Adjust and repair the mold by adding bits of sand, if necessary.
19. Cut gate in the drag from the sprue to the mold. Blow off any loose sand particles in the mold.
20. Close the mold by replacing the cope and placing weights on it.



Safety Precautions:

1. Do not get the sand too wet. Water is an enemy of molten metals.
2. Provide adequate ventilation to remove smoke and fumes.
3. Never stand near or look over the mold during the pouring because of the molten metal might be too hot.
4. Do not shake out a casting too hastily, which may result in second and third-degree burns.

Result:

A sand mold cavity is prepared by using split pattern.

Staff Signature

FOUNDRY SECTION SAMPLE VIVA QUESTIONS

1. What are the main ingredients of good moulding sand?
2.What are the main properties required for a good molding sand?
3. Can you tell the name of bottom and top parts of the moulding box?
4. What are the defects found in a casting?
5. What is meant by foundry?
6. What is the name of item used to smooth the mould cavity?
7. What is the name of tool used to blow off the loose particles from the mould cavity?
8.What is meant by sprue pin?
9. What is the tool used to compact the moulding sand?
10. What is the purpose of draft in pattern?
11. What are the materials to be charged in a cupola furnace?
12. What is the purpose of laddle in a foundry shop?
13. Why a tapering is provided on the sprue pin?
14. What are the main tools used in the Foundry shop?
15. Explain the term Gate related to mould?
16. What is meant by green sand moulding?
17. What is the optimum water content for making a mould cavity.
18. What is meant by core and core print?

WELDING

INTRODUCTION:

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

The various welding processes are:

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

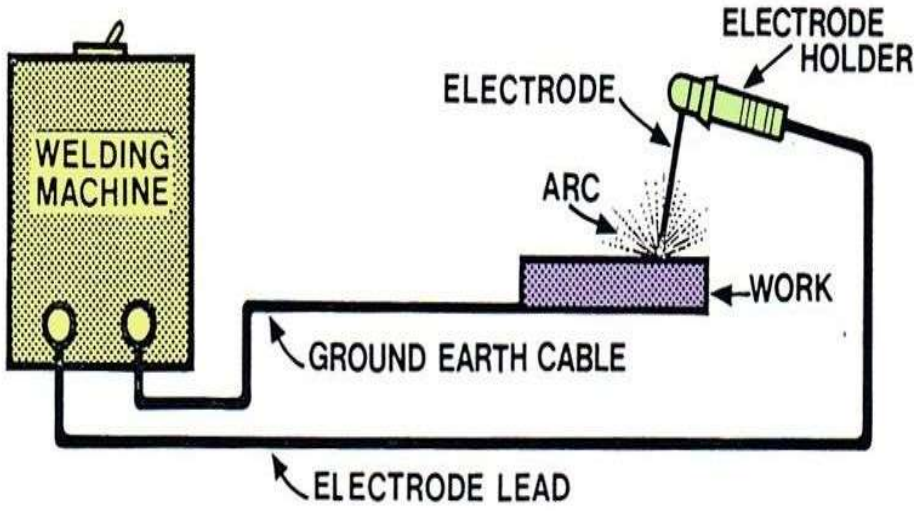
However, only electric arc welding process is discussed in the subject point of view.

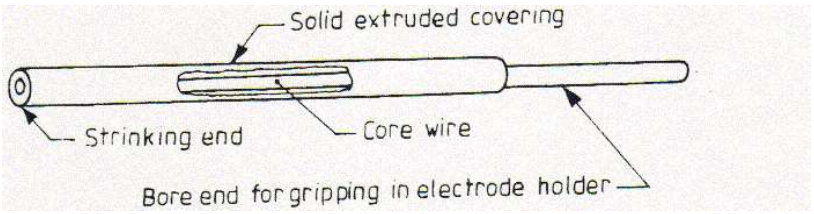
Electric arc welding:

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

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

1. Power supply (AC or DC),
2. Welding electrode,
3. Work piece,
4. Welding leads (electric cables) connecting the electrode and work piece to the power supply.





Parts of an Electrode

Electric arc between the electrode and work piece closes the electric circuit. The arc

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

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

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

Transformers:

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

Motor generators:

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

Rectifiers:

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

Welding cables:

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

Electrodes

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

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

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

Electrodes are also classified on the basis of materials, as

1. Metallic and
2. Non-metallic or carbon

Metallic arc electrodes are further sub-divided into

1. Ferrous metal arc electrode (mild steel, low/medium/high carbon steel, cast iron, stainless steel, etc)
2. Non-ferrous metal arc electrodes (copper, brass, bronze, aluminum, etc).

In case of non-metallic arc electrodes, mainly carbon and graphite are used to make the electrodes.

Welding Tools:

Electrode holder:

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

Ground clamp:

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

Wire brush and chipping hammer:

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

Welding table and cabin:

It is made of steel plate and pipes. It is used for positioning the parts to be welded properly. Welding cabin is made-up by any suitable thermal resistance material, which can isolate the surroundingby the heat and light emitted during the welding process. A suitable draught should also be provided for exhausting the gas produced during welding.

Face shield:

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

Shields are made of light weight non-reflecting fiber and fitted with dark glasses to filter

out the Harmful rays of the arc. In some designs, a cover glass is fitted in front of the dark lens to protect it from spatter.

Hand gloves:

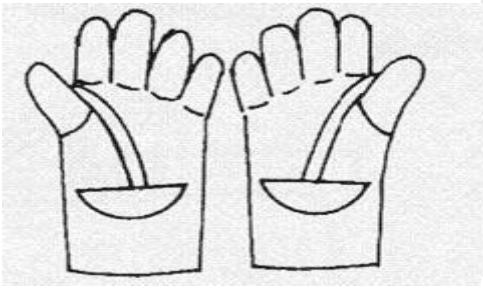
These are used to protect the hands from electric shocks and hot spatters.

Electrode holder

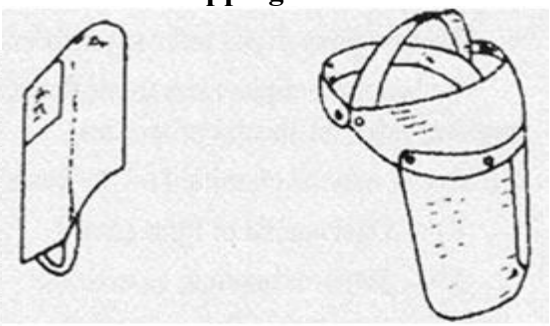
Ground Clamp

Wire brush

chipping hammer



Hand gloves



Face shield

Techniques Of Welding:

Preparation of work:

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

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

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

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

Welding Positions:

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

Flat position welding:

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

position is sometimes called down hand.

Horizontal position welding:

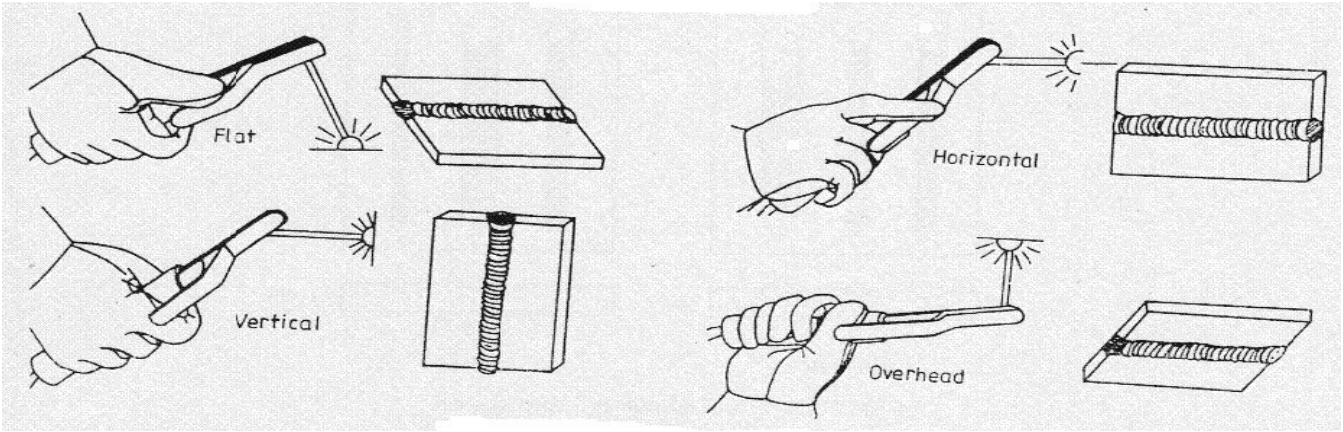
In this position, welding is performed on the upper side of an approximately horizontal surface and against an approximately vertical surface.

Vertical position welding:

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

Overhead position welding:

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



Weld positions

LAP JOINT

EXPERIMENT NO: **DATE:**

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

Material used: Two mild steel pieces of 50X50X5 mm.

Tools and equipment used:

Arc welding machine, Mild steel electrodes, Electrode holder, Ground clamp, flat nose Tong, Face shield, Apron, Hand gloves, Metallic work Table, Bench vice, Rough flat file, Try square, Steel rule, Wire brush, Ball peen hammer, chipping hammer.

Operations to be carried out:

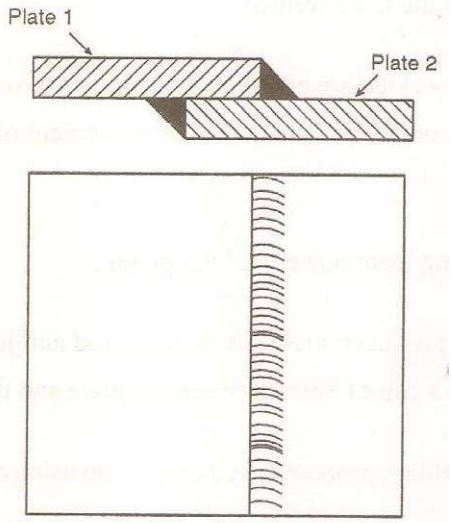
1. Cleaning the work pieces
2. Tack welding
3. Full welding
4. Cooling
5. Chipping
6. Finishing

Working Steps:

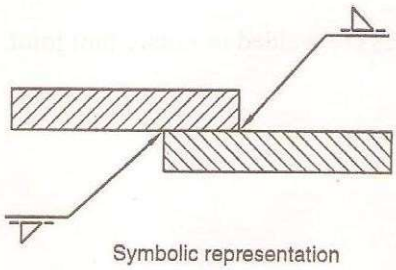
1. Take the two mild steel pieces of given dimensions and clean the surfaces thoroughly from rust, dustparticles, oil and grease.
2. Remove the sharp corners and burrs by filing or grinding and prepare the work pieces.
3. The work pieces are positioned on the welding table, to form a lap joint with the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

Safety Precautions:

1. Use goggles, gloves in order to protect the human body.
2. Maintain the constant arc length.
3. Always turn off the machine when leaving the work.
4. Ensure proper insulation of the cables and check for openings.
5. Never look at the arc with the naked eye.
6. Prevent welding cables from coming in contact with hot metal, water, oil or grease. Avoid dragging the cables around sharp corners.
7. Apply eye drops after welding is over for the day, to relieve the strain on the eyes.



Representation of lap joint



Symbolic representation

Result:

The double lap joint is thus made, using arc welding.

Staff Signature

BUTT JOINT

EXPERIMENT NO: **DATE:**

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

Material used: Two mild steel pieces of 50X50X5 mm.

Tools and equipment used:

Arc welding machine, Mild steel electrodes, Electrode holder, Ground clamp, flat nose Tong, Face shield, Apron, Hand gloves, Metallic work Table, Bench vice, Rough flat file, Try square, Steel rule, Wire brush, Ball peen hammer, chipping hammer.

Operations to be carried out:

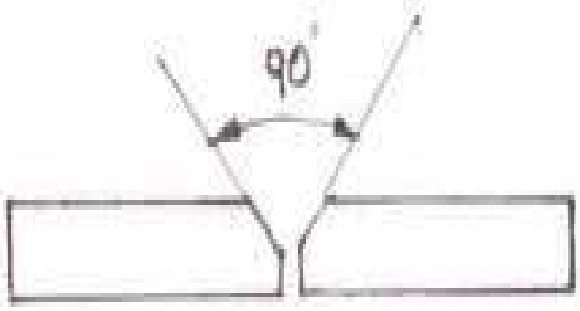
1. Cleaning the work pieces
2. Tack welding
3. Full welding
4. Cooling
5. Chipping
6. Finishing

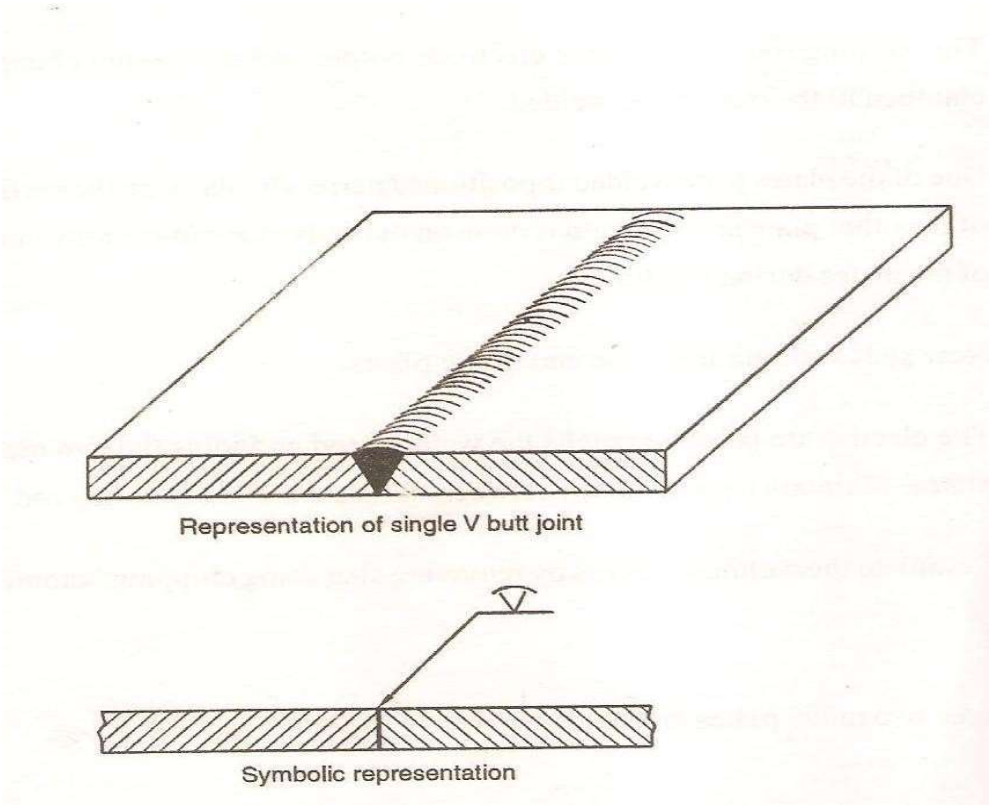
Working Steps:

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

Safety Precautions:

1. Use goggles, gloves in order to protect the human body.
2. Maintain the constant arc length.
3. Always turn off the machine when leaving the work.
4. Ensure proper insulation of the cables and check for openings.
5. Never look at the arc with the naked eye.
6. Prevent welding cables from coming in contact with hot metal, water, oil or grease. Avoid dragging the cables around sharp corners.
7. Apply eye drops after welding is over for the day, to relieve the strain on the eyes.





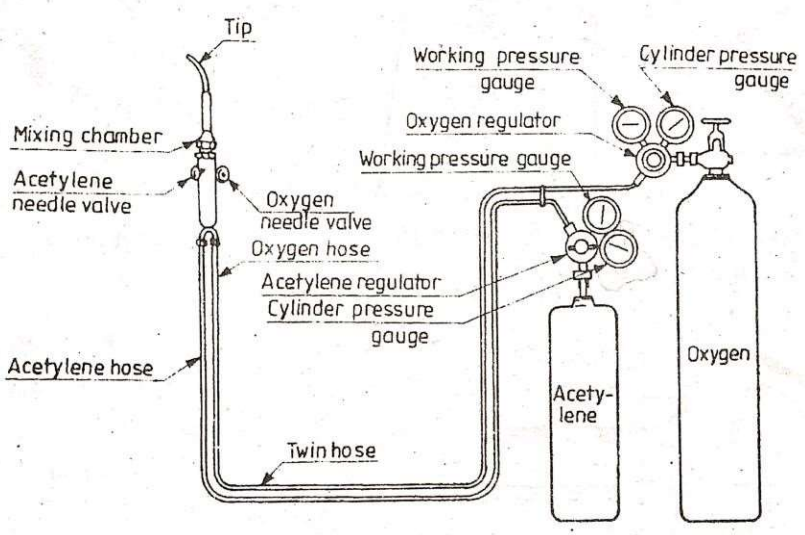
Result:

Thus, the required butt joint is done by using arc-welding process.

Staff Signature

GAS WELDING

Oxyacetylene flame is commonly used for gas welding. It consists of the supply of the oxygen and acetylene under pressure in cylinders, pressure regulators, a torch, hoses, and accessories like Goggles anda lighter. The oxygen and acetylene cylinders are connected to the troche through pressure regulators and hoses as shown in the figure. The regulators consist of two pressure gauges, one for indicating the pressure within the cinder and the other shows the [pressure of the gas fed in to the torch, which may be regulated. The torch mixers the two gases and the flame controlled by adjusting the oxygen and acetylene supply.



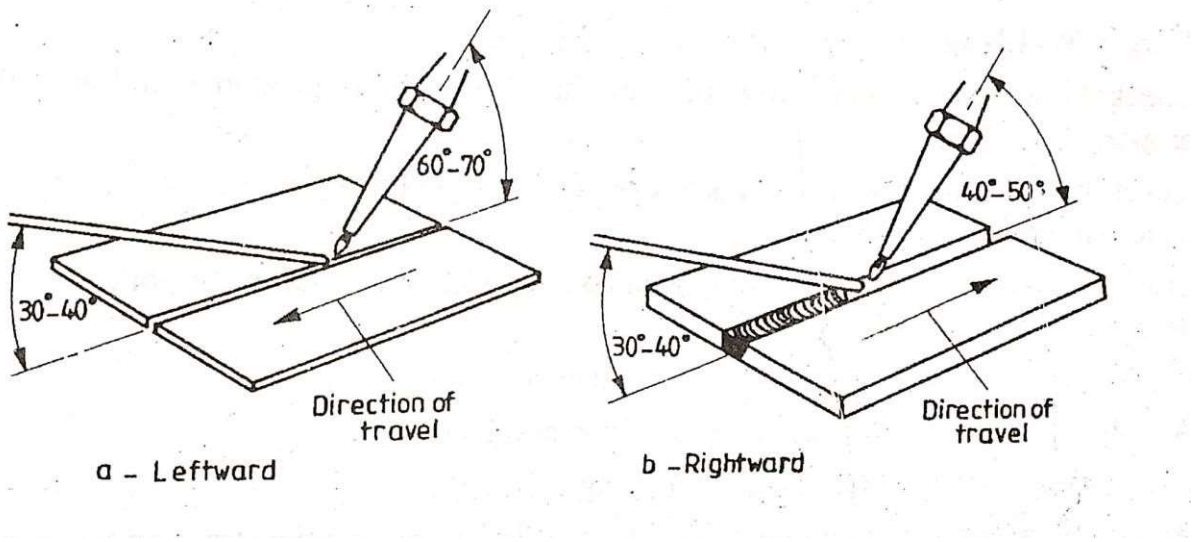
The two techniques of the gas welding are shown in fig.

Left Ward Welding:

In leftward welding, most of the heat is absorbed by the filler material and hence it is preferred in welding thinsheets up to 6mm thick.

Right Ward Welding:

In right ward welding, most of the heat is absorbed by the base metal and so it is preferred in welding thicksheets up to 6mm – 25mm thick.



LAP JOINT

EXPERIMENT NO: **DATE:**

Aim: Preparation of lap joint using oxyacetylene gas welding process.

Material used: Two mild steel pieces of 50X50X5 mm.

Tools required:

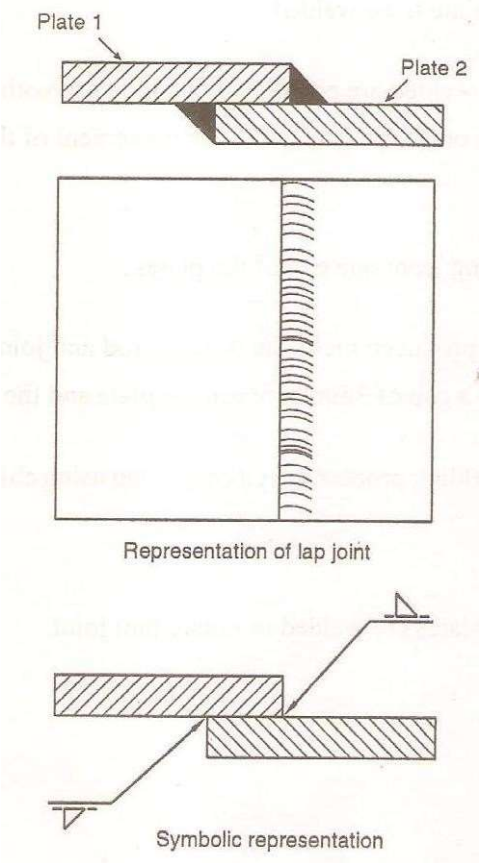
1. Gas welding equipment.
2. Goggles, Gloves and apron.
3. Filler rod.

Working Steps:

1. Prepare the work pieces to be welded and place them in proper position on the welding table
2. Wear goggles, gloves and apron
3. Select proper size tip for the job and fix it to the torch
4. Select the filler rod of recommended size
5. Adjust the welding equipment and light the torch
6. Adjust the torch for neutral flame
7. Hold the torch, with the inner cone about 3mm away from the metal and tack weld the pieces at either end
8. Starting from one end, weld along the edge with a zig-zag torch movement. Add the filler metal to the joint as welding progresses.

Safety Precautions:

1. Always wear welding goggles while doing gas welding
2. Always use the spark lighter to light the torch and never use a match
3. Do not allow blow pipe to heat the cylinders, hoses or any other equipment
4. Do not allow the hose to become excessively warm
5. Do not remove the spanner user for operating the valve. Always keep it with the cylinders
6. Secure cylinder in use against falling, which may knock of valve
7. To test the leakage in a valve or hose use soap water but not a lighted match.



Result:

The double lap joint is thus made, using gas welding.

Staff Signature

BUTT JOINT

EXPERIMENT NO: **DATE:**

Aim: Preparation of butt joint using oxyacetylene gas welding process.

Material used: Two mild steel pieces of 50X50X5 mm.

Tools required:

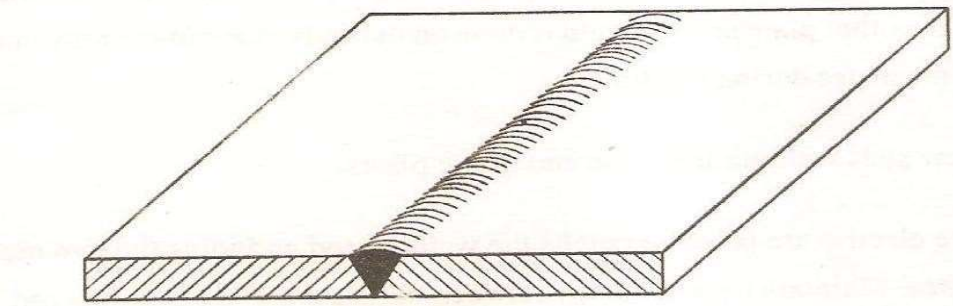
1. Gas welding equipment.
2. Goggles, Gloves and apron.
3. Filler rod.

Working Steps:

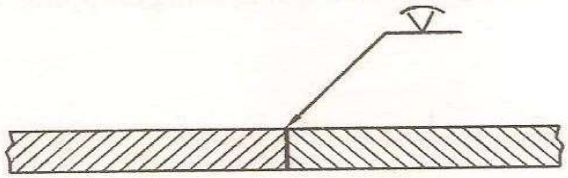
1. Prepare the work pieces to be welded and place them in proper position on the welding table
2. Wear goggles, gloves and apron
3. Select proper size tip for the job and fix it to the torch
4. Select the filler rod of recommended size
5. Adjust the welding equipment and light the torch
6. Adjust the torch for neutral flame
7. Hold the torch, with the inner cone about 3mm away from the metal and tack weld the pieces at either end
8. Starting from one end, weld along the edge with a zig-zag torch movement. Add the filler metal to the joint as welding progresses.

Safety Precautions:

1. Always wear welding goggles while doing gas welding
2. Always use the spark lighter to light the torch and never use a match
3. Do not allow blow pipe to heat the cylinders, hoses or any other equipment
4. Do not allow the hose to become excessively warm
5. Do not remove the spanner user for operating the valve. Always keep it with the cylinders
6. Secure cylinder in use against falling, which may knock of valve
7. To test the leakage in a valve or hose use soap water but not a lighted match.



Representation of single V butt joint



Symbolic representation

Result:

The butt joint is thus made, using gas welding.

Staff Signature

WELDING SAMPLE VIVA QUESTIONS

1. What is meant by welding?
2. What is the name of item coated over a welding rod? What is the purpose of it?
3.What is the name of tool to remove the slag from welded portion?
4. What distance should be maintained between the work and electrode?
5. Can you tell the approximate temperature while welding Mild steel item?
6. What is meant by straight line welding?
7. What is meant by Butt welding?
8. What is the advantage of 'V' Butt joint?
9. What is the difference between welding and soldering?
10. What is the approximate voltage for welding in AC welding set?
11.What are the accessories used in the welding shop?
12. Name the main tools used in the welding shop?
13.What type of transformer is used in welding shop?
14. What are the safety precautions to be followed in welding shop?
15. Tell how to weld a petrol tank to prevent the leak?

PLUMBING

INTRODUCTION:

Plumbing deals with the laying of a pipeline. A craftsman may be perfectlyproficient with the hammer, saw and other tools, but the faces difficulties with leaking pipes and overflowing toilets. Many people rush to a plumber on seeking a tripping pipe, but a person with a little knowledge of the sanitary system can control this problem easily, saving time and, one with help of few tools.

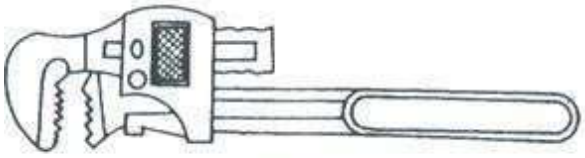
STUDY OF PLUMBING TOOLS

The tools used by a plumber can be classified as follows

1. Pipe wrench
2. Pipe vice
3. Pipe cutter
4. Hacksaw
5. Dies

1. Pipe wrench:

A pipe wrench is used for holding and turning the pipes, rods and machine parts. Wrenches are classified as follows.1. Fixed wrenches 2. Adjustable wrenches.



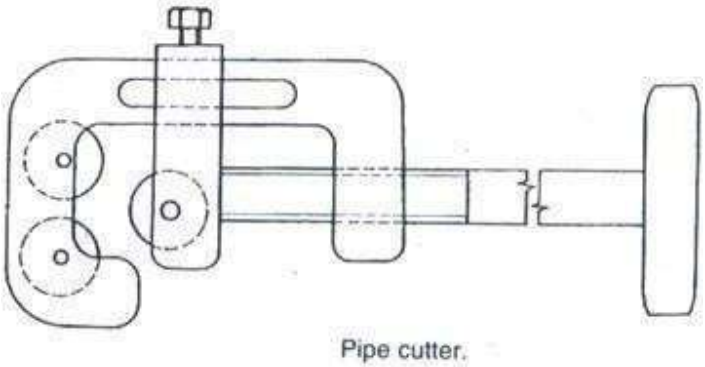
Pipe wrench.

2. Pipe vice:

A pipe vice is fitted on the work bench. This has a set of jaws to grip the pipe and prevent it from turning while cutting, threading and fitting of bends, couplings etc. The yoke vice is commonly used in plumbing used in plumbing practice.

3. Pipe cutter:

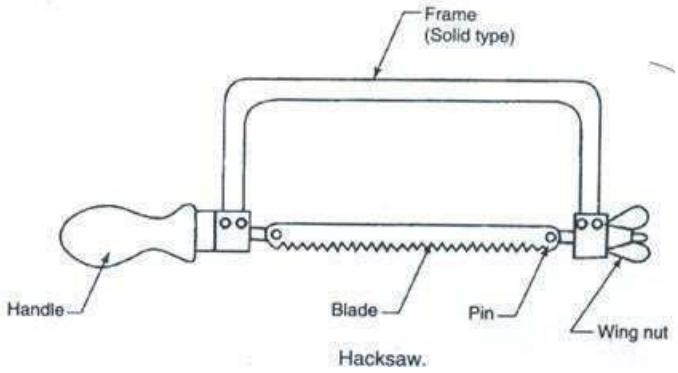
The pipe cutter mainly consists of three wheels which are hardened with sharp cutting edges along their periphery. Of these three wheels, one can be adjusted to any desired distance to accommodate different size of pipes. After adjusting the cutter on a pipe, it is around the pipe, sothat the cutter wheels cut the pipe along a circle as shown in the figure.



Pipe cutter.

4. Hack saw:

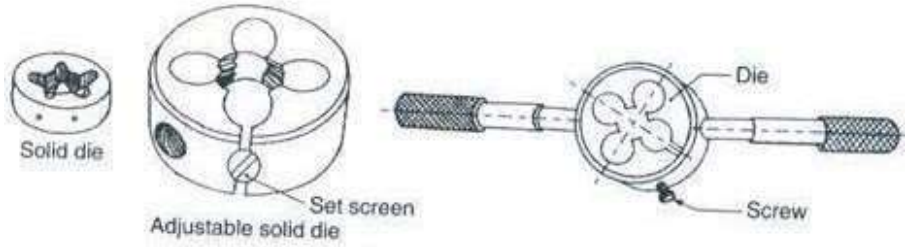
A hacksaw is used for cutting metal rods, bars, pipes, etc.



Hacksaw.

5. Dies:

It is used for cutting external thread on pipes. Threads are produced in various shapes and sizes which are used for fitting inside the handle.



Threading dies and taps.

PIPE FITTINGS:

Pipe fittings are made up of wrought iron. The size of pipe fitting is designated by the size of the pipe on which it fits. Some of the common pipe fittings are shown in figure.

Coupling

It is a short a cylindrical sleeve with internal threads throughout. A coupling is used for joining two pipes in a straight and bend where at least one pipe can be turned.

Union

A union is used for joining two pieces of pipes, where either can be turned. It consists of three parts, two parts joints can be screwed, in to two pipe ends, and the third on for tightening called centre part.

Nipple

A nipple is a short piece of pipe with external threads at both ends. It is used to make upthe required length of a pipe line.

Elbow

An elbow is to make an angle between adjacent pipes.

Tee

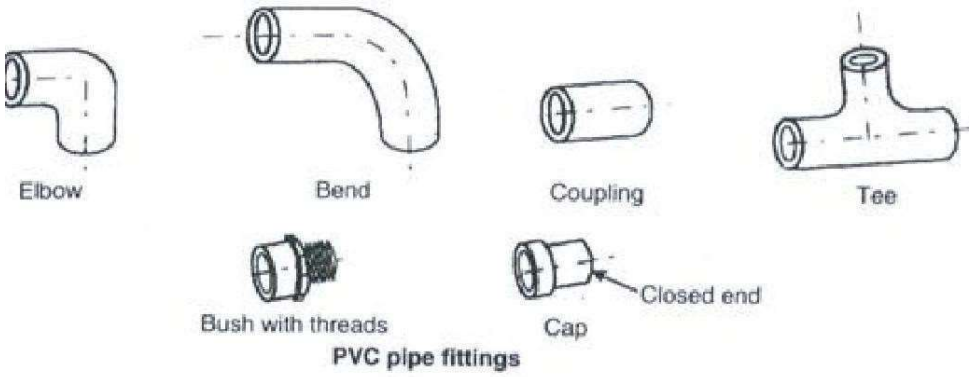
A tee is a fitting that has one side outlet at a right angle to the run. It is used for a single outlet branch pipe.

Reducer

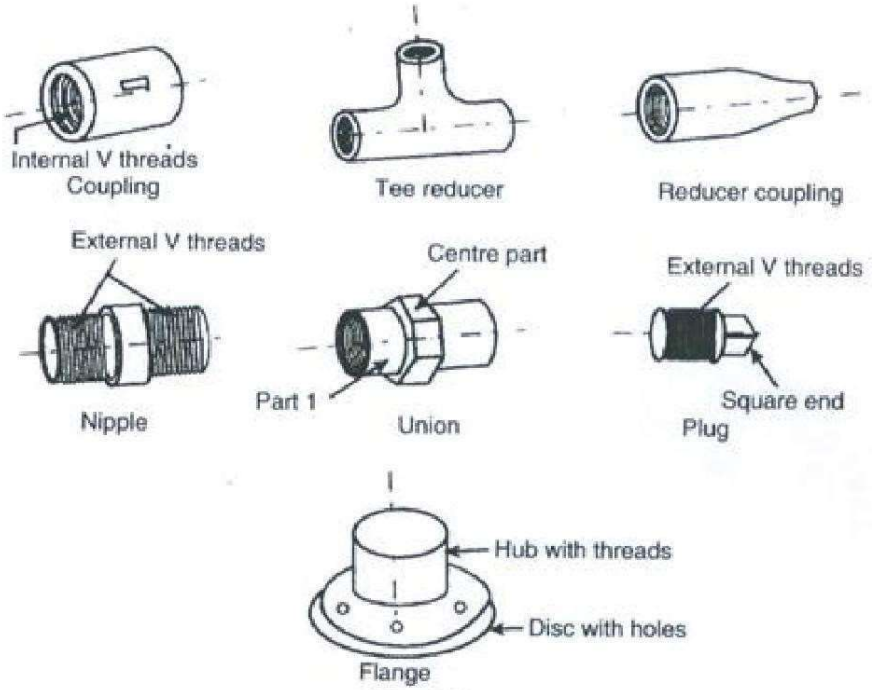
It is used to connect two different sized of pipes.

Plug

It is used to screw on to a threaded opening, for closing it temporarily.



PVC pipe fittings

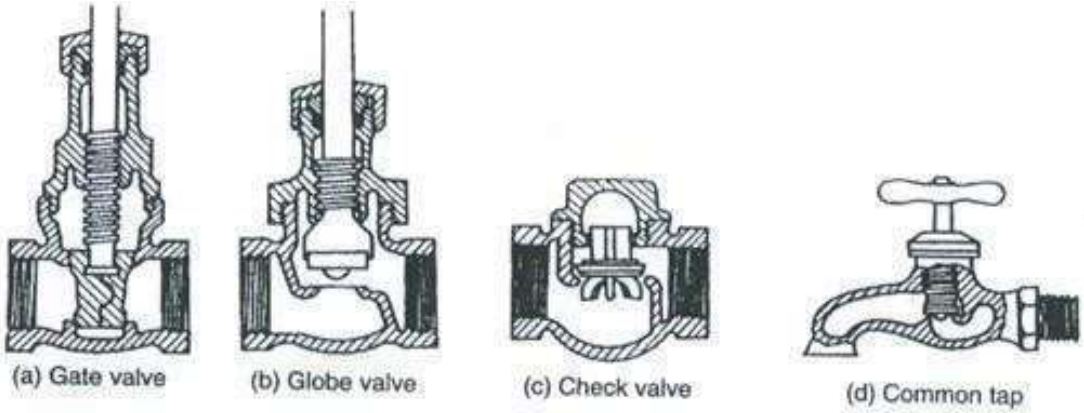


Pipe fittings.

VALVES

Valves are used for regulating the flow of fluid through a pipe. The commonly used valves in plumbing are

1. Gate valve
2.Globe valve
3. Plug valve
4. Check valve
5. Air relief valve.

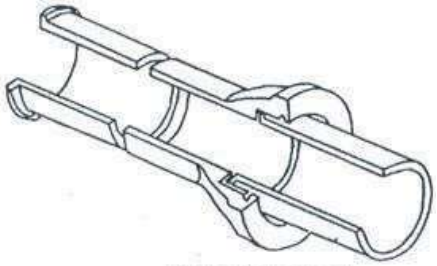


Valves.

TYPES OF PIPE JOINTS

Bell and spigot joints:

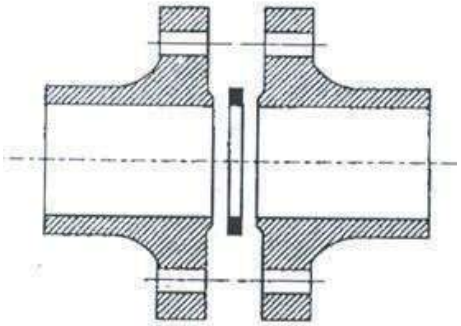
A connection between two sections of pipe i.e. the straight spigot end of one section is inserted into the flared-out end of the adjoining section. The joint is sealed by a sealing component.



Bell and spigot joints.

Flanged joints

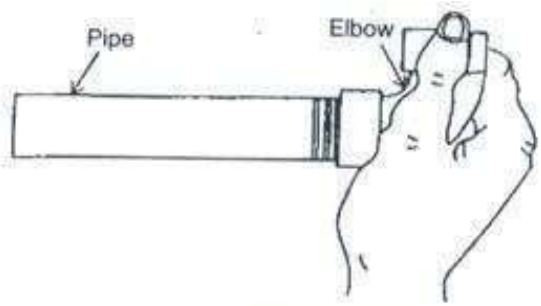
A flanged joint helps to connect and disconnect two pipes as per the need. A similar example is as shown in figure.



Flange joint.

Threaded joints

Threads are formed in a pipe, flange coupling to connect them with each other and thesejoints are called threaded joints.



Threaded joint.

PLUMBING OF ONE TAP WATER DISTRIBUTION SYSTEM

EXPERIMENT NO: **DATE:**

Aim:

To construct the One-Tap water distribution system by using plumbing components.

Material Required:

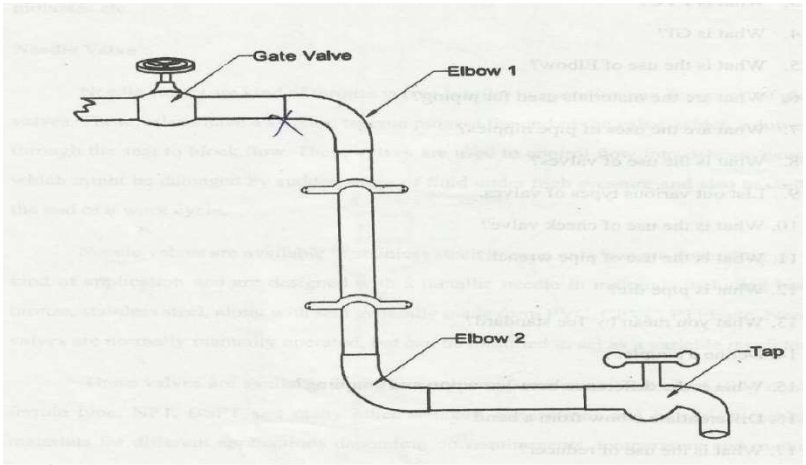
PVC pipe, Elbows, Tap, Gate valve, Clamps, MTA, FTA, Reducer, Union, Coupling, Bend.

Tools Required:

1. Pipe vice
2. Measuring scale
3. Screw drivers
4. Pipe Wrench

Working Procedure:

1. The given PVC pipes are measured out to the required size.
2. The suitable die is selected.
3. Gate valve is connected between the two MTA.
4. 1" x ¾" reducer connected between 1" pipe and ¾" pipe.
5. 5.1" (GI) bend is connected between the two pipes.
6. ¾"x1/2" reducer connected between ¾" pipe and ½".
7. ½" bend connected between ¾" and ½" pipe.
8. At the end of the pipe ½" MTA tap is connected.



Result:

Thus, the pipe-line connection to single tap is given.

Staff Signature

PLUMBING OF FOUR TAP WATER DISTRIBUTION SYSTEM

EXPERIMENT NO: **DATE:**

Aim:

To construct the Four-Tap water distribution system by using plumbing components.

Material Required:

PVC pipe, Elbows, Tap, Gate valve, Clamps, MTA, FTA, Reducer, Union, Coupling, Bend.

Tools Required:

1. Pipe vice
2. Measuring scale
3. Screw drivers
4. Pipe Wrench

Working Procedure:

1. The given PVC pipes are measured out to the required size.
2. The suitable die is selected.
3. Gate valve is connected between the two MTA.
4. 1" x ¾" reducer connected between 1" pipe and ¾" pipe.
5. 5.1" (GI) bend is connected between the two pipes.
6. ¾"x1/2" reducer connected between ¾" pipe and ½".
7. ½" bend connected between ¾" and ½" pipe.
8. Finally, FTA ½" connected at four ends and then ½" tap fixed to the four ends.

Result:

Thus, the pipe-line connection to four taps is given.

Staff Signature

PLUMBING SAMPLE VIVA QUESTIONS

1. How the pipes are specified?
2. Which is the common pipe used nowadays?
3. Which vice used in plumbing?
4. Name any five fittings?
5. What is B.S.P?