Sri Shanmugha™

College of Engineering And Technology

(Approved by AICTE, New Delhi & Affiliated To Anna University)

Connects Life & Learning

GE 8261 – ENGINEERING PRACTICES LABORATORY MANUAL

NAME	: _____
REGISTER NO.	: _____
YEAR/SEM	: _____
SECTION	: _____
BRANCH	: _____

Sri Shanmugha College of Engineering and Technology

Approved by AICTE, Affiliated to Anna University and Accredited by NAAC & NBA (ECE)

Department of Mechanical Engineering

GE8261 ENGINEERING PRACTICES LABORATORY
List of Experiments

Course out come		Upon the completion of this course the students will be able to CO1 Understand the importance of safety precautions in the workshop CO2 Acquire the knowledge about Plumbing & Carpentry components. CO3 Learn the fundamentals of Basic machining using Lathe CO4 Understand the exposure of hands on training on Joining the two metals using arc welding and Foundry CO5 Learn about sheet metal formation by Shearing & Bending.	
Sl.No	**K Level**	**Name of the Experiment**	**Relevance to COs**
CIVIL			
Plumbing			
1.	K2	Basic connection involving PVC / GI pipes and pipe fittings	CO2
2.	K2	Preparation of pipe line from a water tank to shower	CO2
3.	K2	Preparation of pipe line from a water tank to wash basin	CO2
Carpentry using Power Tools			
1.	K2	Wood work, Joints by sawing, planning and cutting	CO2
MECHANICAL			
Welding			
1.	K2	Preparation of Butt joints, Lap joints and T- joints by arc welding.	CO4
Sheet metal			
1.	K2	Model Making - Rectangular tray	CO5
2.	K2	Model Making - Funnel	CO5
Machining			
1.	K2	Facing, Turning, Step turning,	CO3
2.	K2	Taper Turning	CO3
Demonstration			
1	K2	Smithy operations, upsetting, swaging, setting down and bending.	CO4
2.	K2	Foundry operations like mould preparation for gear.	CO4
Content beyond the syllabus			
1.	K2	Study of different Types of Welding	CO4

WORKSHOP SAFETY MEASUREMENTS

- The shop floor should be kept clean always free from dirt of any kind.
- Always wear tight fit clothing.
- Never operate a machine about which you are not fully aware of control / operation.
- Try to keep oil, grease away from the shop floor. Sometimes unknowingly one may slip and meet with accident.
- Ensure that all the safety guards and fenders (anything to defend or to protect from injuries) are available before starting the machine.
- Tools which are not used should always be kept at their respective places.
- Working tools should not be kept at the edge of the table.
- Chisels and other sharp tools should not be kept on table with sharp edges pointing towards the edge of the table.
- Never adjust or shift a belt while machine is functioning.
- Never carry any sharp tool in the pocket.
- Use only a very sharp tool. A dull one requires excessive pressure, which may cause slipping of knife.
- Put the sharp tool always at its proper place after finishing the work with it.
- Never work on electric wires when the power is on.
- While cutting, workpiece should not be kept in hand.
- While cutting, always keep sufficient distance between the working table and yourself.
- Wear helmet, if necessary.
- Whenever a crane is in operation, never stand under it.
- Leather or asbestos apron, shield and gloves should be used while doing welding operation.
- Boards and other pieces having nails should not be removed from the floor.
- Never wear chappals while whirling in the shop floor. Always prefer to use leather shoes.
- Keep sufficient lighting so that possibility of accidents is reduced.
- Avoid talking and unnecessary discussions during working time and try to concentrate on the work.

(Group A – Civil & Mechanical)

INDEX

STUDY OF PLUMBING

Introduction:

Plumbing deals with the laying of a pipeline. A craftsman may be perfectly proficient 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.

Plumbing Tools:

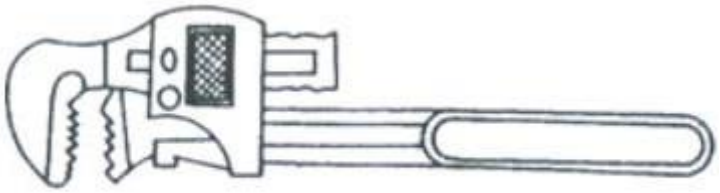
The tools used by a plumber can be classified as follows

1. Pipe wrench 2.Pipe vice 3. Pipe cutter
4. Hacksaw 5. Dies 6.Files and Rasps
7. Plumb bob

Pipe Wrench:

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

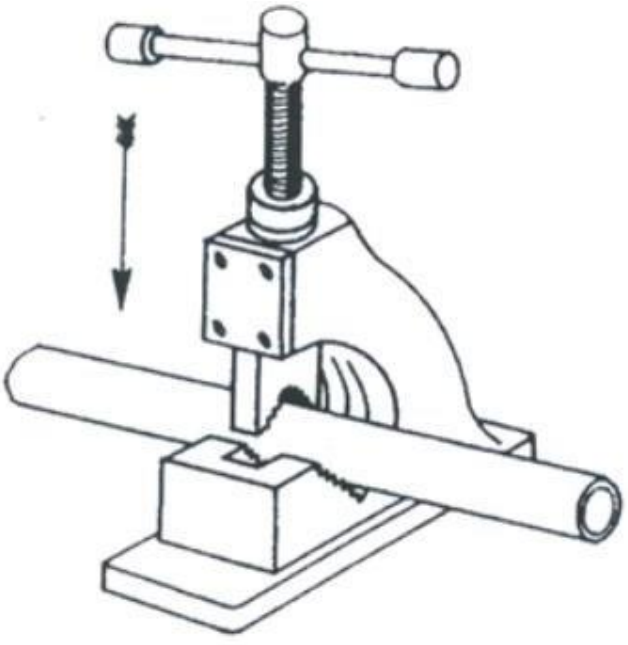
1. Fixed wrenches 2. Adjustable wrenches.



Pipe wrench.

Pipe Vice:

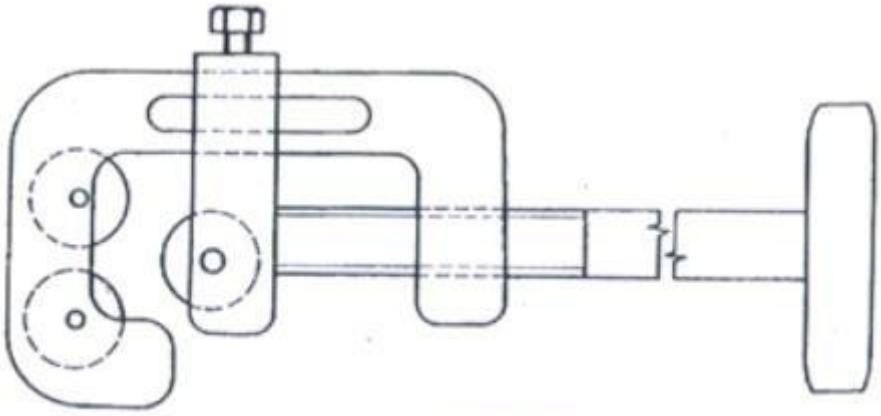
A pipe vice is fitted on the work bench. This has a set of jaws to grip the pipe and prevent it from turning while cutting, threading and fitting of bends, couplings etc. The yoke vice is commonly used in plumbing used in plumbing practice.



Pipe vice.

Pipe Cutter:

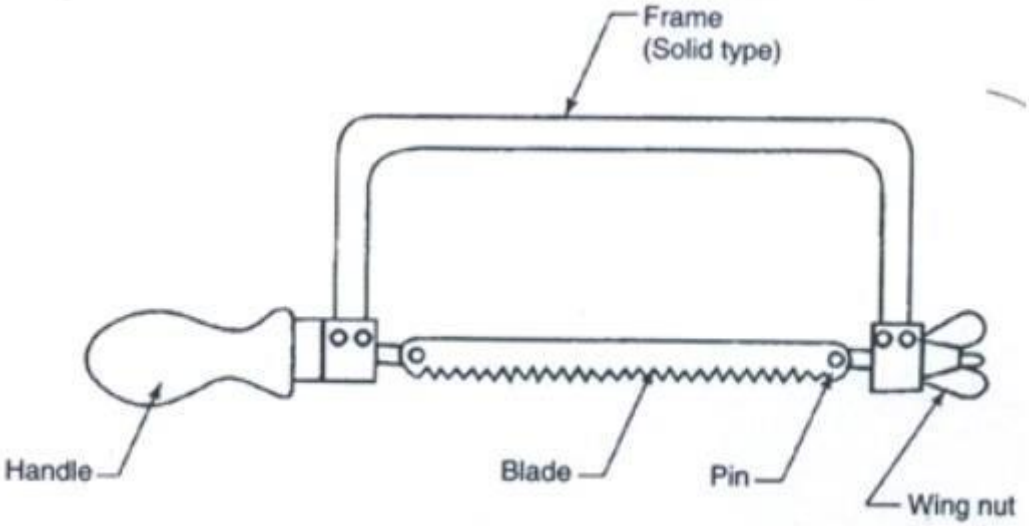
The pipe cutter mainly consists of three wheels which are hardened with sharp cutting edges along their periphery. Of these three wheels, one can be adjusted to any desired distance to accommodate different size of pipes. After adjusting the cutter on a pipe, it is around the pipe, so that the cutter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



Pipe cutter.

Hack Saw:

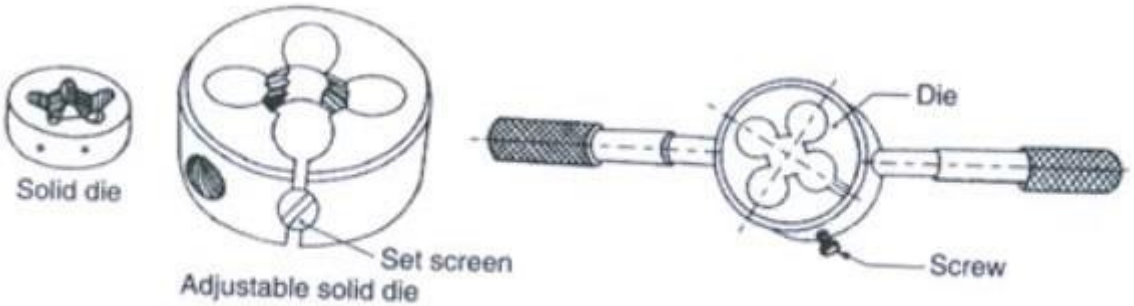
A hacksaw is used for cutting metal rods, bars, pipes, etc.



Hacksaw.

Threading Dies and Taps:

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



Threading dies and taps.

Files and Rasps:

The file surface is covered with sharp edged teeth and it's used for removing metal by rubbing. A rasp is used for finishing the surface of the work piece.

File and rasp

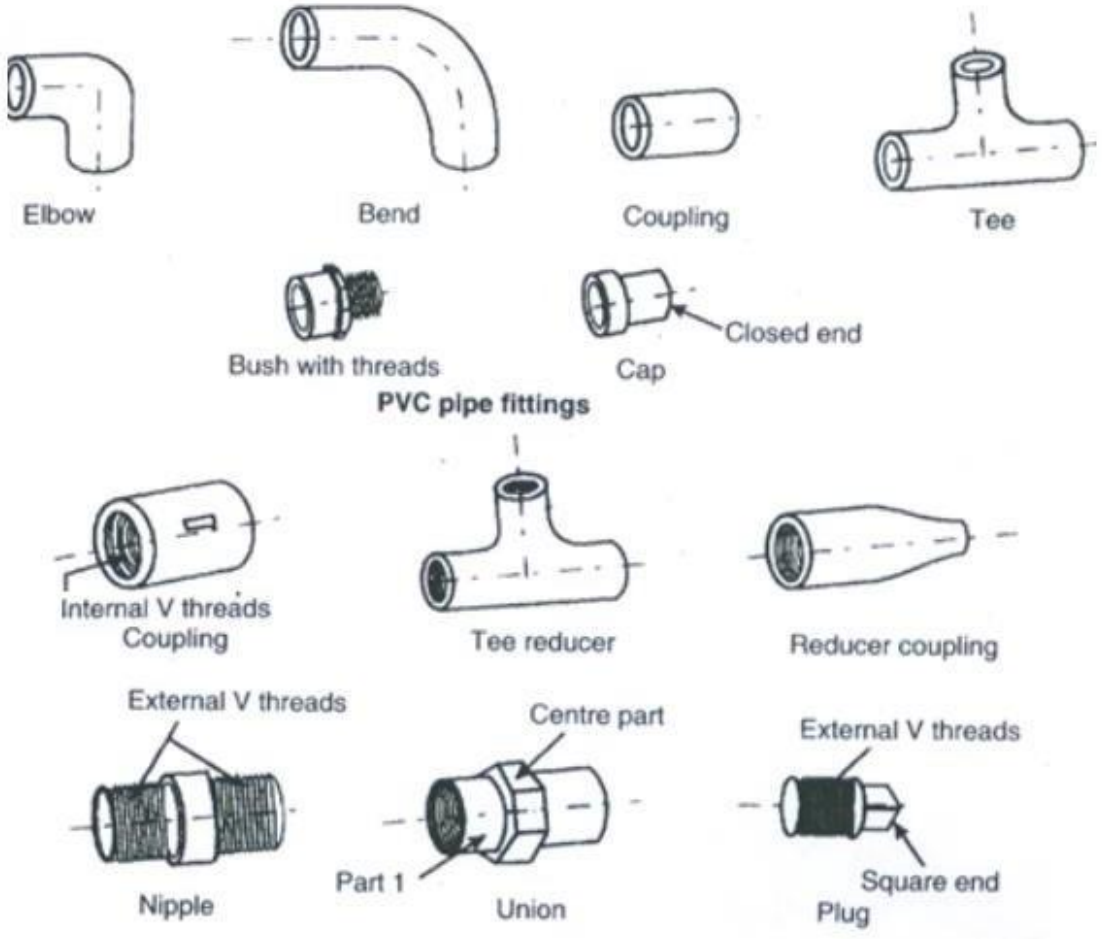
Plumb Bob:

It is used for check the vertical line and made up of steel or brass.

Plumb bob.

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 fig.



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 joint 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 up the 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.

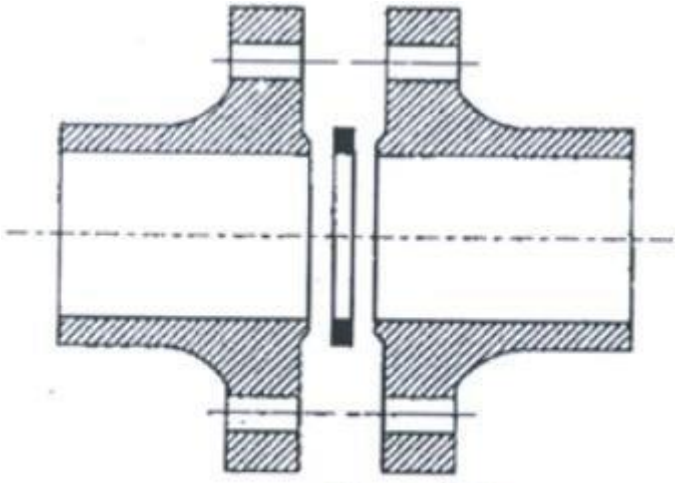
Valves:

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

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

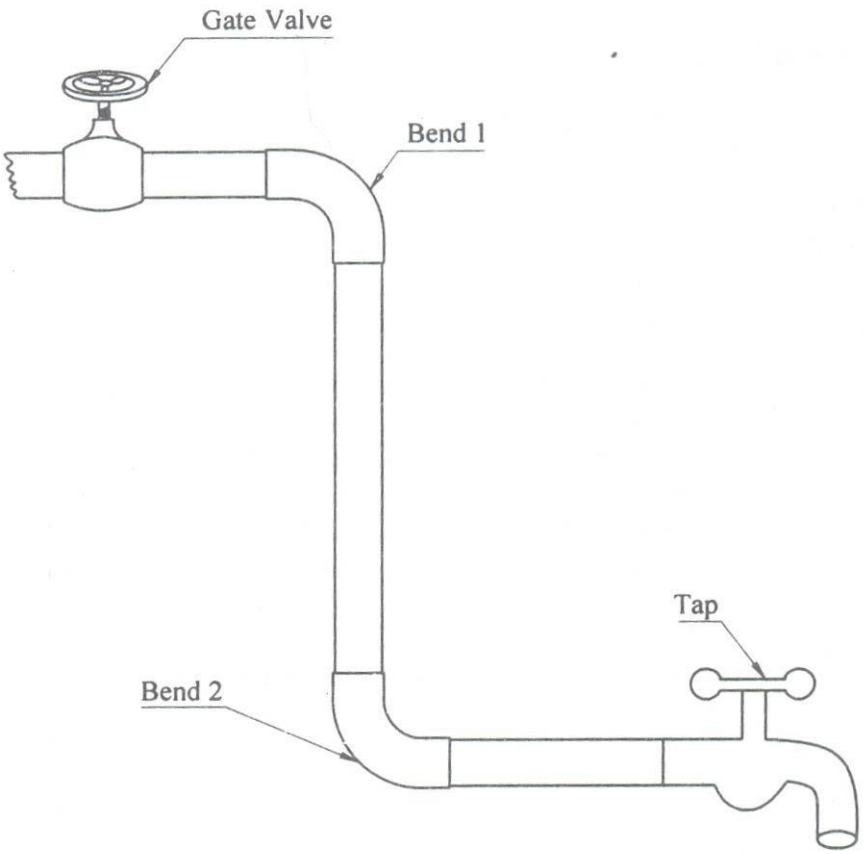
Flanged Joints:

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



Flange joint.

Basic Pipe Connections Involving Fitting like Valves, Taps & Bends



Pipe Layout

Ex. No: 1 Date:	Basic Pipe Connections Involving Fitting Like Valves, Taps & Bends

Aim:

To connect the pipes with pipe fittings like valves, bends and taps with main supply pipe using joints.

Materials Used:

1. Pipe wrench
2. Spanner
3. Bend
4. Valves
5. Taps
6. Cast iron pipes of different length
7. Flange
8. Bench vice.

Procedure:

1. Two pipes are taken and they are held in vice and they are connected by using a flanged joint.
2. A gate valve is connected to the pipe for controlling the water supply.
3. Then bend – 1 is connected to the end of the pipe. Make internal threads using taps in the bend – 1. So it can be screwed to the pipe.
4. One more pipe is connected to the bend for extension of the layout.
5. The pipe is then screwed to bend – 2 for further extension.
6. A horizontal pipe is connected to this bend – 2 for further extension.
7. Then tap is fitted to the end of the pipe for closing and opening water supply.

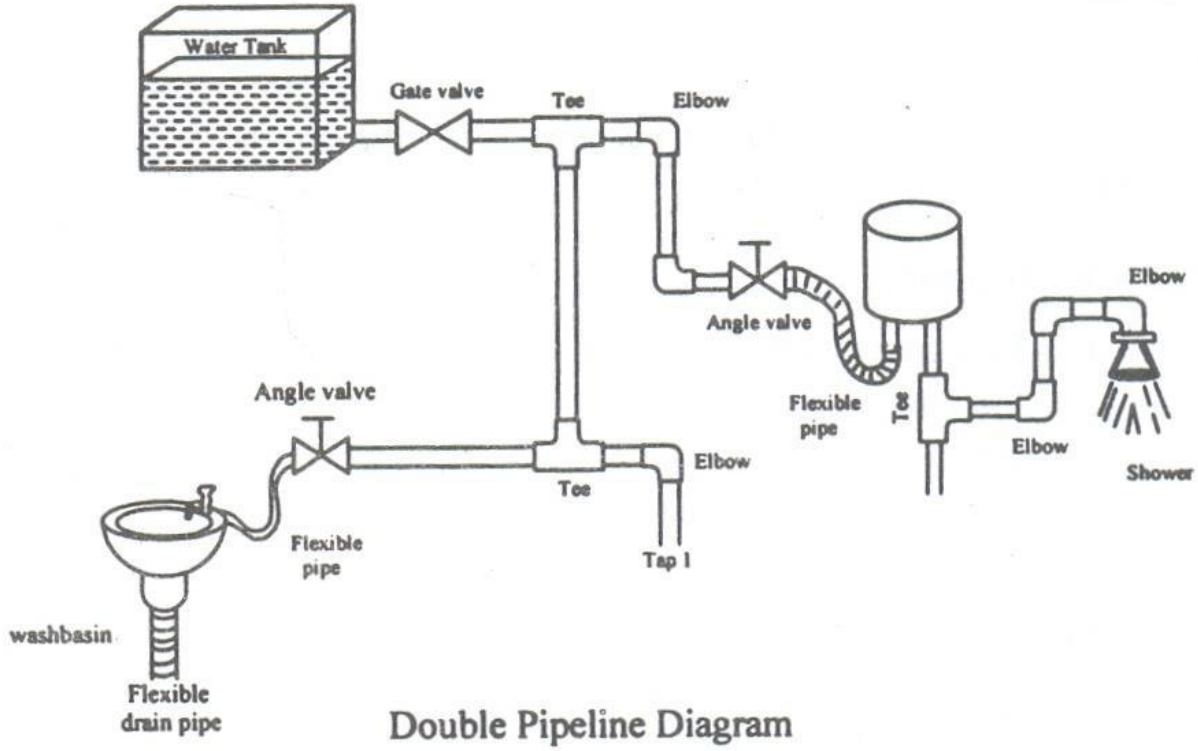
Result:

Thus the basic connections of pipes with pipe accessories are made.

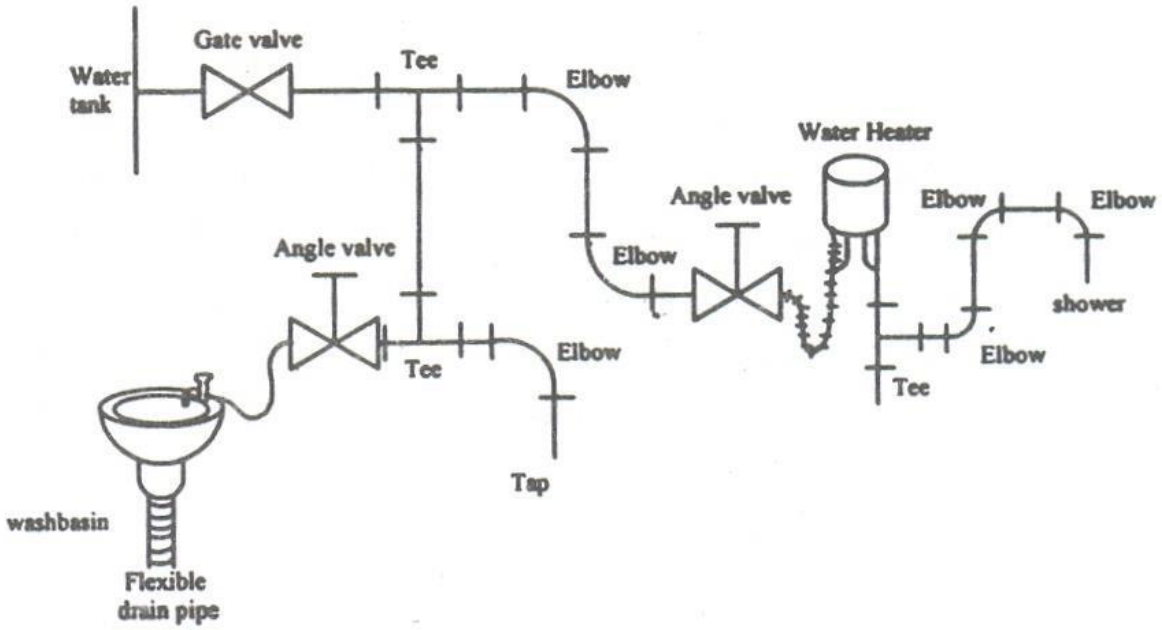
Basic Pipe Connections for Wash Basin and Water Heater

IG :

Basic pipe connections for Waterheater



Double Pipeline Diagram



Single Pipeline Diagram

Ex. No: 2 Date:	Basic Pipe Connections for Wash Basin and Water Heater

Aim:

To construct a basic pipe connections for wash basin and water heater.

Materials Used:

1. Plumbing tool kit - 1 No.
2. Taps - 3 Nos.
3. Wash basin - 1 No.
4. Water heater - 1 No.
5. Elbow - 3 Nos.
6. Tee - 2 Nos.
7. Gate valve - 1 No.
8. PVC pipe - required length

Procedure:

1. Study the given diagram.
2. Mark the location of wash basin, water heater and taps.
3. Fix the wash basin, water heater.
4. Make the tee and elbow connections in the main pipeline to connect it to the wash basin, water heater and taps.
5. Fix the gate valve, near the water tank.
6. Connect all pipe fittings as per diagram.
7. The water tank was filled with water and the gate valve was opened slowly to supply water into pipeline.
8. The taps were opened to check its functions.

Result:

Thus the basic pipe connections for wash basin and water heater are made.

STUDY OF CARPENTRY

Introduction:

Carpentry may be designed as the process of making wooden articles and components such as roots, floors, partitions, doors and windows. Carpentry involves cutting, shaping and fastening wood and other materials together to produce a finished product. Preparation of joints is one of the important operations in wood work.

Joinery denotes connecting the wooden parts using different points such as lap joints, mortise and tenon joints, bridle joints, etc.

Carpentry Tools:

Carpentry tools are used to produce components to an exact size. The types of carpentry tools are as follows.

1. Marking tools 2.Measuring tools 3. Holding tools
4. Cutting tools 5.Planning tools 6.Boring tools
7. Striking tools 8.Miscellaneous tools

Marking Tools:

It is used to marking lines parallel to the edges of a wooden piece. It consists of a square wooden stem with a sliding wooden stock on it. On the stem, a marking pin is attached which is made up of steel. This stem is provided with a steel nail to scratch the surface of the work. It consists of two pins; the distance between the pins is adjustable. It is used to draw parallel lines on the stock.

Measuring Tools:

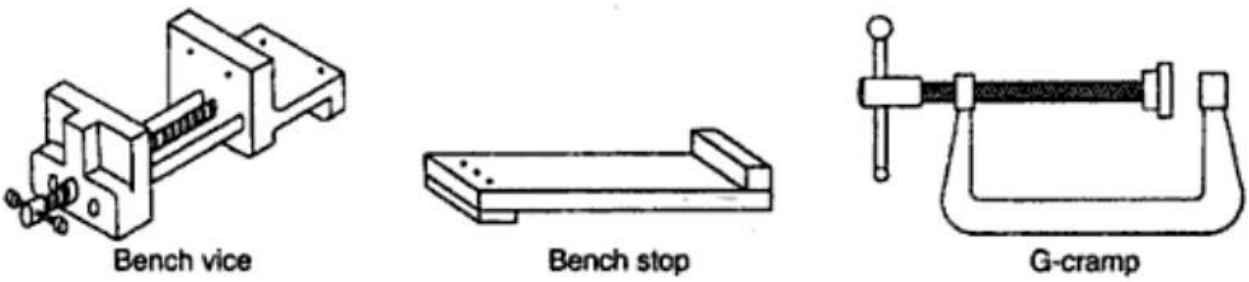
The carpentry measuring tools are classified as follows.

1. Steel tape 2.Steel rule 3.Calipers

- Steel tapes and steel rules are mainly used for measuring short and lengths in millimetres.
- A try square is used for testing squareness and marking of joints.
- A mitre square is used for marking and measuring an angle of 45 degree.
- A bevel square is used for marking and listing angles between 0 degree to 180 degree.
- Calipers are used for the precision measurement of cylindrical surface. Inside calipers are used for measuring outside diameter and outside calipers are used to measure inner diameter of a pipe

Holding Tools:

The carpentry holding tools are shown in fig.



Holding tools.

Carpentry Vice:

A carpentry vice is the common work holding device. It consists of one fixed jaw and one movable jaw. Its one jaw is fixed to the side of the table while the other is movable by means of a screw and a handle.

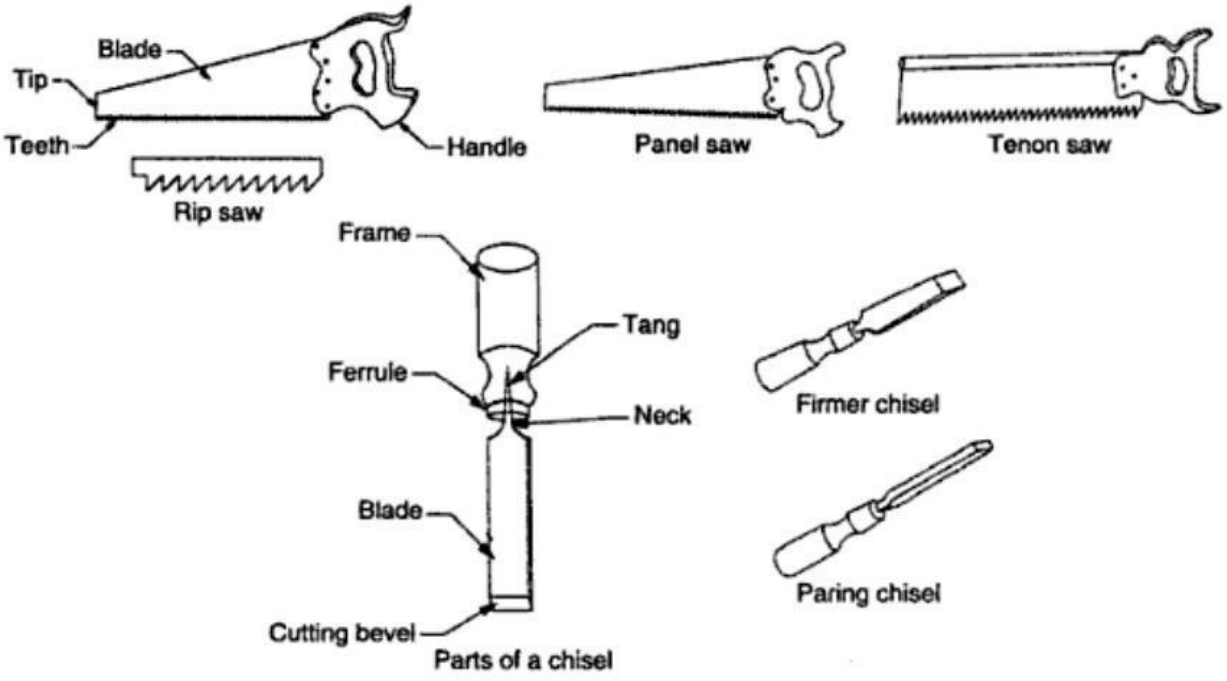
Bar clamp:

The bar clamp (or) sash cramps are generally used in pairs in glueing up operations at the final assembly of joinery work. It is made up of a steel bar of T-section, wine malleable iron fittings and a steel screw.

G-cramp:

G-cramp is made up of malleable iron with acme threads of high quality steel .It can be used for clamping small work when glueing up.

Cutting Tools:



Saws:

A saw is used to cut wood into pieces. There is different type of saws, designed to suit different purpose. A saw is specified by the length of its tooled edge. The following saws are used in the carpentry section.

Rip Saw:

The blade of rip saw is either straight or skew-backed. The teeth are so set that the cutting edge of this saw makes a steeper angle about 60°.

Cross Cut Saw:

This is similar in shape of a rip saw. It is used to cut across the grain of the stock. The correct angle for cross cutting is 45°.The teeth are so set that the saw kerf is wider than the blade thickness. This allows the blade to move freely in the cut without sticking.

Tenon or Back Saw:

A tenon saw is used for fine and accurate work. It consists of a very fine blade, which is reinforced with a rigid steel back. The teeth are shaped like those of cross cut saw.

Chisels:

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

Firmer Chisels:

These are general purpose chisels and are used either by hand pressure or by a mallet. The blade of a firmer chisel is flat and their sloping face is at an angle 15° to 52°.

Mortise Chisels:

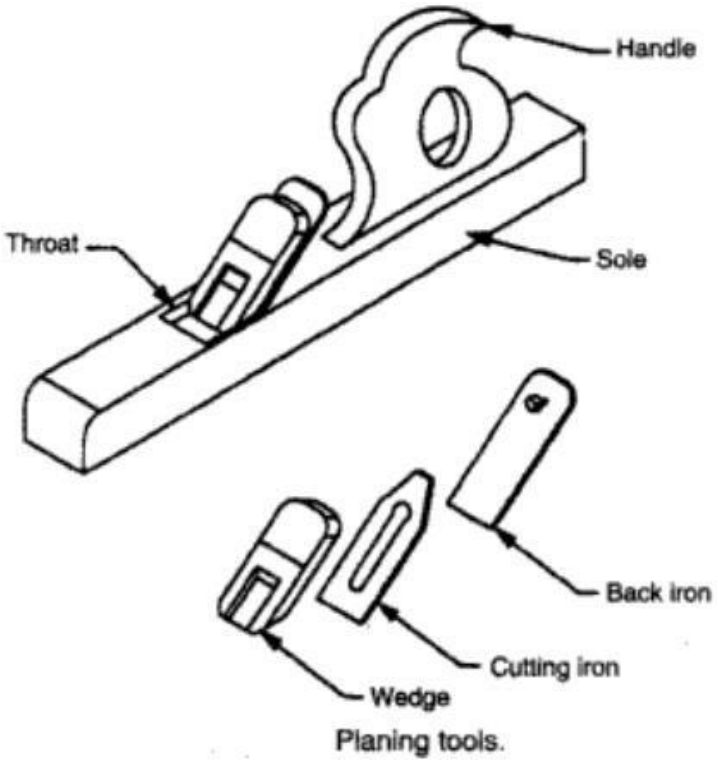
These are general purpose chisels and are used for cutting mortises above 9 mm wide. The blade of a firmer type in which they have a thicker section and a stronger neck. By means of this chisel we can apply more Leverage to remove waste wood from the mortise.

Bevel chisels:

A bevel chisel is similar in construction to the firmer chisel. Its edges are bevelled to allow access to difficult corners. It has a blade with a bevelled back due to which it can enter sharp corners for finishing in dovetail joints.

Planning Tools:

In general, planes are used to produce flat surfaces on wood. The cutting blade used in a place is very similar to a chisel. The blade of a plane is fitted in a wood or metallic block at an angle.



Planing tools.

Jack plane which is about 35 cm long is used for general planning. A smooth plane that is about 20 to 25cm long is used for smoothening the stock .Being short; it can follow even the slight depressions in the stock better than the jack plane. Smooth plane is used after using the jack plane.

A rebate plane is used for making a rebate .A rebate is a recess along the edge of a piece of wood which to generally used for positioning glass in frames and doors. A plough plane is used to cut grooves, which are used to fix handle in a door.

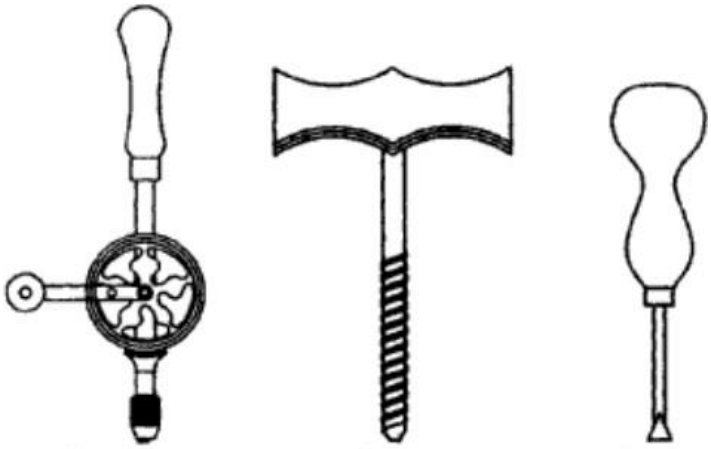
Boring Tools:

Boring tools are used to make holes in wood .Common types of boring tools are as follows.

1. Bradawl
2. Gimlet
3. Brace
4. Bit and drill

A brace bolds and turns the bit and boring of a hole is obtained. A brace having two jaws is used for holing the bit in one end. It has two types, namely ratchet brace and wheel brace.

A bradawl and a gimlet are used for boring small holes. These tools are hand operated.



Boring tools.

Striking Tools:

Striking tools.

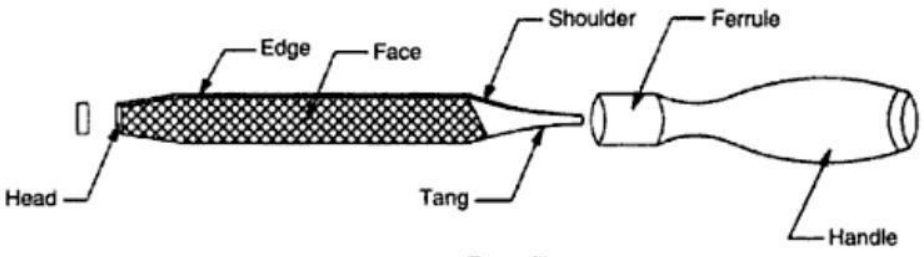
Hammers:

The cross peen hammer is mostly used for positioning small nails. The head is tightly held in the handle with the help of iron wedges. The claw hammer is effective in removing very large nails and also for driving the nails using the other end of the hammer.

Mallet:

A mallet is used to drive the chisel, when considerable force is to be applied, which may be the case in making deep rough cuts. A steel hammer should not be used for this purpose, as it may damage the chisel.

Rasp File:



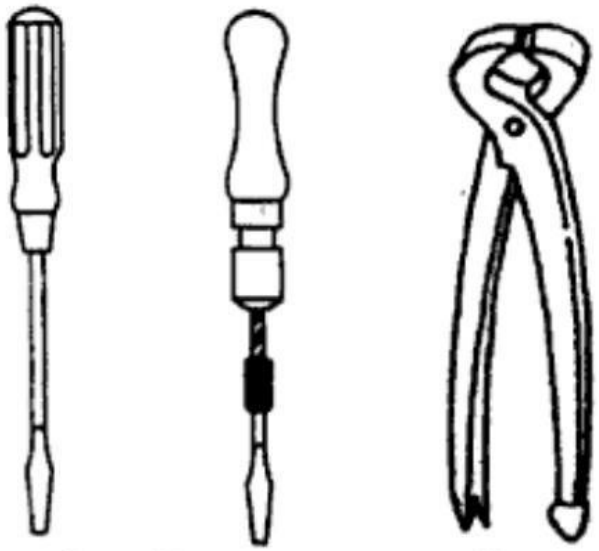
Rasp file.

A rasp file is shown in Fig. rasp is a file used for finishing the surface of wood. The rasp has sharp cutting teeth on its surface for this purpose. The file is used for removing rasp marks end finally the scratches left by the fix are removed with the scraper and glass paper.

Oil stone:

This is an essential flat used for providing sharp edges on cutting tools. The oil stones may be artificial or natural stones. The carborundum is the best artificial stones whereas the Arkansas are the natural stones.

Miscellaneous Tools:



Miscellaneous tools.

Spirit Level:

The spirit level is used to check the level of the wooden surface. A narrow glass tube is fitted into a small rectangular wooden box. The glass tube contains spirit and a bubble.On placing the spirit level if bubble stays in the middle, then the surface is flat otherwise it is having a slope.

Pincers:

They are made up of steel with a hinged joint and are used for pulling out small nails from wood.

Screwdrivers:

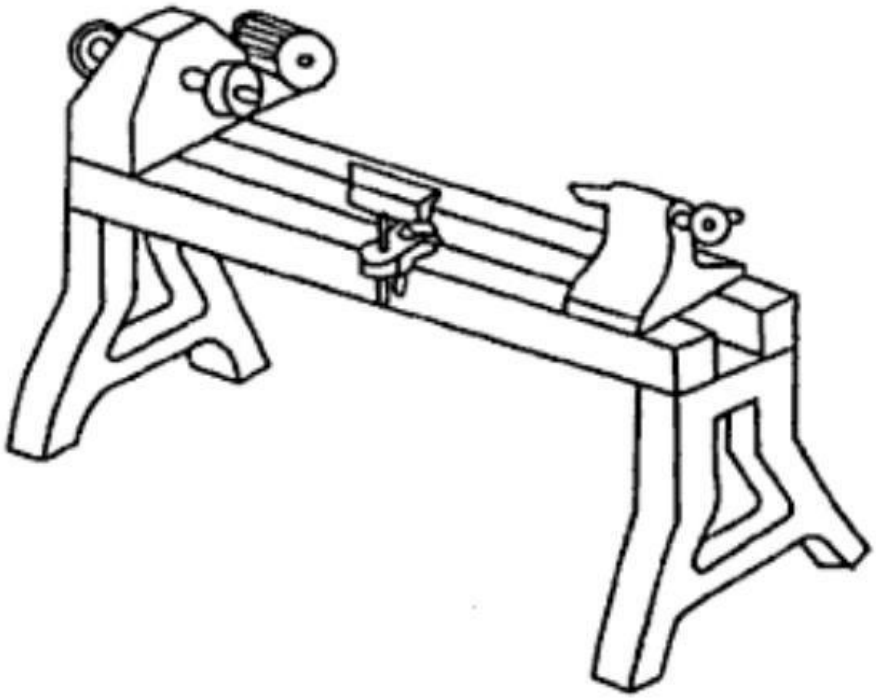
Screwdriver is used for driving wood screws into wood or unscrewing them. The screwdriver used in carpentry is different from the other common types.

CAPPENTRY MACHINES

Carpentry machines are used for large production of components. The commonly used carpentry machines are described below.

Wood Turning Lathe:

A wood turning lathe is the most important machines used in a carpentry shop. It is used for producing cylindrical, spherical and tapered shape products.



Wood turning lathe.

A wood working lathe consists of a cost iron body, main motor, cone pulley system, spindle, tool post, head stock, liveanddeadcenters and speed control devices. In wood working lathes, the workpiece is held between the two centers. The tool is held in the tool post. The workpiece is rotated in between the two centers whereas the cutting tool passes towards the work and removes the material and produces the desired shape and size.

Circular Saw:

A circular saw is used for ripping, cross cutting, leveling, grooving and rebating,. It consists of a cast iron table, a circular cutting blade, guide ways, saw guide, elevating hand wheel, tilting handwheel,and a main motor.

In circular saws, the workpiece is held on the table. Then the work is moved against the circular saw to perform the operations. The saw hand wheel is used to adjust the height of the saw above the surface of the table. The table can be tilted up to 45° for cutting with different angles. It is an ideal machine for large production. The size of the saw depends upon the size of the saw blade.

Band Saw:

A band saw is used for cross cutting, leveling, mitering, grooving and rebating. It consists of two wheels having an equal diameter, saw guider, frametable, wheel guard, saw tension, arrangement and steel blade having teeth on it. The saw blade travels over the rims of two wheels. The blade width varies from 6 to 25 mm and the thickness is about 1 to 2 mm.

CARPENTRY PROCESSES

In a carpentry shop, a number of operations are performed to get the finished workpiece. The different types of process performed in a carpentry shop can be classified as follows.

Marking and Measuring:

It is the process of setting of dimensions on wooden pieces to obtain the required shape. This is the first step for further carpentry operations. The marking operation is done with use of marking tools. Before marking, one end is planed for reference.

Sawing:

Sawing is the process of cutting wood to the required shape and size such as straight, inclined or curved. Sawing can be done along the grains or across the grains.In sawing, wooden work is fixed in a vice and wood is moved up to prevent vibrations during sawing.

Planing:

Planning is an operation of obtaining, smooth, dimensionally true surface of wood by using a planer. It is done along the grains. So smooth surface is achieved. This process can be also called facing or edging.

Chiselling:

It is the process of cutting a small stock of wood to produce required shapes.

Mortising and Tenoning:

Mortising is the process of producing a mortise, i.e. a rectangular or square holes and recesses in wooden pieces. A tenon is a projected piece of wood that fits into the corresponding mortise. This process is done by using mortise chisels and a mallet.

Boring:

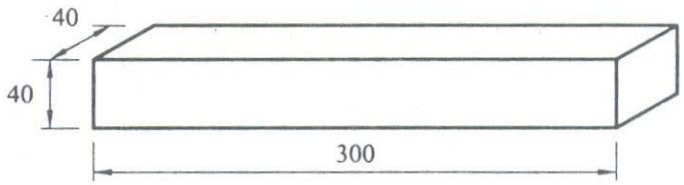
Boring is the process of producing through holes or blind holes in wooden piece. This process can be done straight or inclined according to the type of work. The small holes are produced by using bradawl and gimlet, whereas large holes are produced by using braces, drills.

Grooving:

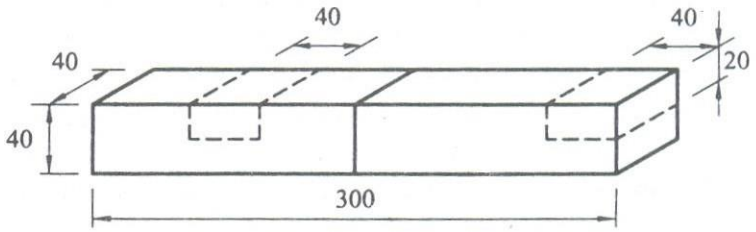
Grooving is the process of making grooves tonguing is the process of producing corresponding projections of wood for fitting into grooves. Grooving and tonguing operation can be seen in drawing boards, floor boards and partitions. Grooving is done with a plough plane tool, and tonguing is done with a moulding plane tool.

T – JOINT

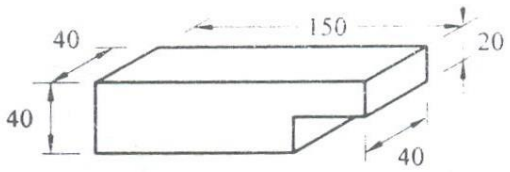
1. PLANING



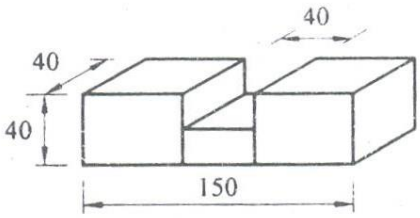
2. MARKING



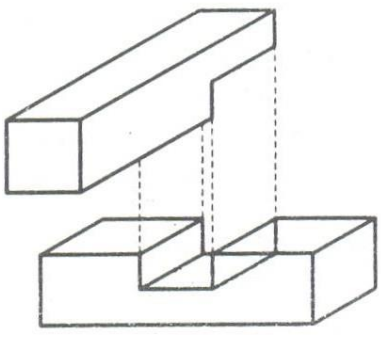
3. CUTTING

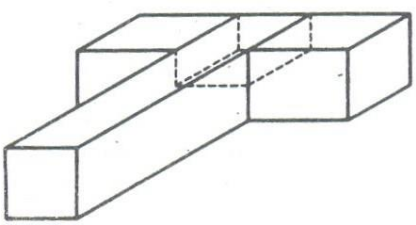


4. CHISELING



5. FINISHING





Ex. No: 3 Date:	T – JOINT

Aim:

To make a T-Joint from the given wooden piece for the desired dimensions.

Materials Used:

A wooden piece of size 300 × 40 × 40 mm.

Tools Required:

1. Jack Plane	2. Try Square	3. Marking Gauge
4. Tenon Saw	5. Carpentry vice	6. Steel rule
7. Firmer chisel	8. Mallet	9. Rip Saw

Sequence of Operations:

1. Rough planning	2. Marking	3. Cutting (or) Sawing
4. Chiselling	5. Finish Planing	

Procedure:

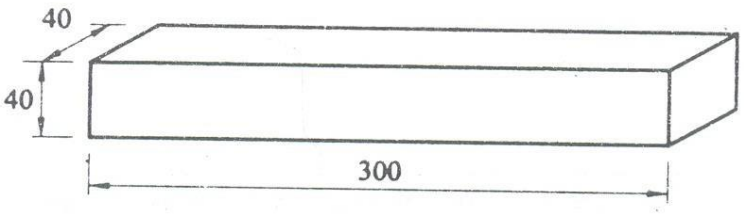
1. The given job is checked to ensure its correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the workpiece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut into two halves using rip saw then proper marking is done for T-Joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using tenon 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 workpiece.
8. Jack plane is used to plane the other two faces upto marked portion.
9. Now the two pieces are assembled to check proper fitting.
10. The finished job is again checked for its accurate shape and size using try square and steel rule.

Result:

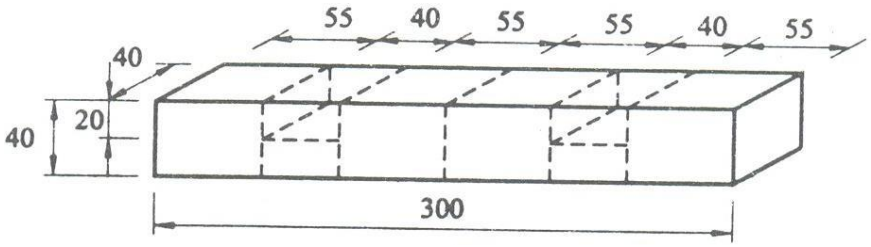
Thus the desired T-Joint is obtained.

CROSS LAP JOINT

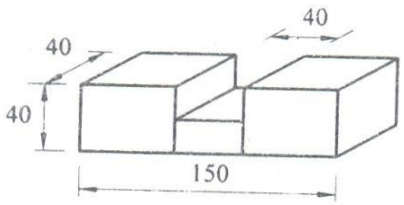
1. PLANING



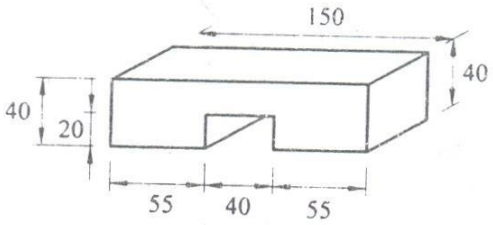
2. MARKING



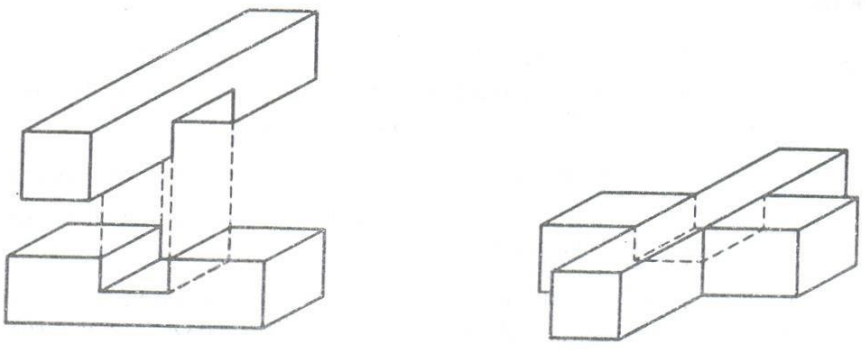
3. CUTTING



4. CHISELING



5. FINISHING



Ex. No: 4 Date:	CROSS LAP JOINT

Aim:

To make a cross lap joint from the given wooden piece for the given dimensions.

Materials Used:

A wooden piece of size 300 × 40 × 40 mm.

Tools Required:

1. Jack Plane	2. Try Square	3. Marking Gauge
4. Tenon Saw	5. Carpentry vice	6. Steel rule
7. Firmer chisel	8. Mallet	9. Rip Saw

Sequence of Operations:

1. Rough planning	2. Marking	3. Cutting (or) Sawing
4. Chiselling	5. Finish Planing	

Procedure:

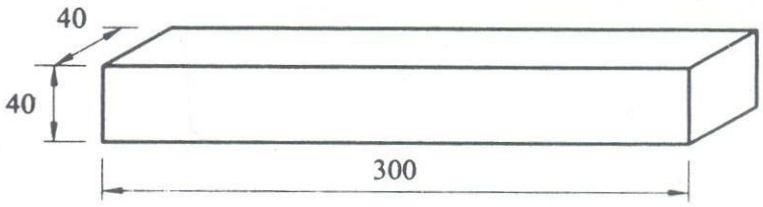
1. The given job is checked to ensure its correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the workpiece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut into two halves using rip saw then proper marking is done for cross lap Joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using tenon 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 workpiece.
8. Jack plane is used to plane the other two faces upto marked portion.
9. Now the two pieces are assembled to check proper fitting.
10. The finished job is again checked for its accurate shape and size using try square and steel rule.

Result:

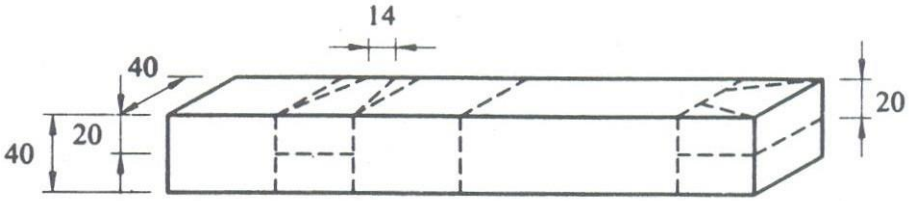
Thus the desired Cross Lap Joint is obtained.

DOVETAIL JOINT

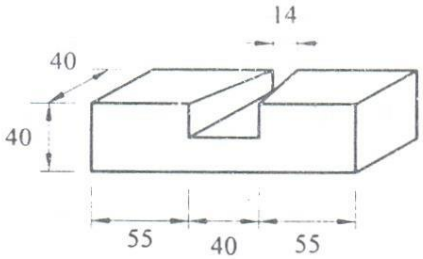
1. PLANING



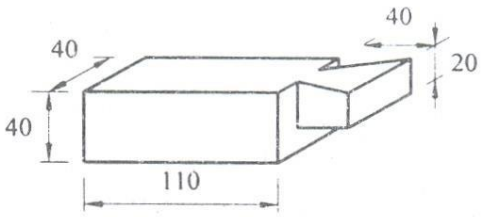
2. MARKING



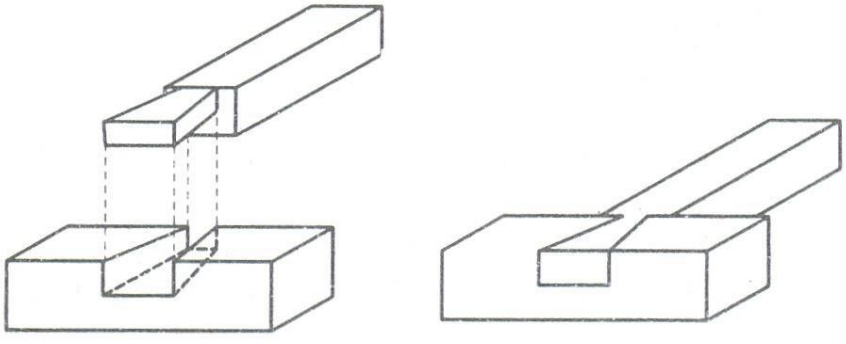
3. SAWING



4. CHISELING



5. FINISHING



Ex. No: 5 Date:	DOVETAIL JOINT

Aim:

To make a Dovetail Joint from the given wooden piece for the desired dimensions.

Materials Used:

A wooden piece of size 300 × 40 × 40 mm.

Tools Required:

1. Jack Plane	2. Try Square	3. Marking Gauge
4. Tenon Saw	5. Carpentry vice	6. Steel rule
7. Firmer chisel	8. Mallet	9. Rip Saw

Sequence of Operations:

1. Rough planning	2. Marking	3. Cutting (or) Sawing
4.Chiselling	5. Finish Planing	

Procedure:

1. The given job is checked to ensure its 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 workpiece 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 into two halves using rip saw then proper marking is done for Dovetail Joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using tenon 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 workpiece.
8. Jack plane is used to plane the other two faces upto marked portion.
9. Now the two pieces are assembled to check proper fitting.
10. The finished job is again checked for its accurate shape and size using try square and steel rule.

Result:

Thus the desired Dovetail Joint is obtained.

STUDY OF WELDING

Introduction:

Welding is metal joining process wherein localized coalescence is produced either by heating the metal to a suitable temperature, with or without the use of filler metal, with or without application of pressure.

The filler material has similar composition and melting point temperature as that of the base metal. It is used to fill gap between the joint surfaces.

Types of welding:

The welding process is divided into two main sub divisions.

1. Plastic welding:

The pieces of metal to be joined are heated to the plastic state and then forced together by external pressure without the addition of filler material.

2. Forge welding:

The work piece are placed in a forge or other appropriate furnace and heated within the area to be joined to the plastic condition. Then parts are quickly superimposed and worked into a complete union by hand or power ham mering or by pressing together.

3. Resistance welding:

In resistance welding, a heavy electric current is passed through the metals to be joined over limited area, causing them to be locally heated to plastic state and the welding is completed by the application of pressure for the prescribed period of time.

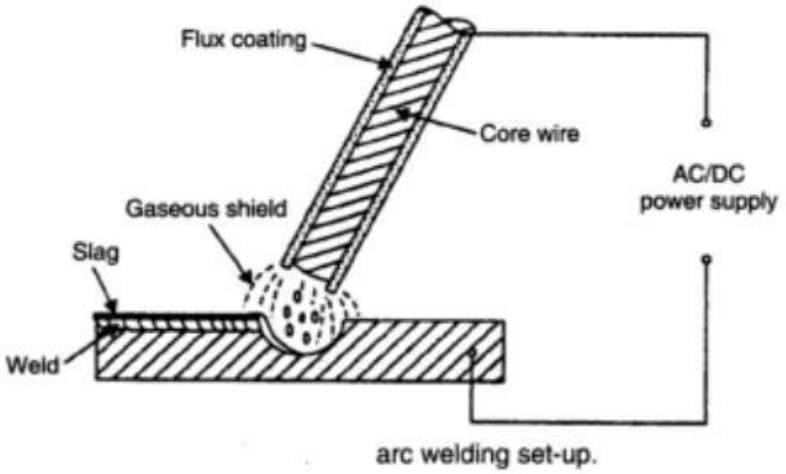
4. Fusion welding:

In fusion welding, the metal parts to be joined are melted and then allowed to solidify pressure is not applied and filler metals may be used for this type of welding.

5. Gas welding:

Gas welding is a process in which the required heat to melt the surfaces is supplied by a high temperature flame obtained by a mixture of two gases. Usually the mixture of oxygen and acetylene is used for welding purpose.

6. Electric Arc welding:



arc welding set-up.

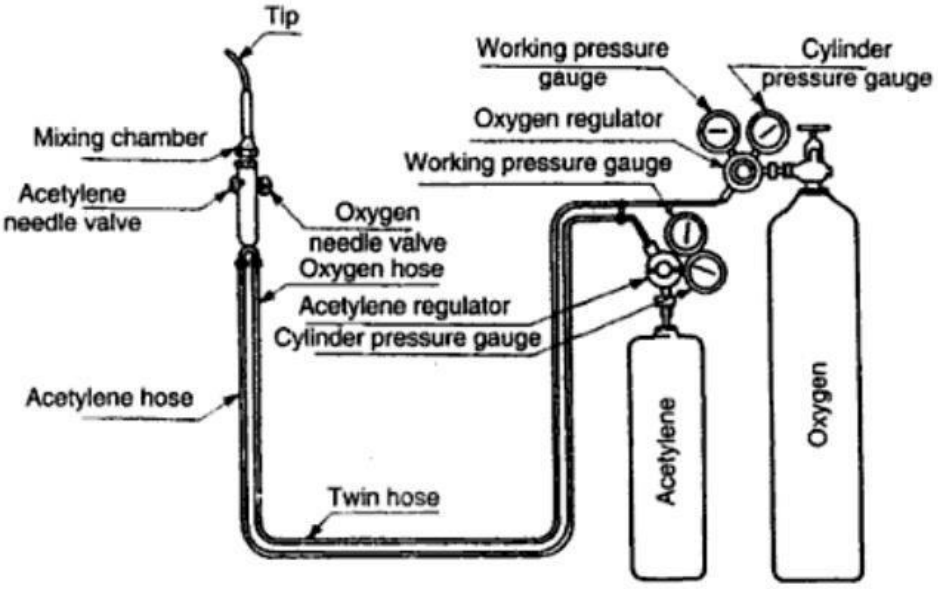
Electric arc welding is the process of joining two parts by melting their edges by an electric arc with or without the application of pressure and with or without use of filler metals.

7. Thermit welding:

Thermit welding is a fusion process in which weld is effected by pouring super heated liquid thermit steel, around the parts to be united with or without the application of pressure.

8. Oxy-acetylene welding:

In oxy-acetylene welding oxygen and acetylene are the two gases used for producing flame. Oxygen is mainly used for supporting the combustion intensity.



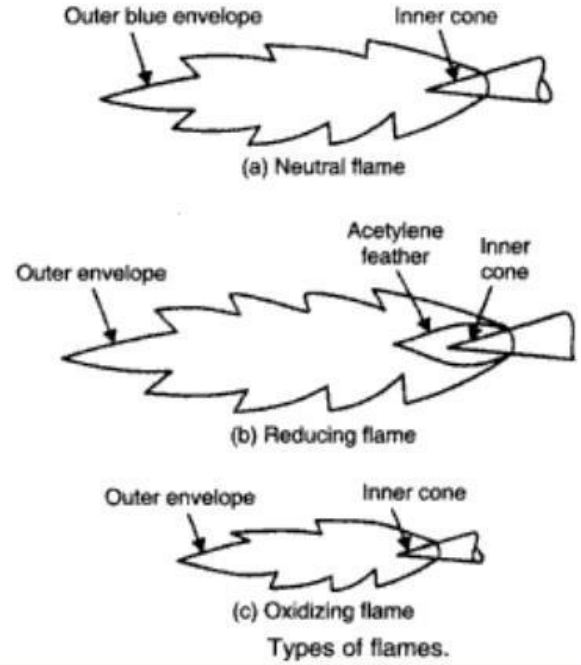
oxy-acetylene gas welding.

The oxygen and acetylene under high pressure in cylinders which are fitted with pressure regulator. Each cylinder is connected to the blowpipe by flexible hoses. The oxygen cylinders are painted block and acetylene cylinders are painted maroon.

When acetylene is mixed with oxygen in correct proportions in the welding torch, ignition is takes place. The flame resulting at the tip of the torch is sufficient enough to melt and the parent material .The fla me temperature is about 3200ºC.The filler metal rod is generally added to the molten metal pool to built up the seam for greater strength.

Types of flames:

1. Neutral Flame (Oxygen, Acetylene in equal proportions)
2. Oxidizing Fla me (excess of Oxygen)
3. Reducing Flame (excess of Acetylene)



Types of flames.

Neutral Flame:

- A neutral flame is produced when approximately equal volumes of oxygen and acetylene are mixed in the welding torch and burnt at the torch tip.
- The temperature of the neutral flame is of the order of about 3260ºC
- The flame has inner cone which is light blue in color.

Oxidizing Flame:

- If the volume of the oxygen supplied to the neutral flame is increased, then resulting flame will be oxidizing flame.
- The temperature of oxidizing flame is of the order of about 3482ºC.
- Normally the outer flame envelope is much shorter. It has very small white inner cone.
- This flame is used to weld copper-base metals, zinc-base metals.

Reducing Flame (Carburizing Flame):

- If the volume of the oxygen supplied to the neutral flame is reduced, the resulting flame will be a reducing flame.
- In this case, flame is recognized by acetylene feather which exists between the inner cone and outer envelope.
- The outer flame envelope is longer than that of the neutral flame and is usually much brighter in color.
- It has an appropriate temperature of 3038ºC.
- In this type, flames are used to weld the high-carbon steel, non-ferrous alloys, zinc-bearing alloys.

Filler Metal:

It is the material that is added to the weld pool to assist in filling the gap. Filler metal forms an integral part of the weld. The filler metal is usually available in rod form. The rods are called filler rods.

Fluxes:

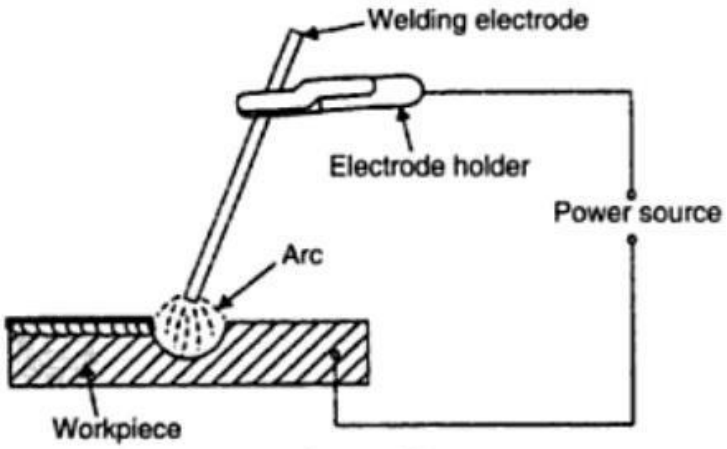
During the welding, if the metal is heated in the air, oxygen in the air combines with the metal 5to form oxides which result in poor quality, low strength welds or in some cases may even make welding impossible. In order to avoid this problem, a flux is added during the welding. The flux prevents oxidation by preventing oxygen from contacting the weld zone.

Arc welding:

In the arc welding process, the source of heat is electricity. In arc welding process, coalescence is produced by heating the work piece with an electric arc struck between electrode and the work piece. Welding may be carried out in air or in an inert atm. Filler material may or may not be used. The temperature of the arc is of the order of 3600ºC.

Principle of Arc Welding:

The heat required for joining the metals is obtained from an electric arc. The electric motor generator or transformer sets are used to supply high electric current and the electrodes are used to produce the necessary arc. The electrode serves as the filler rod and arc melts the surfaces so that the metals to be joined are fused together. The transformer type welding machine produces AC current. It takes power directly.



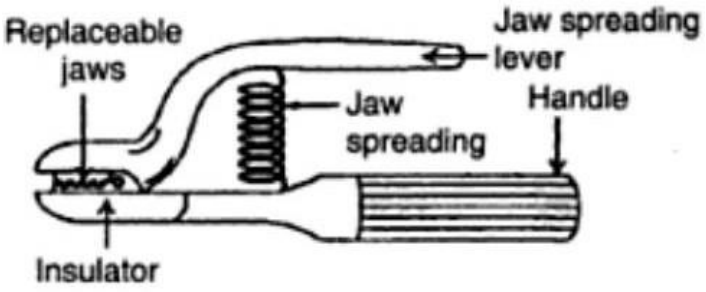
Arc welding set-up.

Electrodes:

Filler rods are used in arc welding are called as electrodes. The Electrodes are made of metallic wire called core wire. It is uniformly with a protective coating called flux while fluxing an electrode about 20 mm of length is left bare at one end for holding it using electrode holder. It is used to transmit full current from electrode holder to the front end of the electrode coating.

Electrode Holder:

- It is a device used for mechanically holing the electrode and conducting current to it.
- Electrode holder should be light, to minimize fatigue incurred by the welder.
- Jaws are made to hold the bare end of the electrode in either at vertical or at an angular position.

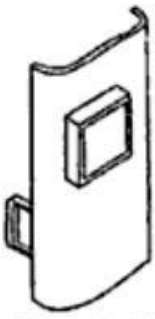


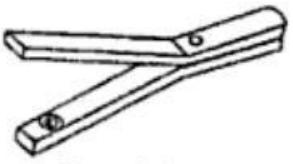
Electrode holder.

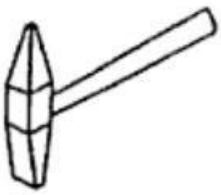
Welding Cables:

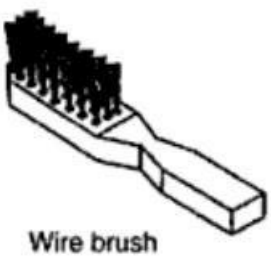
- Two cables are needed for welding purpose. One is used to connect the power source to electrode; another cable is connected to ground.
- The cables are well isolated with rubber.

Welding Bead Cleaning Accessories:


Face shield


Ground clamp


Chipping hammer


Wire brush

Chipping Hammer:

A chipping hammer is chisel-shaped one and it is used to remove the slag from the weld bead.

Wire Brush:

A wire brush made up of stiff steel wire, embedded in wood, removes small particles of slag from the weld bead after the chipping ham mer is used.

Hand Screen:

It is a protective device used in arc welding. A hand shield is held in the hand of the welder and it is fitted with a suitable fitter lens.

Helmet:

It is used for shielding and protecting the face and neck of the welder and it is fitted with a suitable fitter lens.

Tongs:

Tongs are used to handle the hot metal-welding job while cleaning; they are also used to hold the metal for hammering.

Goggles:

Chipping goggle is used to protect the eyes while chipping the slag. They are fitted while a plain glass to see the area to be cleaned.

Hand Gloves:

Hand gloves are used to protect the hands from electrical shock, arc radiation and hot spatters.

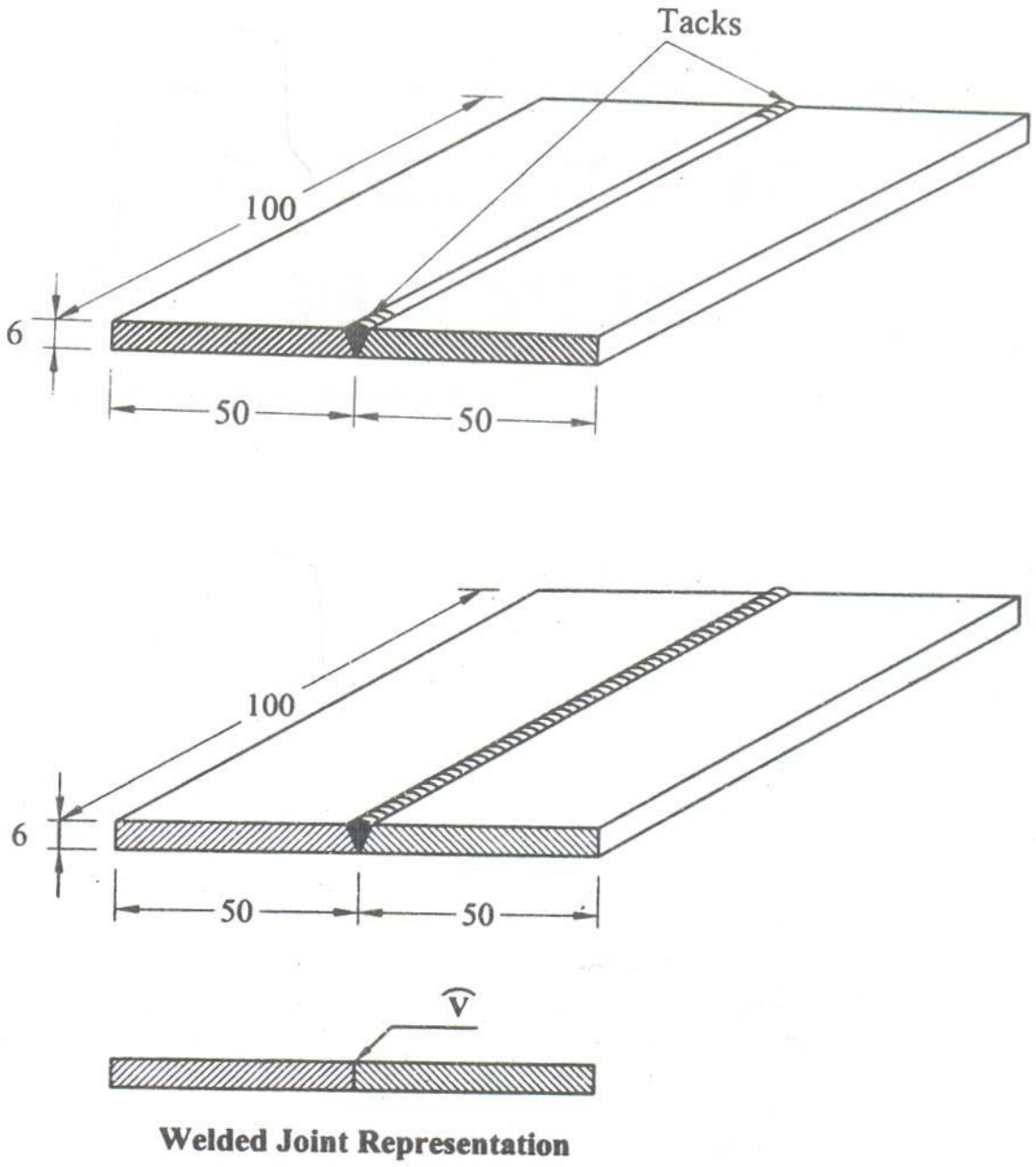
Advantages of Arc Welding:

- Flux shielded manual metal arc welding is the simplest of all the arc welding process.
- The equipment can be portable and the cost is fairly low.
- This process finds innumerable applications, because of the availability of a wide variety of electrodes.
- A big range of metals and their alloys can be welded.

Disadvantages of Arc Welding:

- Because of the limited length of each electrode and brittle flux coating on it, Mechanization is difficult.
- In welding long joints, as one electrode finishes, the weld is to be progressed with the next electrode. Unless properly cared, a defect may occur at the place where welding is restarted with the new electrode.
- It cannot be used to weld metal thickness less than 1.6 mm.

SINGLE V – BUTT JOINT



Welded Joint Representation

Ex. No: 6 Date:	SINGLE V – BUTT JOINT

Aim:

To make a Single V – Butt Joint using arc welding on the given workpieces.

Materials Used:

Mild Steel plate of size 100 × 50 × 6 mm – 2 Nos.

Tools Required:

1. Power Supply (AC or DC)
2. Welding Torch
3. Electrodes
4. Tongs
5. Chipping Hammer
6. Wire Brush
7. Gloves
8. Apron
9. Shield
10. Safety Goggles
11. Earthing Clamps

Sequence of Operations:

1. Edge Preparation
2. Tacking
3. Welding
4. Cooling
5. Chipping
6. Cleaning

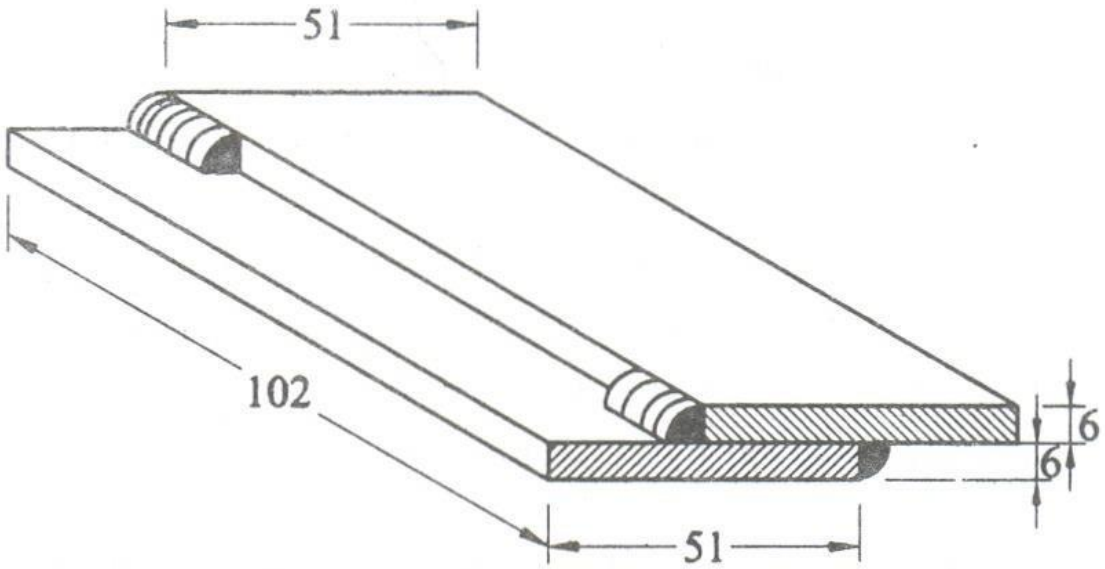
Procedure:

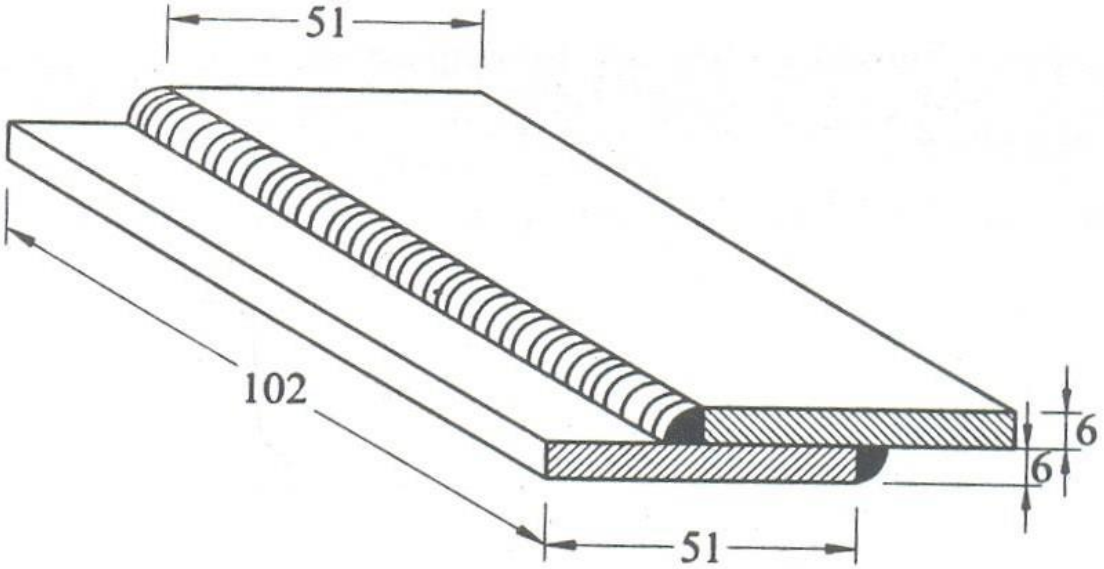
1. First of all, the work pieces must be thoroughly cleaned to remove rust, scale and other foreign materials.
2. Then the given workpiece are placed on the table in such a way that two workpiece are brought close to each other so that it forms a 'V-Shape' when the plates butt each other.
3. Appropriate power supply should be given to the electrode and the workpiece.
4. Now the welding current output may be adjusted.
5. When current is passed, arc is produced between the electrode and workpiece.
6. Now set the two workpiece in correct position and maintain the gap 3mm and tack at both ends of the workpiece as shown in the figure.
7. Then the welding is carried out throughout the length.
8. As soon as the welding process is finished, switch off the current supply and allow the workpiece to cool.
9. Slags are removed by chipping process with the help of chipping hammer.
10. Finally using wire brush, welded portions are cleaned.

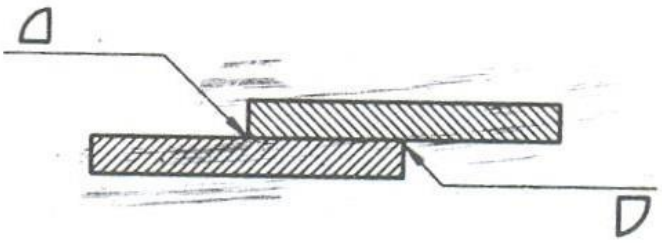
Result:

Thus the desired Single V – Butt Joint is obtained using arc welding.

LAP JOINT







Welded Joint Representation

Ex. No: 7 Date:	LAP JOINT

Aim:

To make a Lap Joint using arc welding on the given workpiece.

Materials Used:

Mild Steel plate of size 100 × 50 × 6 mm – 2 Nos.

Tools Required:

1. Power Supply (AC or DC)		2. Welding Torch
3. Electrodes	4. Tongs	5. Chipping Hammer
6. Wire Brush	7. Gloves	8. Apron
9. Shield	10. Safety Goggles	11. Earthing Clamps

Sequence of Operations:

1. Edge Preparation	2. Tacking	3. Welding
4. Cooling	5. Chipping	6. Cleaning

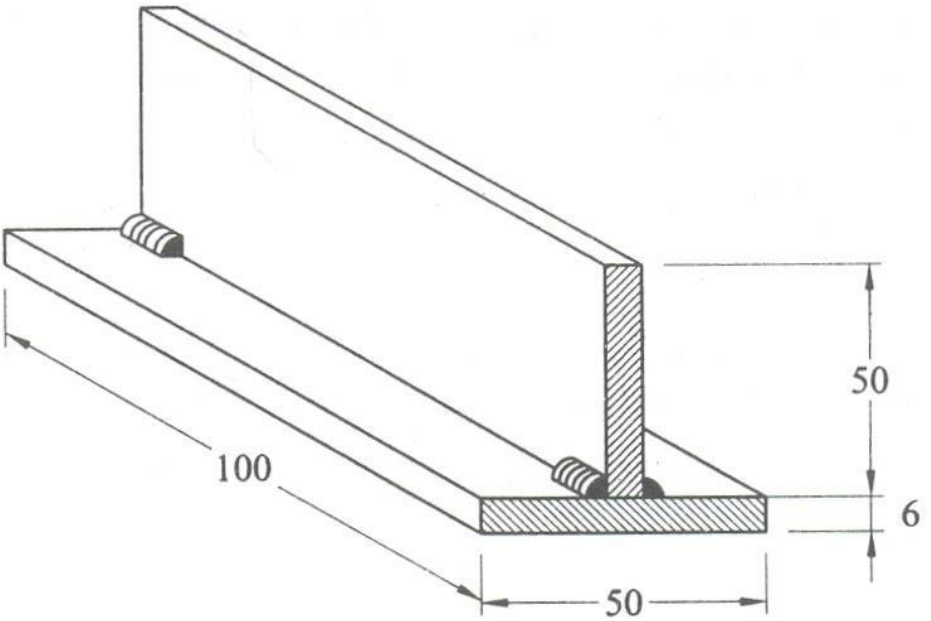
Procedure:

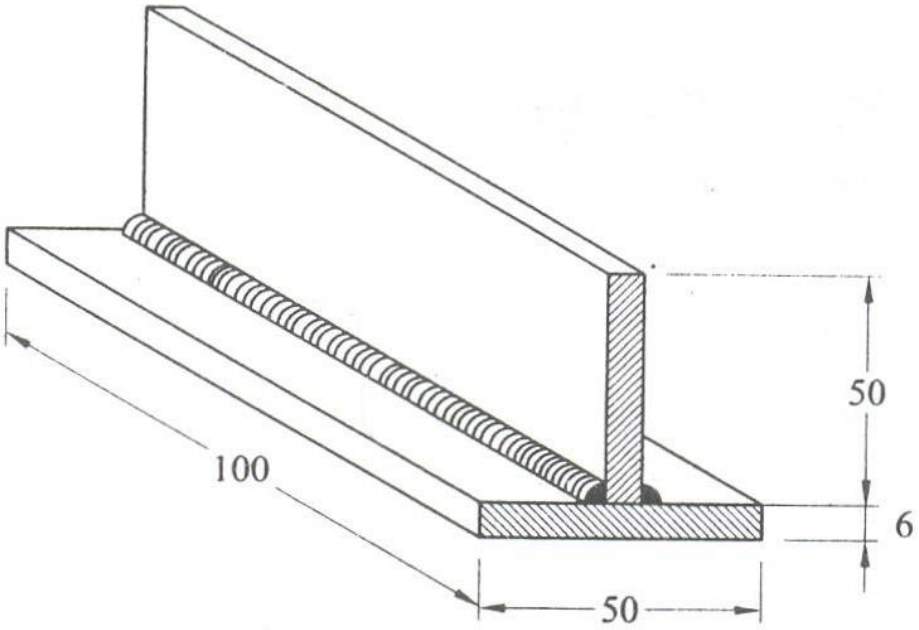
1. First of all, the work pieces must be thoroughly cleaned to remove rust, scale and other foreign materials.
2. Then the given workpiece are placed on the table in such a way that two workpiece are overlapped on over another as shown in the figure.
3. Appropriate power supply should be given to the electrode and the workpiece.
4. Now the welding current output may be adjusted.
5. When current is passed, arc is produced between the electrode and workpiece.
6. Now set the two workpiece in correct position like lap joint and tack at both ends of the workpiece as shown in the figure.
7. Then the welding is carried out throughout the length.
8. As soon as the welding process is finished, switch off the current supply and allow the workpiece to cool.
9. Slags are removed by chipping process with the help of chipping hammer.
10. Finally using wire brush, welded portions are cleaned.

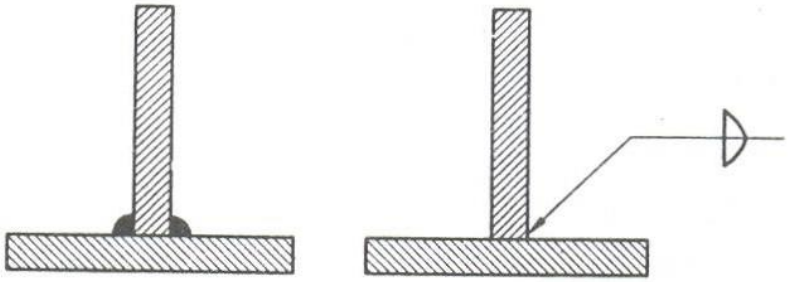
Result:

Thus the desired Lap Joint is obtained using arc welding.

T – FILLET JOINT







Welded Joint Representation

Ex. No: 8 Date:	T – FILLET JOINT

Aim:

To make a T – Fillet Joint using arc welding on the given workpiece.

Materials Used:

Mild Steel plate of size 100 × 50 × 6 mm – 2 Nos.

Tools Required:

1. Power Supply (AC or DC)
2. Welding Torch
3. Electrodes
4. Tongs
5. Chipping Hammer
6. Wire Brush
7. Gloves
8. Apron
9. Shield
10. Safety Goggles
11. Earthing Clamps

Sequence of Operations:

1. Edge Preparation
2. Tacking
3. Welding
4. Cooling
5. Chipping
6. Cleaning

Procedure:

1. First of all, the work pieces must be thoroughly cleaned to remove rust, scale and other foreign materials.
2. Then the given workpiece are placed on the table in such a way that two workpiece are brought close to each other so that it forms a 'T-Shape' as shown in the figure.
3. Appropriate power supply should be given to the electrode and the workpiece.
4. Now the welding current output may be adjusted.
5. When current is passed, arc is produced between the electrode and workpiece.
6. Now set the two workpiece in correct position like T – Fillet joint and tack at both ends of the workpiece as shown in the figure.
7. The joint is placed on a welding table in a flat position by keeping the tack side down.
8. Then the welding is carried out throughout the length of the workpiece.
9. As soon as the welding process is finished, switch off the current supply and allow the workpiece to cool.
10. Slags are removed by chipping process with the help of chipping hammer.
11. Finally using wire brush, welded portions are cleaned.

Result:

Thus the desired T – Fillet Joint is obtained using arc welding.

STUDY OF LATHE

Introduction:

Machining is a process of converting the given workpiece into the required shape and size with the help of a machine tool. The most widely used machine tool is lathe. There are different types of tools used in lathe. Several types of operations can be carried out in the workpiece with the help of lathe. In simple words, machining is a process of removing certain material from the workpiece.

Lathe:

Lathe is a machine tool which is used to perform several operations on the workpiece. Lathe is useful in making several parts which is further assembled to make new machine. Hence lathe is known as “mother of machines”.

Working principle of lathe:

In a lathe, the work piece is held in chuck and rotates about its axis by means of power. A single point cutting tool is mounted in tool post. When the chuck rotated the work piece also rotated. The tool moves parallel to the axis of rotation of work piece to produce a cylindrical surface, where as the tool moves perpendicular to the work piece to produce a flat surface. The tool moves at an angle to the axis of work piece to produce a turn surface. The material is removed in the form of chip from the work piece by giving proper feed and depth of cut. So, there quire size and shape of the work is obtained.

Types of Lathe Machines:

There are different types of lathe machines. They are,

1. Centre lathe
2. Tool room lathe
3. Bench lathe
4. Capstan lathe
5. Turret lathe
6. Automatic lathe

Main parts of Lathe:

The lathe consists of various parts. Their parts and function are discussed below.

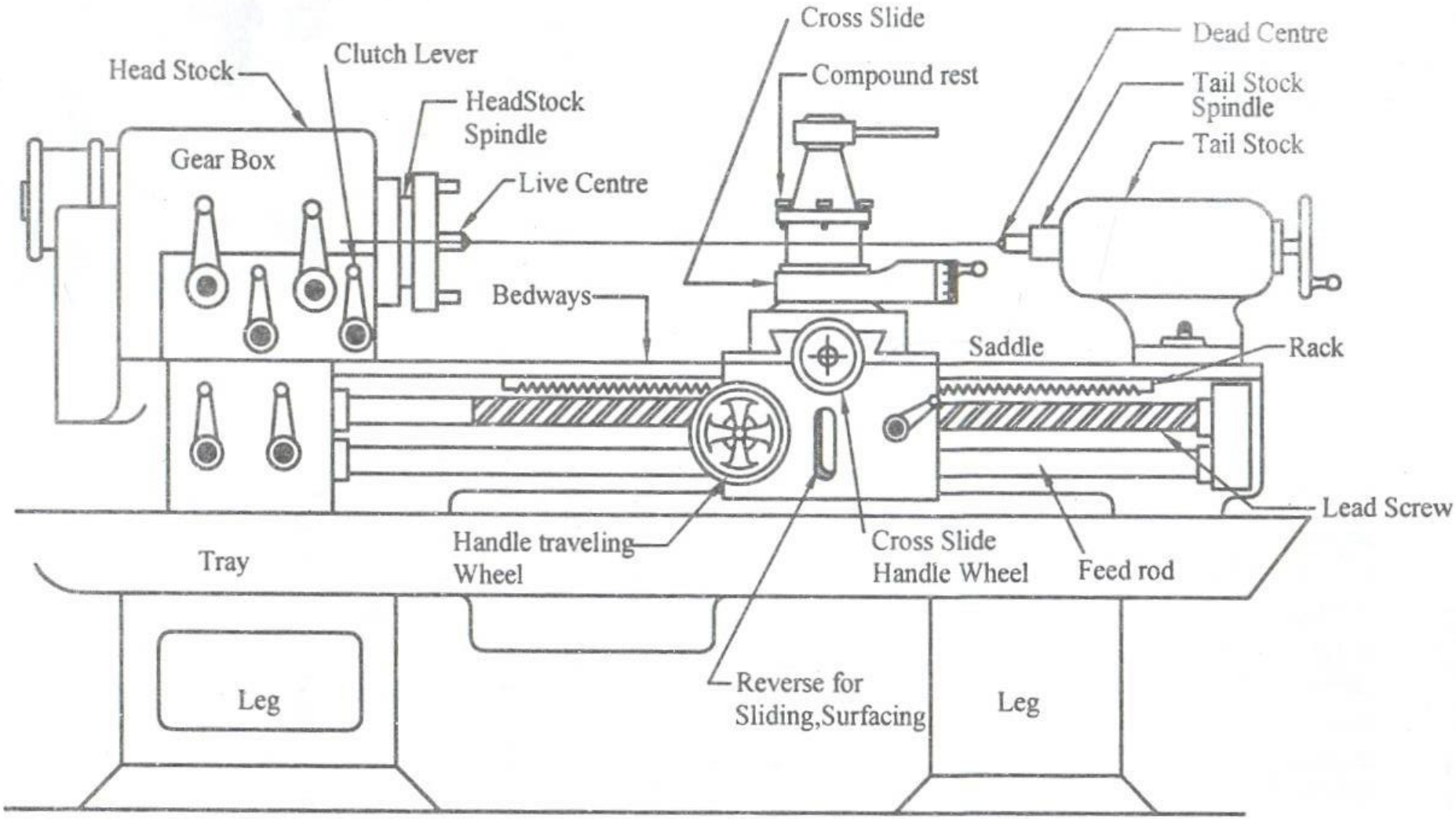
Bed:

Bed is the base of the lathe. The headstock is mounted on the left end; the carriage is in the middle and the tailstock at the right end of bed. The bed is made up of cast iron, alloyed with nickel, chromium. The bed is made up of cast iron to observe shock and vibration created during machining. The guide ways of the bed may be flatter inverted ‘V’ shape.

Headstock:

It is mounted on the left end of the bed. It carries a hollow spindle. The live center can be attached in the spindle. The spindle nose is threaded. In chuck faceplates can be attached to the spindle. The headstock may be back threaded type. The headstock has two types of driving mechanism

- Back geared mechanism
- Belt driven mechanism



Centre Lathe

Tailstock:

It is located on the bed at the right end. It is used for supports right end of work and also for holding drills, reamer tools for drilling, reaming and such other operations. The tailstock can be moved along the bed and clamped at any position, to support the different length work.

Carriage:

Carriage is used for giving various feed to the tool by hand or by power. The carriage is attached with the saddle.

Saddle:

It is a H shaped casting fitted on the bed and moves along the guide ways. It carries the cross slide, compound rest and a tool post.

i) Cross slide:

It is attached to the upper side of saddle and carries compound slide and tool post. The cross slide can be moved cross wise by hand or power. The micro meter dial is mounted on the cross slide hand wheel, with an accuracy of 0.05mm.

ii) Compound Rest:

It is attached over the cross slide. It is used during the taper turning opening operations to set the tool for angular cuts. Here the micro meter dial is mounted to show the depth of cut.

iii) Tool post:

The tool is clamped over the tool post. It is fixed over the compound rest. There are four types of tool post

a. Single screw tool post
b. Open side tool post
c. Four bolt tool post
d. Four way tool post

Apron:

Apron is attached to the saddle and hangs in front of the bed. It has gears, levers, clutchesfor moving the carriage automatically. A split nut is attached for engaging and disengaging thecarriage from the lead screw. It is used in thread cutting work.

Lead Screw:

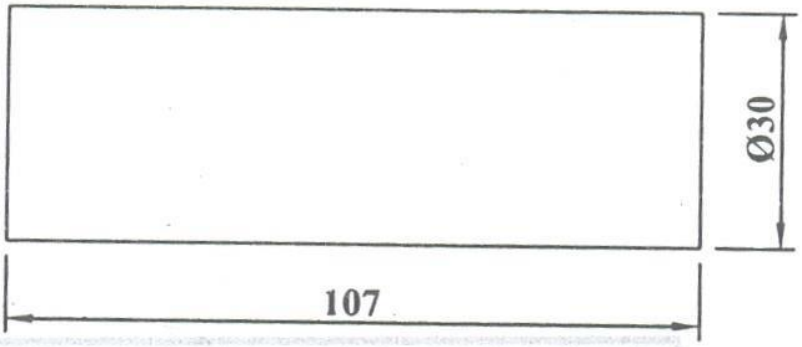
It is a longer screw with standard AC ME square threads and used for transmitting power for automatic feed for thread cutting operation.

Feed rod:

The feed rod is the long shaft used for the movement of carriage along the axis of bed. Itis used for operations like facing, turning and boring.

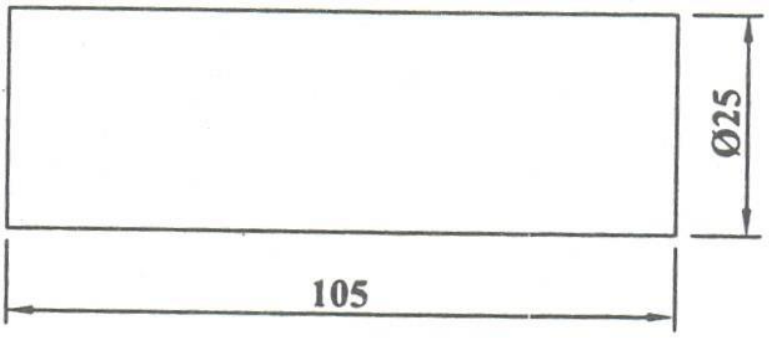
FACING AND TURNING

1)



Before Machining

2)



After Machining

Ex. No: 9 Date:	FACING AND TURNING

Aim:

To obtain the required shape and size of the workpiece by turning and facing operations.

Materials Used:

Cylindrical workpiece of diameter 30mm and length 107mm mild steel rod.

Tools Required:

1. Lathe
2. Cutting tool
3. Vernier Caliper
4. Try Square
5. Scriber
6. Vernier Height Gauge

Sequence of Operations:

1. Checking
2. Workpiece setting
3. Tool setting
4. Facing
5. Turning

Procedure:

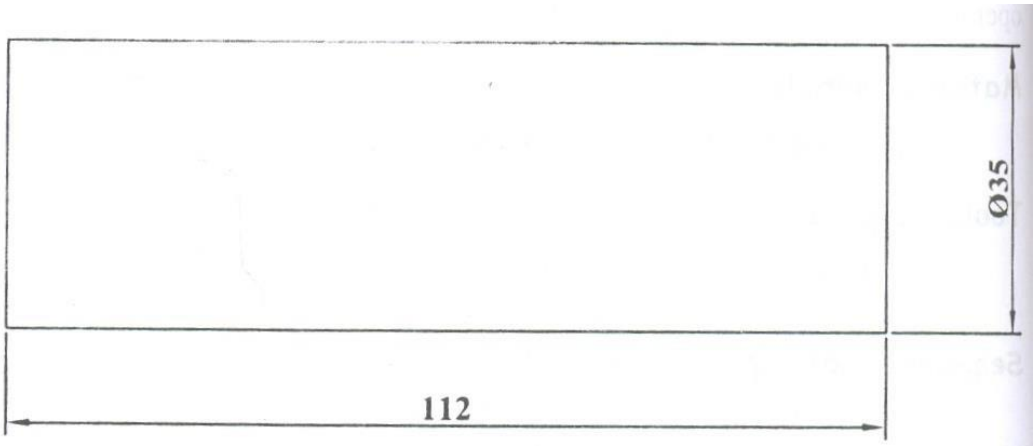
1. The given workpiece is checked for its dimensions.
2. The workpiece is help in the chuck. Chuck key is used to tighten the job firmly, ensuring centre of workpiece.
3. The single point cutting tool is held in the tool post and tighten the nuts using spanner.
4. Facing is done with cutting tool moving from the centre of workpiece towards outside. It is done until the required length of the job is obtained.
5. Turning is done to reduce the diameter of the job. Sufficient depth of cut is given and it is done until the required diameter of the job is obtained.
6. Finally, the dimensions of workpiece are again checked.

Result:

Thus the required size and shape of the given workpiece is obtained.

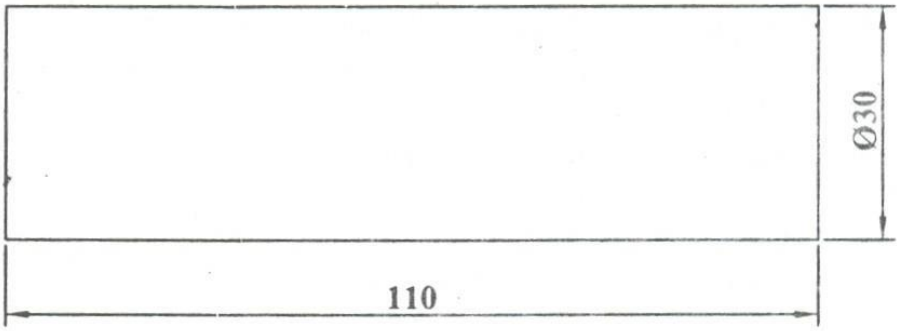
STEP TURNING AND TAPER TURNING

1)

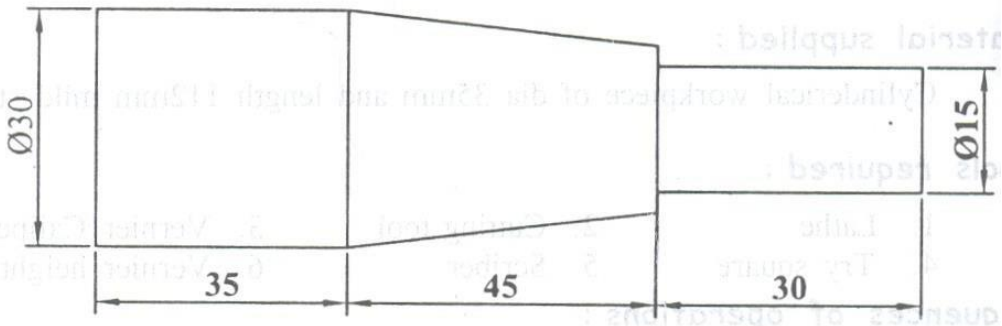


Before Machining

2)



3)



After Machining

Ex. No: 10 Date:	STEP TURNING AND TAPER TURNING

Aim:

To obtain the required shape and size of the workpiece by turning, facing and taper turning operations.

Materials Used:

Cylindrical workpiece of diameter 35mm and length 112mm mild steel rod.

Tools Required:

1. Lathe	2. Cutting tool	3. Vernier Caliper
4. Try Square	5. Scriber	6. Vernier Height Gauge

Sequence of Operations:

1. Checking	2. Workpiece setting	3. Tool setting
4. Facing	5. Turning	6. Taper Turning

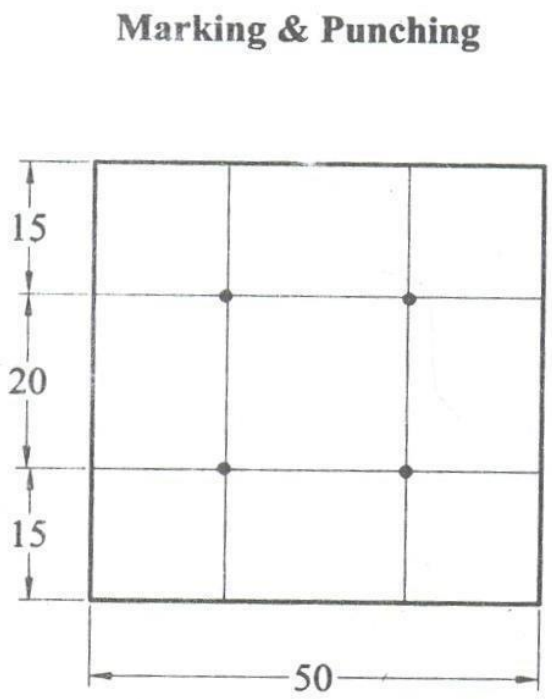
Procedure:

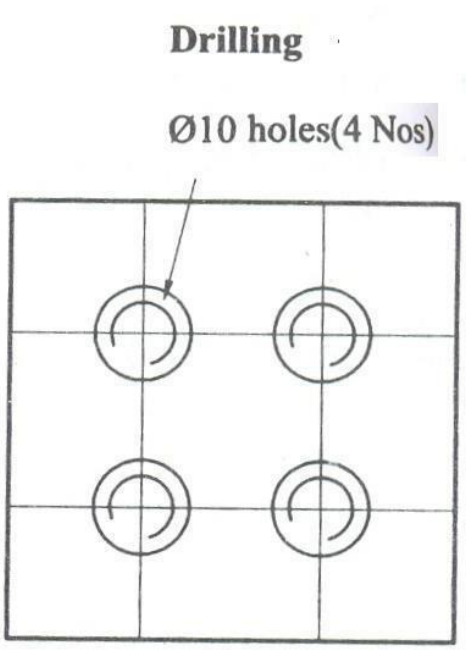
1. The given workpiece is checked for its dimensions.
2. The workpiece is help in the chuck. Chuck key is used to tighten the job firmly, ensuring centre of workpiece.
3. The single point cutting tool is held in the tool post and tighten the nuts using spanner.
4. Facing is done with cutting tool moving from the centre of workpiece towards outside. It is done until the required length of the job is obtained.
5. Turning is done to reduce the diameter of the job. Sufficient depth of cut is given and it is done until the required diameter of the job is obtained.
6. Next the taper turning is done on the workpiece, as per the taper angle already calculated. Then the compound rest base is swivelled and set to half tape angle. Cutting tool is moved at an angle to the lathe axis. Tool is moved by the compound rest hand wheel.
7. Finally, the dimensions of workpiece are again checked.

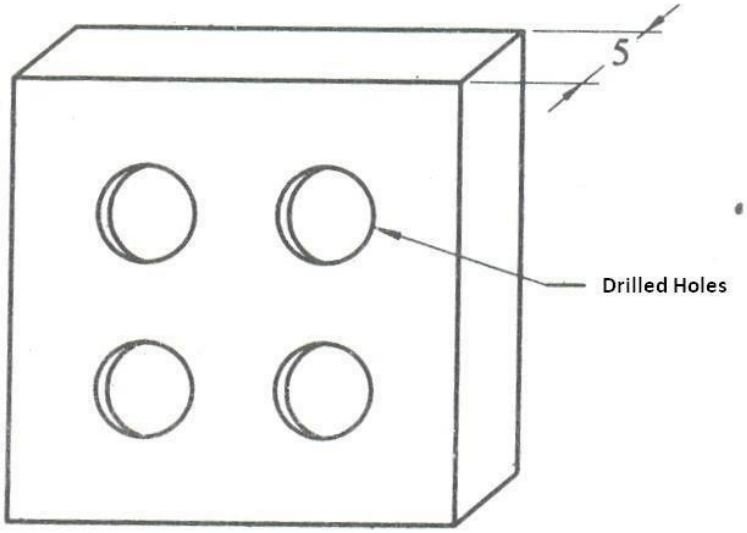
Result:

Thus the required size and shape of the given workpiece is obtained.

DRILLING


Marking & Punching
15
20
15
50


Drilling
Ø10 holes(4 Nos)


5
Drilled Holes

Ex. No: 11 Date:	DRILLING

Aim:

To obtain the required holes on the workpiece by drilling operations.

Materials Used:

50 × 50 × 5 mm Mild Steel plate – 1No.

Tools Required:

1. Bench Vice
2. Machine Vice
3. Steel Rule
4. Standard set of filing tools
5. Try Square
6. Surface plate
7. Vernier height gauge
8. Scriber
9. Dot punch
10. Drill Bit
11. Drilling Machine

Sequence of Operations:

1. Checking
2. Filing
3. Marking
4. Punching
5. Drilling

Procedure:

1. The raw material is checked for its size 50 × 50 × 5 mm using steel rule.
2. The given workpiece is clamped in a vice and any two surfaces are filed to get right angle.
3. Chalk is applied uniformly on the surfaces of the workpiece.
4. With the help of vernier height gauge, surfaces plate, angle plate, steel rule, and scriber, the given dimensions are marked.
5. The midpoint of the required holes is punched by using a dot punch.
6. The punched dots are drilled by drilling machine.
7. After drilling the holes, they are tapped by using tap set.
8. Finally the dimensions are again checked.

Result:

Thus the given workpiece is drilled and tapped to the required dimensions.

STUDY OF SHEET METAL

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.

Sheet metal work is one of the major applications in engineering industry. It has its own significance as useful trade in engineering work.

Application of Sheet Metal:

Sheet metal work is used for making hoppers, funnels, various ducts, chimneys, ventilating pipes, machine tool guards, boilers, etc.

It is also extensively used in major industries like aircraft manufacturing, ship building, automobile body building and fabrication of ducts in air conditioning equipments, etc.

Principle Involved in Sheet Metal Work:

Generally, all the sheet metal work patterns are based on the development of the surfaces of a number of geometrical models like prism, cylinder, pyramid and cone. Besides development of surfaces, geometrical projections are also used for sheet metal work.

General Procedure for Sheet Metal Work:

- The exact size and shape of the sheet to be cut is given by the development of the concerned object.
- The development is drawn on a flat sheet of metal and then the sheet is cut.
- The cut sheet is folded or rolled to the required shape before the joints are made by welding or any other form of fastening.

Tools used in Sheet Metal Work:

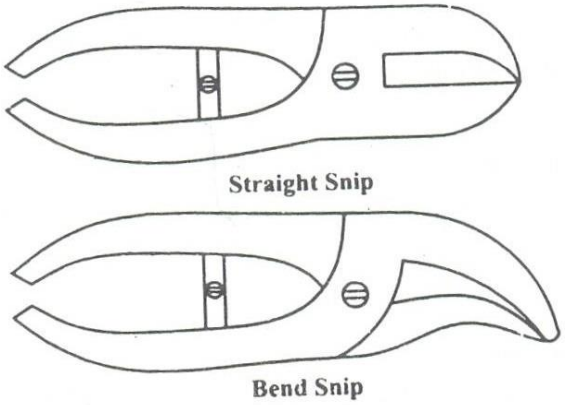
The various types of tools used in sheet metal work are explained below.

1. Cutting Tools:

a) Chisels: Chisels are used in sheet metal work for cutting sheets, rivets, bolts and chipping operations. Though there are many types of chisels available, round nose chisel and flat chisel are mostly used for sheet metal work.

Flat Chisel Round Nose Chisel

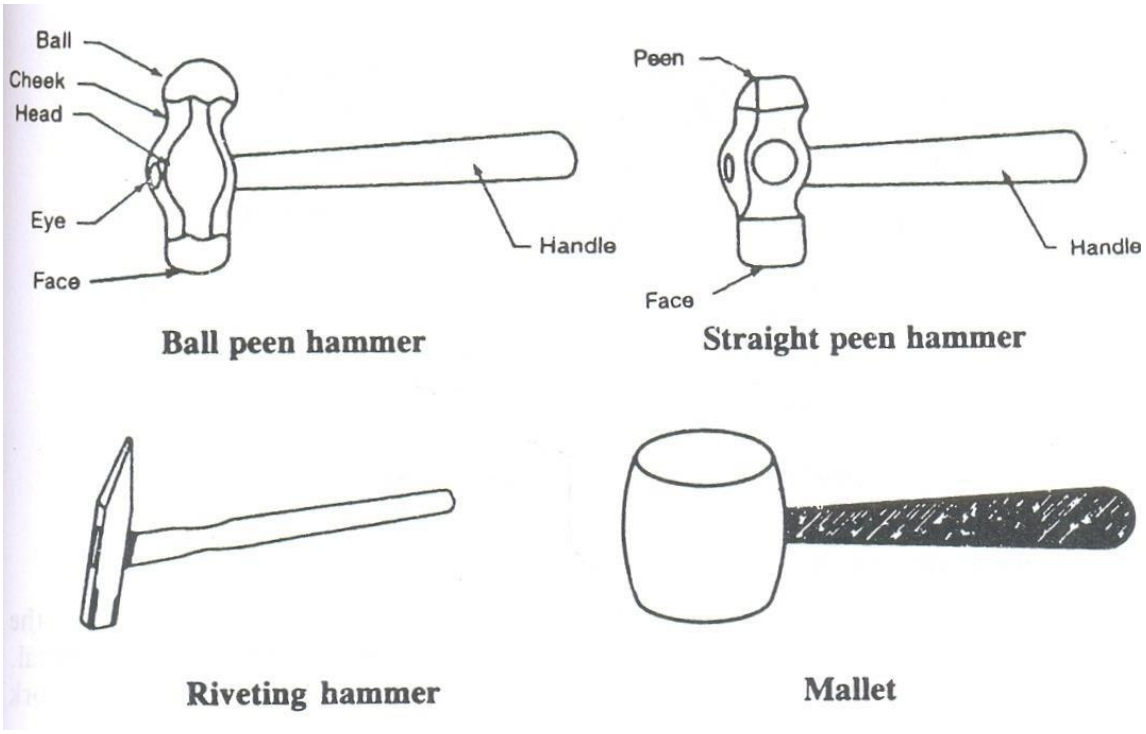
b) Ships (or) Shears: Snips are hand shears, varying in length from 200mm to 600mm. 200mm and 250mm length is most commonly used. In sheet metal work, straight and curved snips are mostly used. **Straight snips** are used for cutting along outsidecurves and straight lines. **Curved snips or bent snips** are used for trimming along inside curves.



2. Striking Tools:

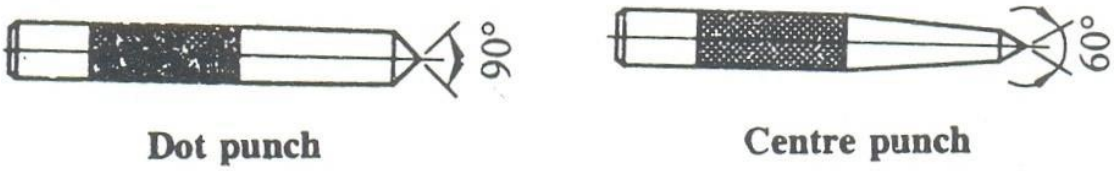
a) Hammers: hammers are used in sheet metal work for hollowing, stretching, levelling, riveting, strengthening of sheet metal joints, etc. The following hammers are mostly used in sheet metal work.

i. Ball peen hammer
ii. Straight peen hammer
iii. Riveting hammer
iv. Mallet



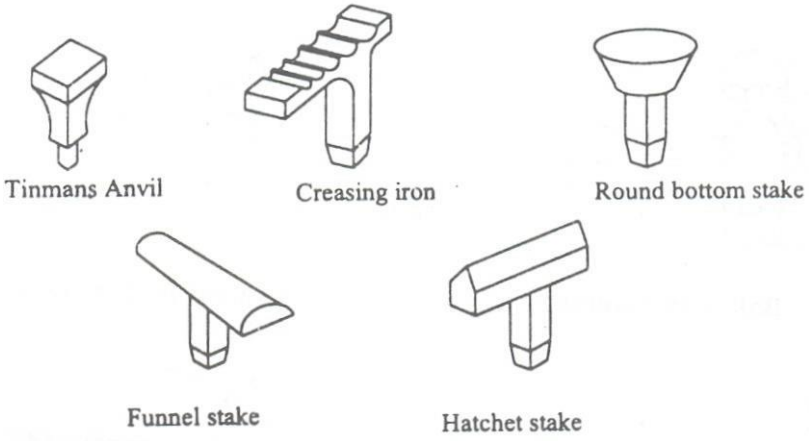
b) Punches: In sheet metal work, punch is used for making out work locating centres etc. the following two types of punches are widely used.

i. Dot Punch ii. Centre Punch



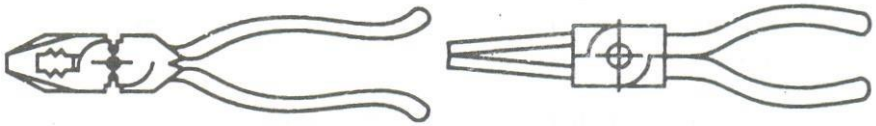
3. Supporting Tools:

Stakes: Stakes are nothing but sheet metal work anvils used for bending, hemming, seaming, forming, etc. using hammers or mallet. The following figure shows different shapes and size of stakes.



4. Bending Tools:

Pliers: Pliers are mainly used for bending the sheet metal to the required shape. It is also used for holding and cutting the sheet metal. Flat nose pliers and round nose pliers are used in sheet metal work for forming and holding work.



Pipe Pliers Round - Nose Pliers

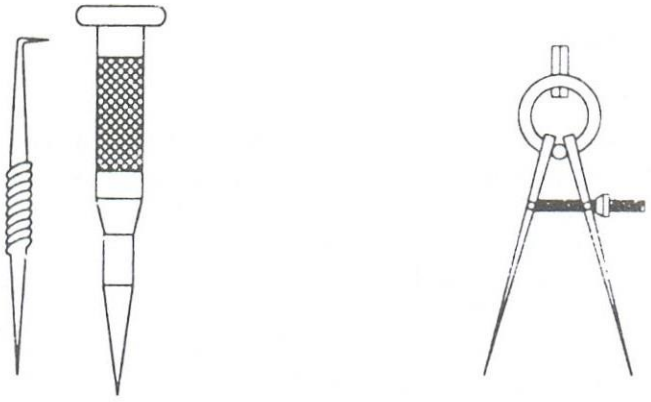
5. Layout Tools:

Steel Rule: It is used for measuring and laying out small work. It can measure with an accuracy of upto 0.5mm.

Steel Rule

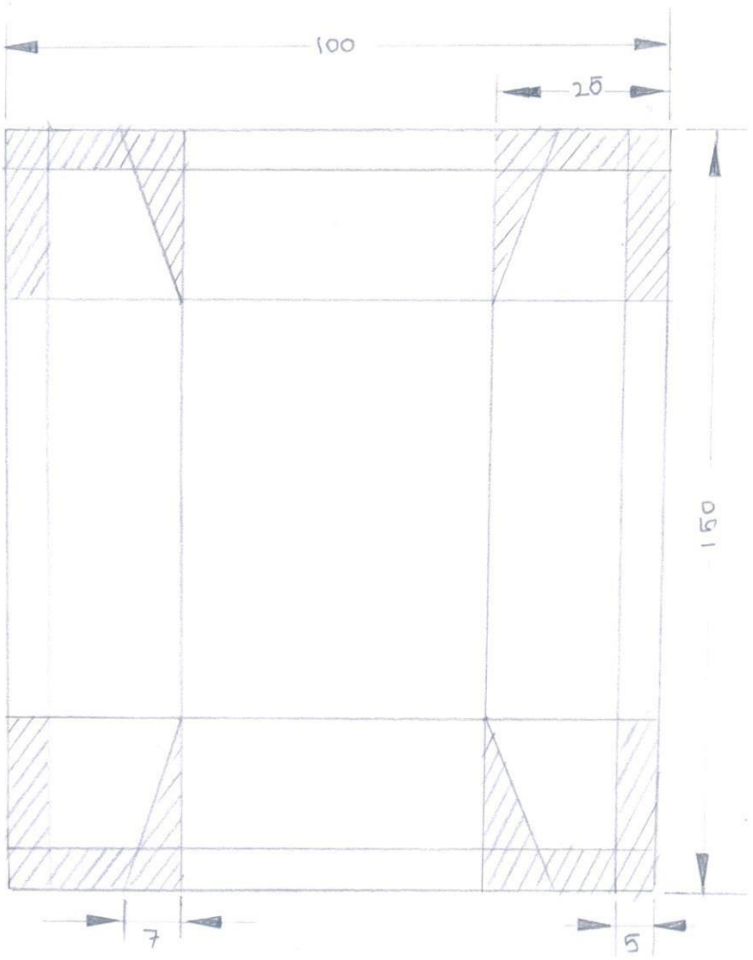
Scriber: It is a long wire of sheet with its one end sharply pointed and hardened to scratch line on sheet metal for laying our patterns.

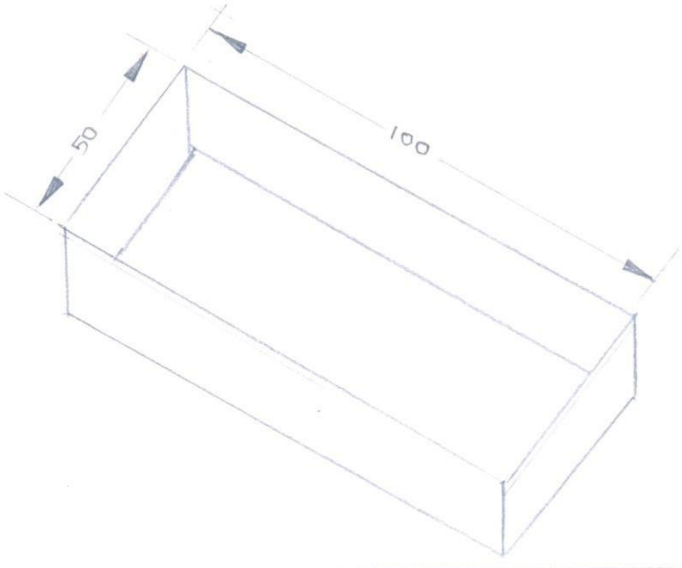
Dividers: Dividers are used for drawing circles or arcs on sheet metal. They are used to mark a desired distance between two points and to divide lines into equal parts.



Scriber Divider

RECTANGULAR TRAY





Ex. No: 12 Date:	RECTANGULAR TRAY

Aim:

To make a rectangular tray from the given sheet metal.

Materials Used:

22 gauge Galvanized Iron (G.I.) sheet.

Tools Required:

1. Steel rule
2. Mallet
3. Scriber
4. Divider
5. Protractor
6. Snips
7. Stakes
8. Rivet Set
9. Ball Peen Hammer

Sequence of Operations:

1. Checking
2. Levelling
3. Marking
4. Cutting
5. Bending
6. Hemming
7. Riveting

Procedure:

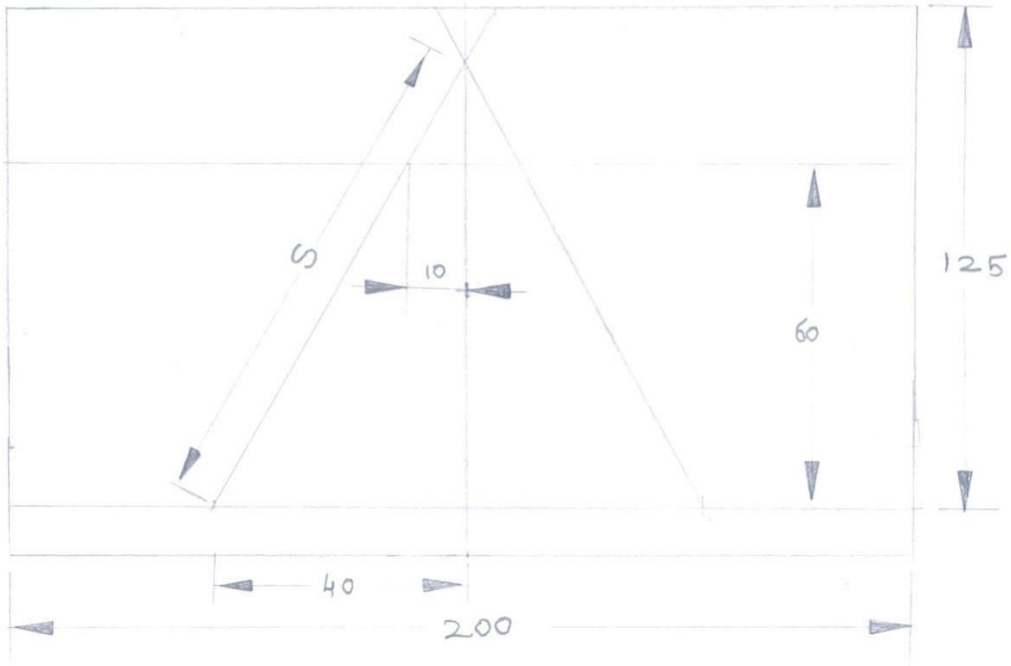
1. The size of the given sheet is checked for its dimensions using a steel rule.
2. Then the sheet is levelled on the levelling plate using a mallet.
3. The development procedure is followed same as square taper tray.
4. The dimensions are marked as shown in the figure.
5. The sheet is cut as per the marked dimensions by straight snips.
6. Then a single hemming is made on the four sides of the tray as shown in the figure.
7. These four sides of the tray are bent to 90° using stakes anvil.
8. Finally all the corners of the tray are joined by riveting.

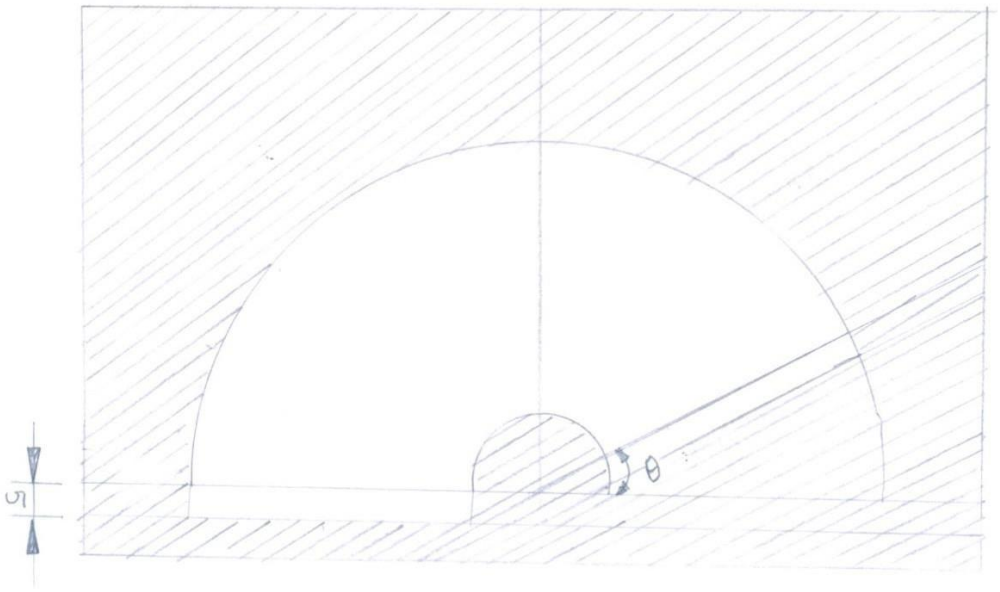
Result:

Thus the desired rectangular tray is made from the given sheet metal.

FUNNEL

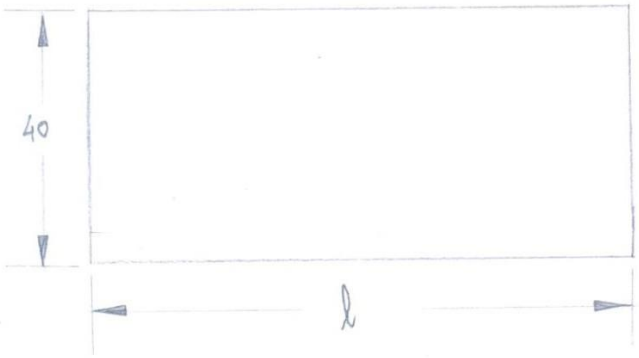
DEVELOPMENT DRAWING

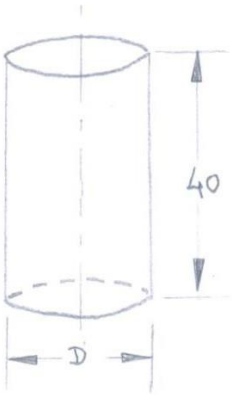




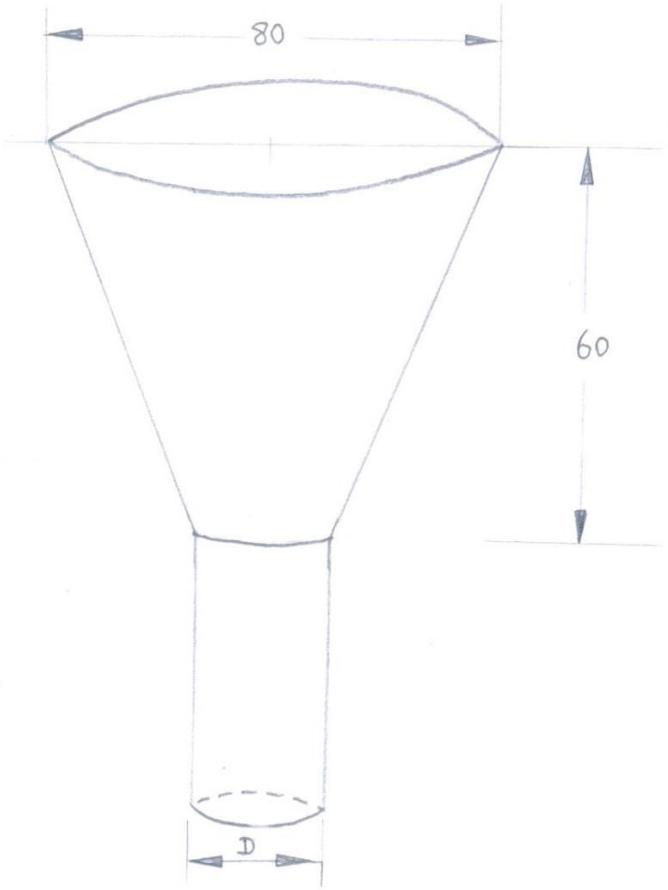
$$\theta = \frac{R}{S} \times 360^{\circ}$$

ALL DIMENSIONS ARE IN `mm'





$l = \pi D$



Ex. No: 13 Date:	FUNNEL

Aim:

To make a funnel from the given sheet metal.

Materials Used:

22 gauge Galvanized Iron (G.I.) sheet.

Tools Required:

1. Steel rule
2. Mallet
3. Scriber
4. White paper
5. Groover
6. Snips
7. Solder
8. Ball Peen Hammer

Sequence of Operations:

1. Checking
2. Levelling
3. Marking on paper
4. Marking on Sheet Metal
5. Cutting
6. Folding
7. Hemming
7. Soldering

Procedure:

1. The size of the given sheet is checked for its dimensions using a steel rule.
2. The required development of surface is being made on the white paper which is overlapped on the sheet metal.
3. The marking is done on the sheet metal as per the development being done on the paper.
4. Now using straight snips, unwanted materials are removed.
5. Now fold and bend the workpiece to make the funnel shape and joint is made on the workpiece.
6. Then using groover, locked grooved joint is made for about 5 mm. Also, hemming is done in the bottom of the funnel.
7. In between top face and bottom face, butt joint is made using solder.
8. Finally, trimming and finishing operation are being carried out.

Result:

Thus the funnel of the required dimensions is made from the given sheet metal.

STUDY OF CENTRIFUGAL PUMP

Introduction:

The pump is a hydraulic machine which converts the mechanical energy into hydraulic energy in the form of pressure energy. The centrifugal pump is a hydraulic machine which converts the mechanical energy into pressure energy by means of centrifugal force.

Working Principle:

The centrifugal pump works on the principle of forced vortex flow which means that when a certain mass of liquid is rotated by an external torque, the rise in pressure head of the rotating liquid takes place.

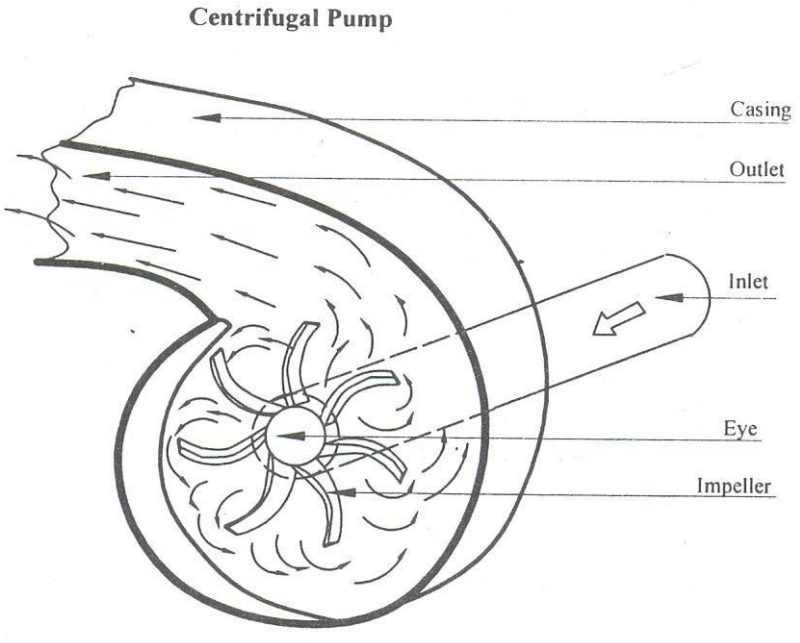
The rise in pressure head at any point of the rotating liquid is proportional to the square of tangential velocity of the liquid at that point of the rotating liquid is proportional to the square of tangential velocity of the liquid at that point (i.e., Rise in pressure head). Thus at the outlet of the impeller, where radius is more , the rise in pressure head will be more and the liquid will be discharged at the outlet with a high pressure head. Due to this high pressure head, the liquid can be lifted to a high level.

Main Parts of a Centrifugal Pump:

The following are the main parts of a Centrifugal Pump.

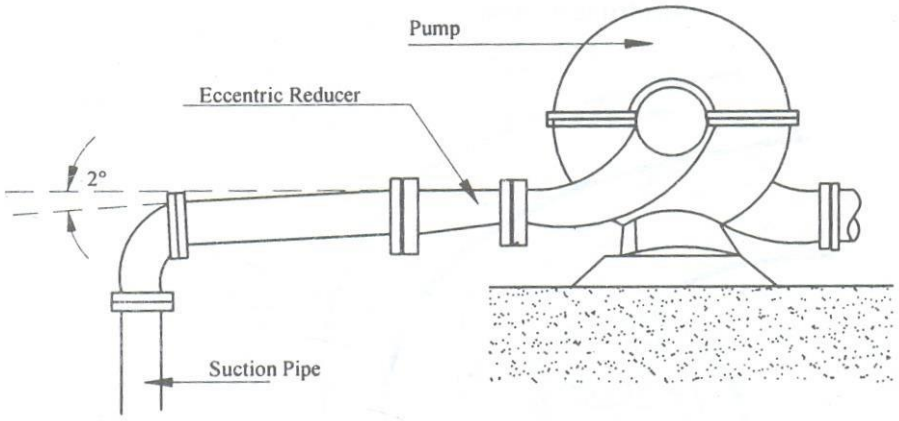
1. Suction pipe
2. Impeller
3. Casing
4. Delivery pipe

All the main parts of the centrifugal pump are shown in the following figure.



Suction Pipe:

A pipe whose one end is connected to the inlet of the pump and other end dips into water in a sump is known as suction pipe. A foot valve which is a non-return valve or one-way type of valve is fitted at the lower end of the suction pipe. The foot valve opens only in the upward direction. A strainer is also fitted at the lower end of the suction pipe for filtering purpose.



Impeller:

The rotating part of a centrifugal pump is called 'impeller'. It consists of a series of backward curved vanes. The impeller is mounted on a shaft which is connected to the shaft of an electric motor which runs the pump.

Casing:

Casing is an air tight passage surrounding the impeller and is designed in such a way that the kinetic energy of the water discharged at the outlet of the impeller and is converted into pressure energy before the water leaves the discharged at the outlet of the impeller is converted into pressure energy before the water leaves the casing and enters the delivery pipe.

The following three types of the casing are commonly adopted:

i. Volute Casing
ii. Vortex Casing
iii. Diffuser Casing

i. Volute Casing:

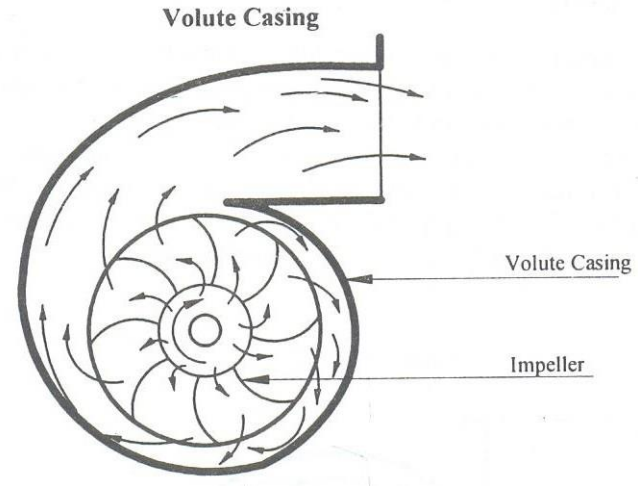
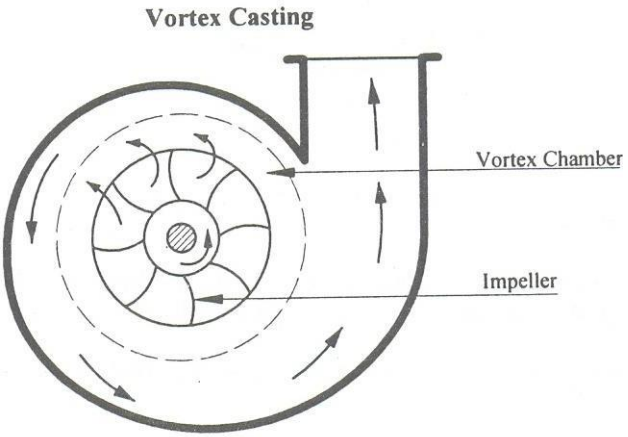


Figure shows the volute casing, which surrounds the impeller. It is of spiral type in which area of flow increases gradually. The increase in area of flow decreases the velocity of flow. The decrease in velocity increases the pressure of the water flowing through the casing. It has been observed that in case of volute casing, the efficiency of the pump increases slightly as a large amount of energy is lost due to the formation of eddies in this type of casing.

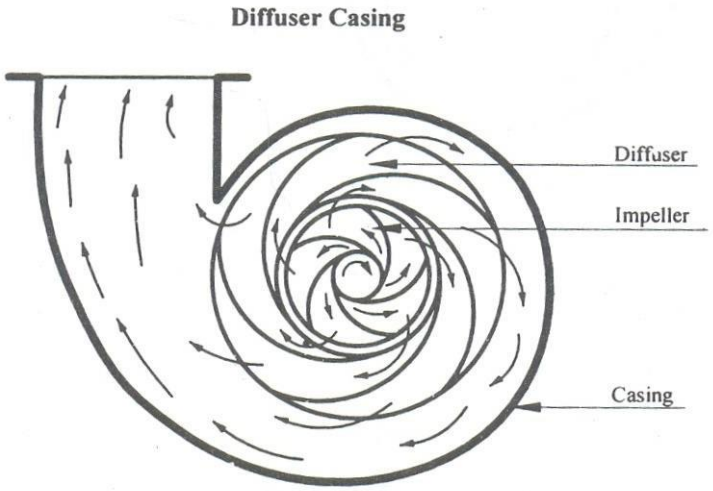
ii. Vortex Casing:

If a circular chamber is introduced between the casing and the impeller as shown in figure, the casing is known as Vortex Casing. By introducing the circular chamber, the loss of energy due to

the formation of eddies is reduced to a considerable extent. Thus the efficiency of the pump is more than the efficiency when only volute casing is provided.



iii. Diffuser Casing:



This casing is shown in figure in which the impeller is surrounded by a series of guide blades mounted on a ring which is known as diffuser. The guide vanes are designed in which a way that the water from the impeller enters the guide vanes without stock. Also the area of the guide vanes increases, thus reducing the velocity of flow through guide vanes and consequently increasing the pressure of water. The water from the guide vanes then passes through the surrounding casing which is in most of the cases concentric with the impeller as shown in figure.

Delivery Pipe:

A pipe whose one end is connected to the outlet of the pump and other end delivers the water at a required height is known as delivery pipe.

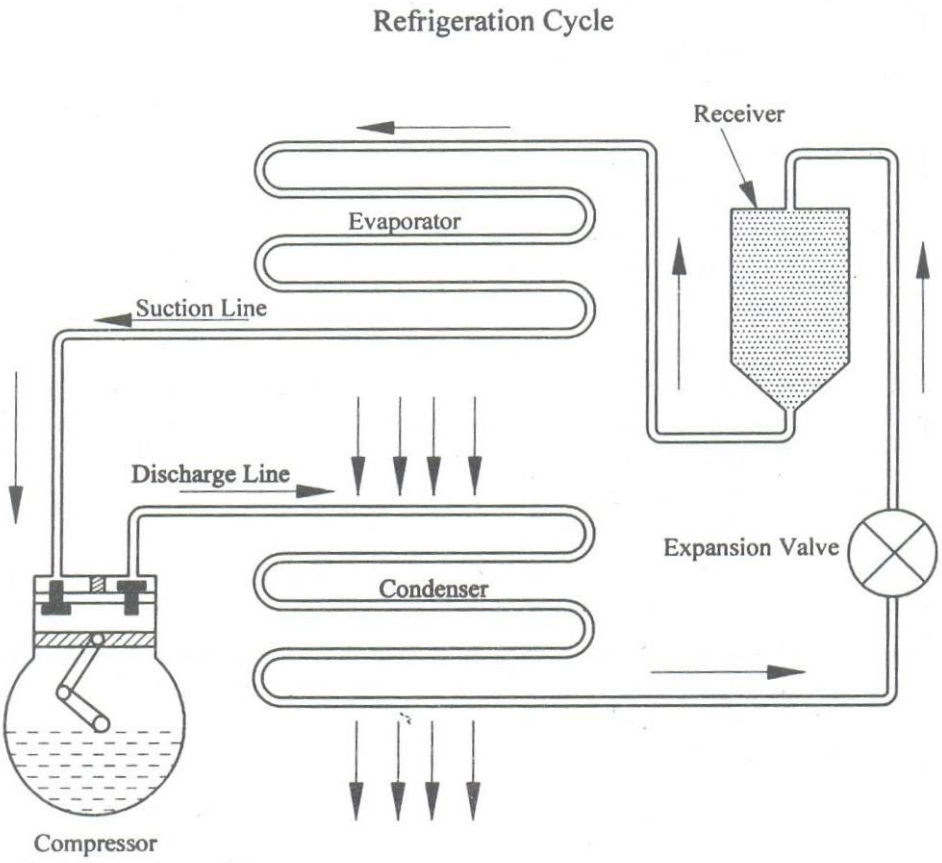
STUDY OF AIR CONDITIONER

Introduction:

An Air-Conditioner is defined as an assembly of different parts of the system used to produce a specified condition of air within a required space or building below that of the atmosphere or surroundings.

An ideal air-conditioner should maintain correct temperature, humidity and air movement etc. generally a small domestic air conditioning plant having the capacity of 0.5 ton. In a window air conditioner all the components are located in a box.

Mechanism:



An air-conditioning system works on vapour compression cycle. This cycle works in following four phases.

1. Compression
2. Condensation
3. Expansion
4. Evaporation

Compression:

Compression takes place at the compressor. The low pressure, low temperature dry refrigerant or coolant vapour is drawn from the evaporator into the compressor cylinder during suction stroke of the compressor. During compression stroke, pressure and temperature of the vapour increases until the vapour temperature is greater than the temperature of condenser cooling medium (Air or water). This high pressure and high temperature vapour passes out to the condenser through discharge line.

Condensation:

In the condenser, the high pressure and high temperature refrigerant vapour rejects heat to cooling medium thus allowing the vaporised refrigerant to return to liquid state.

Expansion:

After condenser, the liquid refrigerant is stored in the liquid receiver until needed. Then it is passes through an expansion device (i.e. expansion valve). Due to the expansion the high pressure is reduced very much to allow the vaporisation of liquid at a very low temperature of about –10°C.

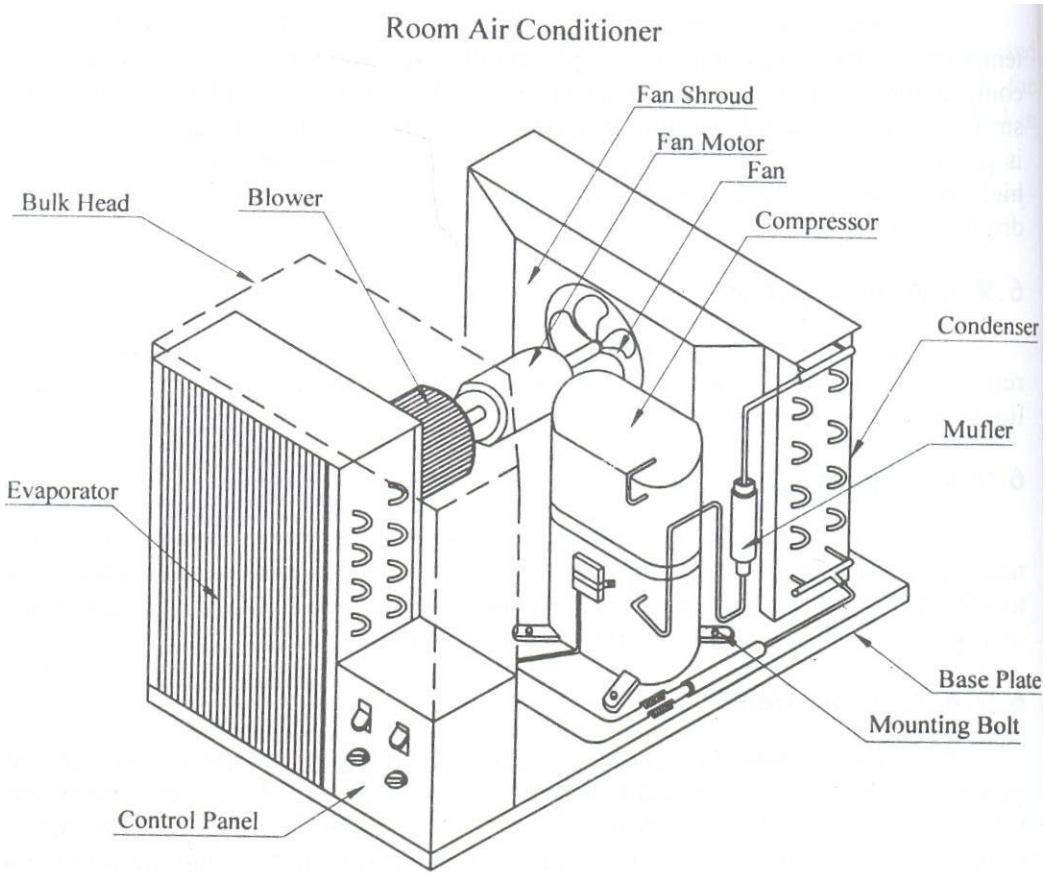
Evaporation:

Then the low pressure low temperature refrigerant vapour enters into the evaporator. Where a considerable amount of heat is absorbed from the surrounding by the refrigerant. After absorbing heat from the surrounding, the liquid refrigerant changes to vapour state. Then the refrigerant vapour again moves into the compressor through the suction line. Again the vapour compression cycle is repeated.

Main parts of an Air-Conditioner:

The following are the main parts of an air-conditioner.

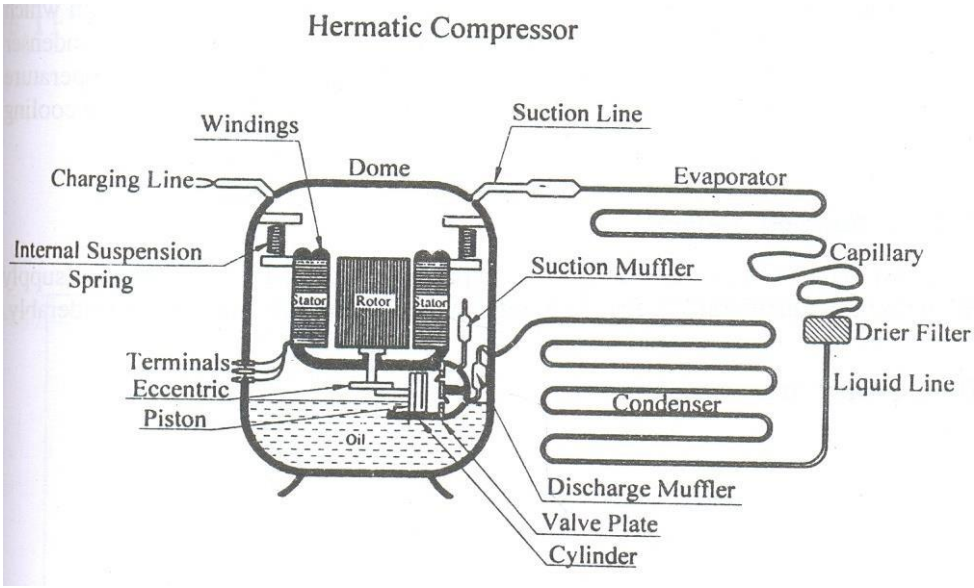
1. Compressor
2. Condenser
3. Expansion device
4. Evaporator
5. Fan



Compressor:

The most important part of the air-conditioner is hermatic compressor (also called searled compressor). In this hermatic compressor, the rotary compressor and motor are assembled together

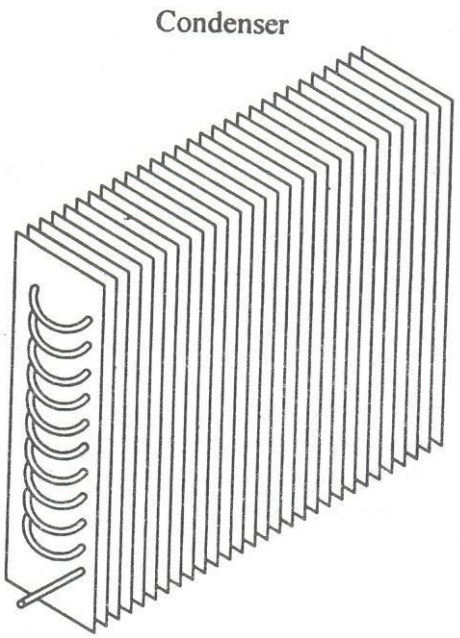
and suspended inside a metal casing called “Dome”. The motor located above the compressor operates horizontally.



RSIR (Resistant Start Induction Run) or CSIR (Capacitor Start Induction Run) type motor is used to operate the compressor. Function of the compressor is to provide the necessary pumping action to the refrigerant. It draws cold refrigerant vapour and to raise its temperature and pressure to such a point so that it may be easily condensed with normally available condensing medium. It also maintains a continuous flow of the refrigerant through the system.

Condenser:

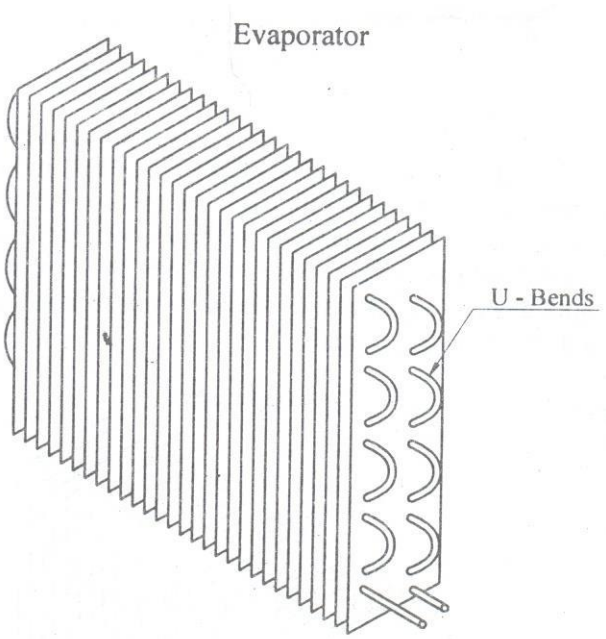
Function of the condenser is to provide hear transfer surface through which heat passes from the refrigerant to the condensing medium. Normally the condenser is made by copper aluminium or iron pipe. Here the high pressure high temperature vapour refrigerant becomes to liquid state by losing heat because of the cooling medium.



Expansion Devise:

An expansion valve is used as an expansion device. Its function is to supply proper amount of refrigerant to the evaporator after reducing its pressure considerably.

Evaporator:



Its function is to provide a heat transfer surface through which heat can pass from the air-conditioned space into the vaporizing refrigerant. The pressure inside the evaporator is low and the liquid refrigerant vaporises by absorbing heat from the air surrounding the evaporator. The low pressure low temperature vapour thus formed moves into the compressor through the suction line. The evaporator also made of copper aluminium or iron pipe.