# ST. ANNE'S

## COLLEGE OF ENGINEERING AND TECHNOLOGY

ANGUCHETTYPALAYAM, PANRUTI – 607110.

## DEPARTMENT OF MECHANICAL ENGINEERING


### II YEAR – III SEMESTER

## ME 8361 MANUFACTURING TECHNOLOGY

## LABORATORY – I

**Name:** _____

**Roll No:** _____

**Reg No:** _____

**Dept:** _____

## SYLLABUS: ME 8361 MANUFACTURING TECHNOLOGY LAB – I

**OBJECTIVE**

To gain hands on experience on working of general-purpose machine tools and on various manufacturing processes.

**LIST OF STUDY**

- Study of lathe
- Study of welding
- Study of sheet metal
- Study of foundry
- Study of shaping machine

**UNIT I LATHE**

1.1. Facing, plain turning and step turning
1.2. Taper turning using compound rest, Tailstock set over, etc
1.3. Single and Multi-start V thread, cutting and knurling
1.4. Boring and internal thread cutting.

**UNIT II WELDING EXCERCISES**

2.1. Horizontal and Vertical welding.

**UNIT III SHEET METAL WORK**

3.1. Fabrication of sheet metal tray
3.2. Fabrication of a funnel

**UNIT IV PREPARATION OF SAND MOULD**

4.1. Mould with solid, split patterns
4.2. Mould with loose-piece pattern
4.3. Mould with Core

**UNIT IV SHAPING MACHINE**

5.1 Square Head Shaping
5.2 Hexagonal Head Shaping

Total Number of Periods: P = 45

# SAFETY PRECAUTION

- Always wear uniform, shoes and gloves for safety
- Never operate any machines until you have been instructed properly
- Always wear goggles to protect your eyes from flying chips.
- Never hold the job when the machine runs.
- Never give heavy cut on longer job
- Never change the gear and belt when the machine is running
- Always use the correct size spanner and tool for fitting and removing of tool
- Never try to clear the chips when the machine is running
- To prevent accident, clean the spilled oil and grease immediately
- Always clear the area around the machine and machine tool surface
- Leather shoes or boots with steel toes are recommended.
- No open toed shoes or sandals are allowed in the shop.
- Do not wear loose clothing. Cotton clothes are best to wear.
- Remove all jewelry and tie back long hair.
- Do not operate any machine equipment unless you have been instructed on its proper use and the safety risks involved with the machining operation.
- Do not leave any machinery or power tools running and unattended.
- Clean up metal shavings, oil, etc. from machine tools after use; pick up after yourself and return tools to their proper storage area.
- Wear closed toe shoes and appropriate clothing
- Don’t run, push or surprise other students. No horse play will be tolerated
- Don't eat, drink, or smoke, in the laboratory
- Always listen carefully to the teacher and follow instructions.
- Do not run in the workshop, you could ‘bump’ into another pupil and cause an accident.
- 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 machines.
- Always wear an apron as it will protect your clothes and hold loses clothing such as ties in place.
- When attempting practical work all stools should be put away.
- Bags should not be brought into a workshop as people can trip over them.
- 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.
- Do not use a machine if you have not been shown how to operate it safely by the teacher.
- Always be patient, never rush in the workshop.
- Always use a guard when working on a machine.
- Keep hands away from moving/rotating machinery.
- Use hand tools carefully, keeping both hands behind the cutting edge.
- Report any damage to machines/equipment as this could cause an accident.

# CONTENT

| EX NO - 1 | STUDY OF LATHE |
|---|---|

## INTRODUCTION

Lathe is a machine tool which is used to perform several operations on the work piece. Lathe is useful in making several parts which is further assembled to make new machine. Hence, lathe is known as "mother of machine".

## BASIC WORKING PRINCIPLE

In lathe, the work piece is held in the chuck, a working holding device. The cutting tool is mounted in the tool post. The chuck is rotated by means of power. When the chuck rotates, the work piece also rotates. The tool is moved against the rotating work piece by giving small amount of depth of cut. The material is removed in the form of chips. Continuous feed and appropriate depth of cut is given until the required dimension of the work piece is obtained.

## TYPES OF LATHE:

There are different types of lathe machine they are,

- ✓ Centre lathe
- ✓ Production lathe
- ✓ Capstan lathe
- ✓ Turret lathe
- ✓ Auto lathe

## DESCRIPTION OF LATHE

Lathe is a machine tool which is made up of several parts,

### 1. BED

It is the base of the machine on its left side. The head stock is mounted. A movable casting is called tail stock which is mounted on the right side. The legs of the bed have holes to bolt down and ground of lathe.

### 2. HEAD STOCK

It consists of a hollow spindle; gear's and speed change levers. It is used to transmit motion to the job. There are two types of head stock.

1.Belt driven head stock

2.Geared head stock

### 3. CARRIAGE

Carriage is used to carry a tool to bring in conduct with rotating work piece or to withdraw from such a contact. It operates on bed ways between the head stock and tail stock.

### 4. SADDLE

It is an "H" shaped part fitted on the lathe bed. There is a hand wheel to move it on the bed way. Cross slide, compound rest, too post is fitted on this saddle.

### 5. CROSS SLIDE

It is on the upper side of saddle in the form of dove tail. A hand wheel is provided to drive the cross slide. It permits the cross wise movement of the tool i.e., movement of tool towards or away from the operator.

### 6. COMPOUND REST

It is fitted over the cross slide on a turn table. It permits both parallel and angular movements to cutting tool.

**7. TOOL POST**

It is fitted on the top most part of compound rest. Tool is mounted on this tool post. Cutting tool is fixed in it with the help of screw.

**8. APRON**

It is the hanging part in front of carriage. It accommodates the mechanism of hand and power feed to the cutting tool for carrying out different operations.

**9. LEAD SCREW**

It is a long screw with ACME threads. It is used for transmitting power for automatic feed or feed for thread cutting operation.

**10. TAIL STOCK**

It is located at the right end of the lathe bed and it can be positioned anywhere in the bed. Itis used for supporting lengthy jobs and also carries tool to carry out operations such as tapping, drilling, reaming.

**WORK HOLDING DEVICE**

**1.LATHE CENTRE:**

They are used to support work. It has two categories of centers.

- Live Centre is one which is fitted in the head stock
- Dead Centre is one which is fitted in the tailstock

**2.CHUCK:**

- It is a device used to hold a job. It is easily fitted on the thread cut on the end of head stock spindle.
- Various types of chuck are
  - a) Two jaw chuck
  - b) Three jaw chuck
  - c) Four jaw chuck
  - d) Collet chuck
  - e) Magnetic chuck

**3.FACE PLATE:**

- It is a circular plate and it is screwed to lathe spindle
- It is used for mounting the type of jobs which cannot be held by chucks.
- There are number of holes and slots on the face of the plate.

**4.CATCH PLATE:**

- It is a plain disc of steel or cast iron
- It is screwed to the nose of the head stock spindle.
- It is used to drive the work piece through a carrier or dog when it is held between the centres.

**5.LATHE CARRIERS OR DOGS**:

- It is used for transferring the motion from the rotating driving plate to thework held between the centres.
- It is used for connecting end of work piece to the driving plate
  - ✓ The types of Dogs are
    - a. Bent tail
    - b. Straight tail
    - c. Clamp type

**6. STEADY REST:**

- It supports long work piece it is when machined between the centres or by a chuck.
- It is used for cylindrically long jobs. Two types of steadily rest are
    a. Fixed steady rest.
    b. Travelling steady rest.

**7. MANDREL:**

- It is used for holding hollow jobs.
- It is a hardened piece of round bar for holding bored or reamed jobs. It has drill holes at both the ends.
- Work piece is mounted over the mandrel and the mandrel is rotated between centers.

**8. FOLLOWER REST:**

- It is made of cast iron and is used for supporting long slender work pieces against the cutting tool forces.
- It can be clamped to the carriage
- It has two adjustable jaws to support the work piece.
- The two supporting jaws of the rest resist the cutting forces. To reduce the damage to the finished surfaces of the jobs, the jaws are normally made of brass.

**CUTTING TOOL USED**

For making a finished job on lathe machine, various types of cutting tools are used. One of them is single point cutting tool which is used to perform several operations on the work piece. Various types of cutting tools are,

1.Facing tool

- It is used for facing the longitudinal ends of the job. Its shape is like a knife.

2.Rough turning tool

- It is used to remove excess material from the work piece in quick time.
- It can be used to give large depth of cut and works at coarse feed.

3.Finishing tool

- It is used for getting smooth finish on the work piece
- Its point is a little rounder.

4.Radius tool

- Jobs which need round cutting are done with this tool. Its types are
    i. Concave radius tool'
    ii. Convex radius tool'

5.Parting tool

- It is used to cut the job into two parts
- It is also used for grooving.

6.Form turning tool

- It is used for jobs which require both convex and concave turning.

7.Thread cutting tool

- It is used for making internal or external threads on the work piece.
- The tool nose is designed with a definite profile for making threads.

8.Drill tool

- It is used for making hole of various diameters on the job.
- Drill bit of various sizes of diameter are available.

9.Boring tool

- It is used for enlarging the drilled hole.

10. Knurling tool

- Drawing slanting or square projecting lines on the surface of a job is known as knurling.
- It is used for making better grip on the surface of a job.

**TOOL MATERIALS**

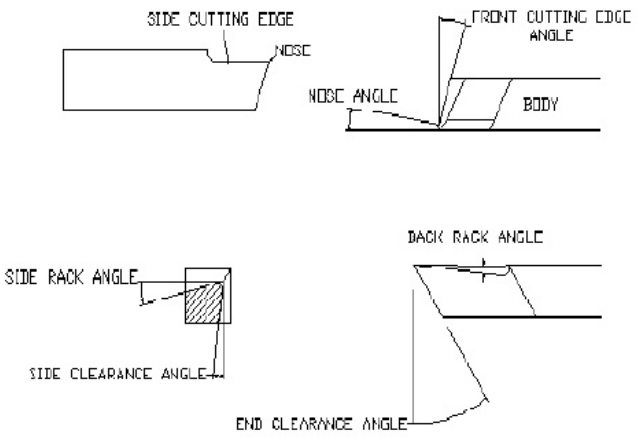
1.The single point lathe cutting tools are made of high-speed steel (H.S.S)

2.The main alloying elements in 18-4-1 HSS tools are 18% tungsten, 4% chromium and 1%vanadium. 5 to 10 % cobalt is also added to improve the heat resisting properties of the tool.

3. General purpose hand cutting tools are usually made from high carbon steel or tool steel.

4.Carbide tipped tools fixed in tool holders, are mostly used in production shops.

**TOOL SIGNATURE**




**CUTTING TOOLS ANGLES**

1.TOP RAKE ANGLE (Back rake angle)

If the shop is given to the surface of the tool and if this slope is along the tool's length then it is called top rake angle. It is usually 15° to 20°

2.SIDE RAKE ANGLE

If the shop is given to the face or top of the tool along the tool's width then it is called side rake angle. It lies between 6° and 15°.

3.CLEARANCE ANGLE (Relief angle)

Types: 1. Side clearance and

2. End clearance angle

They are provided to keep the surface of the tool clear of the work piece.

4.CUTTING EDGE ANGLES

Types:

1.Side cutting edge angle – (generally 15°) it is an angle, the Side cutting edge makes with the axis of the tool.

2. End cutting edge angle – (from 7° to 15°) it is an angle, the end cutting edge makes with the width of the tool.

5.LIP ANGLE (Cutting angle)

Angle between the face and the end surface of the tool.

6.NOSE ANGLE

Angle between the side cutting edge and end cutting edge.

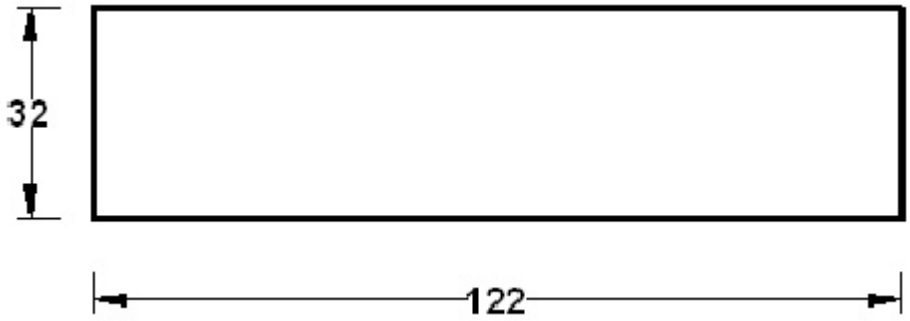
**MARKING AND MEASURING TOOLS**

1.Steel rule
2.Vernier caliper
3.Vernier height gauge
4.Scriber
5.Try square
6.Dot punch
7.Surface plate.

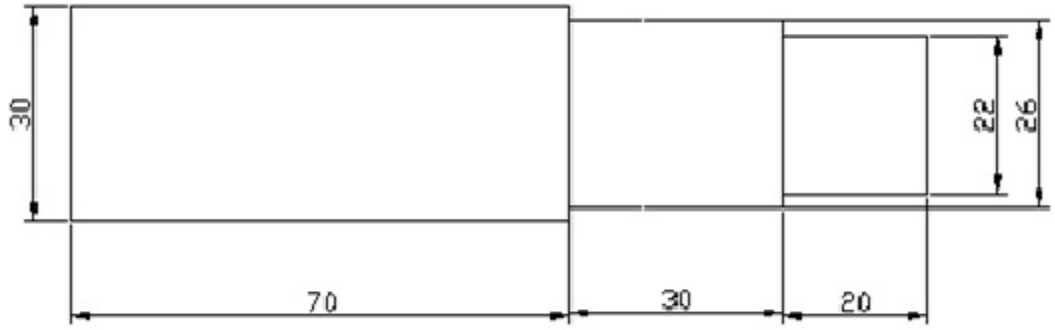
**Operations used in lathe**

- ✓ Facing
- ✓ Turning
- ✓ Drilling
- ✓ Knurling
- ✓ Tapering

**BEFORE MACHINING**




**AFTER MACHINING**




**ALL DIMENSIONS ARE IN “mm”**

**TOLERANCES OF RANGE 0.02**

| EX NO - 2 | FACING, PLAIN TURNING AND STEP TURNING |
|---|---|

**AIM:**

To obtain the required shape and size of the work piece by machining operations.

**MATERIAL SUPPLIED:**

Φ 32 x 122mm length

**TOOLS REQUIRED:**

Lathe, cutting tool, Scriber, Vernier caliper, Vernier height gauge, Try square.

**MACHINE SPECIFICATION:**

| | | |
|---|---|---|
| Name of machine | : | Centre lathe |
| Type of drive | : | "V" pulley belt drive |
| Power required | : | 1 HP single phase |
| No. of spindle speed | : | 16 |
| Type of chuck | : | Three jaw self-centering chuck |
| Length of lathe bed | : | 1390mm |
| Height of the centre | : | 163mm |
| Swing dia over carriage: | | 190mm |
| Swing dia over bed | : | 330mm |

**SEQUENCE OF OPERATIONS**

1. Checking
2. Work piece setting
3. Tool setting
4. Facing
5. Plain turning
6. Step turning

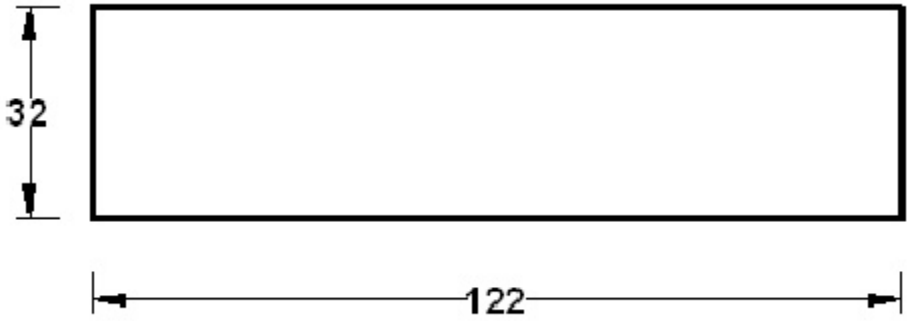
**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The work piece is held in the chuck. Chuck key is used to tighten the job firmly, ensuring centering of work piece.
3. The single point cutting tool is held in the tool post and tightens the nuts using spanner
4. Facing is done with cutting tool moving from the centre of work piece towards outside. It is done until 120mm length of the job is obtained.
5. Turning is done to reduce the diameter of the job. Sufficient depth of cut is given and itis done until the Φ30mm diameter of the job is obtained.
6. Then the step turning feed Φ26 and 50mm length is done in one end so that the work piece is rest to other side and then the work piece is machined as Φ22X20mm.
7. Finally, the dimensions of work piece are again checked.

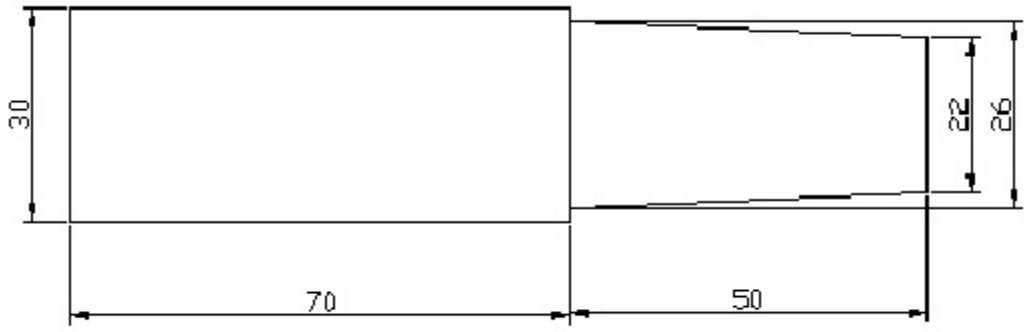
**RESULT:**

Thus, the job is machined as per the drawing in the given work piece and the dimensions are inspected using Vernier caliper.

**BEFORE MACHINING**




**AFTER MACHINING**




**ALL DIMENSIONS ARE IN “mm”**

**TOLERANCES OF RANGE 0.02**

| EX NO - 3 | TAPER TURNING |
|---|---|
| | |

**AIM:**

To obtain the required shape and size of the work piece by machining operations.

**MATERIAL SUPPLIED:**

Φ 32 x 122mm length

**TOOLS REQUIRED:**

Lathe, cutting tool, Scriber, Vernier caliper, Vernier height gauge, Try square.

**MACHINE SPECIFICATION:**

| | | |
|---|---|---|
| Name of machine | : | Centre lathe |
| Type of drive | : | "V" pulley belt drive |
| Power required | : | 1 HP single phase |
| No. of spindle speed | : | 16 |
| Type of chuck | : | Three jaw self-centering chuck |
| Length of lathe bed | : | 1390mm |
| Height of the Centre | : | 163mm |
| Swing dia over carriage: | | 190mm |
| Swing dia over bed | : | 330mm |

**SEQUENCE OF OPERATIONS:**

1. Checking
2. Work piece setting
3. Tool setting
4. Facing
5. Plain turning
6. Taper turning

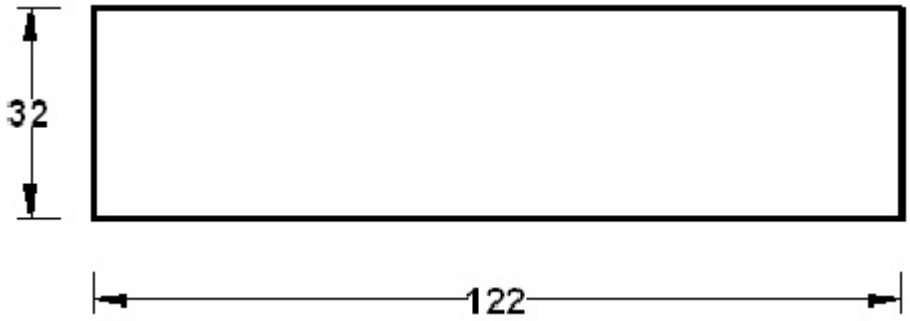
**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The work piece is held in the chuck. Chuck key is used to tighten the job firmly, ensuring centering of work piece.
3. The single point cutting tool is held in the tool post and tightens the nuts using spanner
4. After setting the work piece and cutting tool is proper manner the tool is aligned then the facing of work piece is done on both sides for the required length of120mm.
5. A counter sinking hole is drilled in one face using combination drill chuck through tailstock.
6. Turning is done to reduce the diameter of the job. Sufficient depth of cut is given and I tis done until the Φ30mm diameter of the job is obtained.
7. Then the step turning feed Φ26 and 50mm length is done in one end so that the work piece is rest to other side and then the work piece is machined as Φ22 X20mm.
8. Using the formula Tan-1(D-d/2L) calculate the angle for the taper machined.
9. Tilting the compo slide for required angle and machine the taper to the 50mm length.
10. Finally all the dimensions of work piece are again checked.

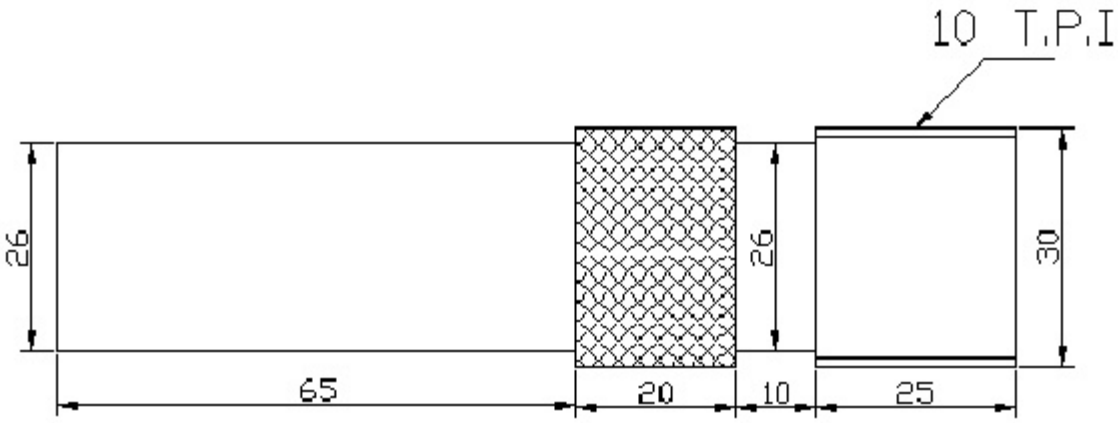
**RESULT:**

Thus, the job is machined as per the drawing in the given work piece and the dimensions are inspected using Vernier caliper.

**BEFORE MACHINING**




**AFTER MACHINING**




**ALL DIMENSIONS ARE IN "mm"**

**TOLERANCES OF RANGE 0.02**

| EX NO - 4 | THREAD CUTTING AND KNURLING |
|---|---|

**AIM:**

To obtain the required shape and size of the work piece by machining operations.

**MATERIAL SUPPLIED:**

Φ 32 x 122mm length

**TOOLS REQUIRED:**

Lathe, cutting tool, Scriber, Vernier caliper, Vernier height gauge, Try square.

**MACHINE SPECIFICATION:**

| | | |
|---|---|---|
| Name of machine | : | PL – 4 Lathe |
| Type of drive | : | "V" pulley belt drive |
| Power required | : | 1 HP single phase |
| No. of spindle speed | : | 16 |
| Type of chuck | : | Three jaw self-centering chuck |
| Length of lathe bed | : | 1390mm |
| Height of the Centre | : | 163mm |
| Swing dia over carriage: | | 190mm |
| Swing dia over bed | : | 330mm |

**SEQUENCE OF OPERATIONS:**

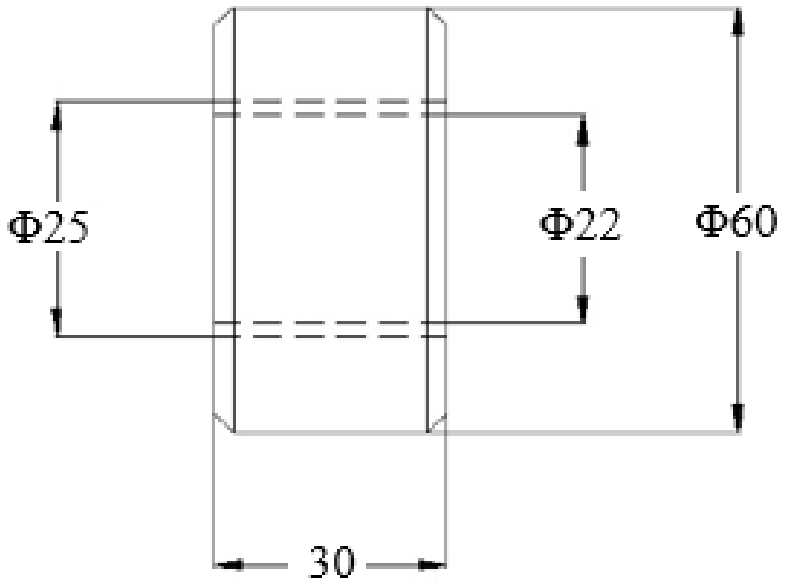
1. Checking2. Work piece setting3. Tool setting4.Facing 5. Plain turning 6. Taper turning7. Recessing

**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The work piece is held in the chuck. Chuck key is used to tighten the job firmly, ensuring centering of work piece.
3. The single point cutting tool is held in the tool post and tightens the nuts using spanner.
4. After setting the work piece and cutting tool is proper manner the tool is aligned then the facing of work piece is done on both sides for the required length of 120mm.
5. A counter sinking hole is drilled in one face using combination drill chuck through tailstock.
6. Then the step turning forΦ26X65mm, Φ30X20mm, Φ26X10mm and Φ30X25mm are machined in the work piece.
7. We know Nominal outside diameter (OD=30mm) and the number of threads per inch (TPI=10) desired. From this, we can calculate: Pitch Diameter = [OD-(.6495/TPI)] Cutting Depth (Cross Slide) = (.7587/TPI)
8. After arranging the gear's the cut of 10 TPI on Φ30mm on work piece thread cutting tool is used in tool post.
9. For right hand thread, the lead screw rotates in clock wise direction. The Carriage is engaged to lead screw.
10. In the same the knurling formation is done by knurling tool on Φ30mm.
13. Finally all the dimensions of work piece and pitch of the thread are again checked.

**RESULT:**

Thus, the job is machined as per the drawing in the given work piece and the dimensions are inspected using Vernier caliper.




**ALL DIMENSIONS ARE IN “mm”**

**TOLERANCES OF RANGE 0.02**

| EX NO -5 | BORING AND INTERNAL THREADING |
|---|---|

**AIM:**

To obtain the required shape and size of the work piece by machining operations.

**MATERIAL SUPPLIED:**

Φ 45 x 25mm length

**TOOLS REQUIRED:**

Lathe, cutting tool, Scriber, Vernier caliper, Vernier height gauge, try square, Boring and thread cutting tool.

**MACHINE SPECIFICATION:**

| | | |
|---|---|---|
| Name of machine | : | PL – 4 Lathe |
| Type of drive | : | "V" pulley belt drive |
| Power required | : | 1 HP single phase |
| No. of spindle speed | : | 16 |
| Type of chuck | : | Three jaw self-centering chuck |
| Length of lathe bed | : | 1390mm |
| Height of the Centre | : | 163mm |
| Swing dia over carriage | : | 190mm |
| Swing dia over bed | : | 330mm |

**SEQUENCE OF OPERATIONS:**

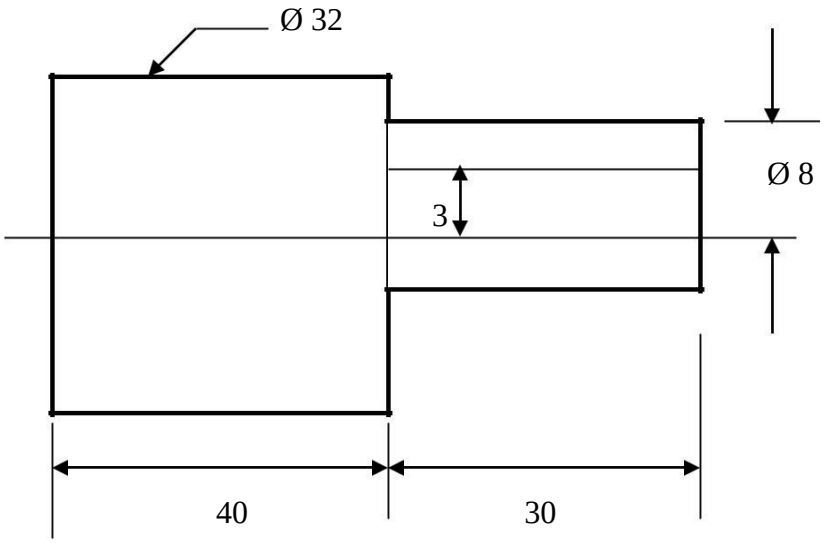
1. Checking 2. Work piece setting
3. Tool setting 4. Facing
5. Drilling 6. Internal boring
7. Internal threading

**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The work piece is held in the chuck. Chuck key is used to tighten the job firmly, ensuring centering of work piece.
3. The single point cutting tool is held in the tool post and tightens the nuts using spanner
4. Facing is done with cutting tool moving from the Centre of work piece towards outside. It is done until the required length of the job is obtained.
5 A counter sinking hole is drilled in one face using combination drill chuck through tailstock.
6. Drilling is done with the help of drilling bit until the required diameter of the job is obtained.
7. Boring is done with boring tool after the drilling operation.
8. Internal thread cutting is done with internal cutting tool until the entire length of the job.
9. Finally all the dimensions of work piece and pitch of the thread are again checked.

**RESULT:**

Thus, the job is machined as per the drawing in the given work piece and thedimensions are inspected using Vernier caliper.




**ALL DIMENSIONS ARE IN “mm”**

**TOLERANCES OF RANGE 0.02**

| EX NO - 6 | ECCENTRIC TURNING |
|---|---|

**AIM:**

To machine the given cylindrical rod as per the diagram, by using the lathe machine.

**MATERIAL SUPPLIED:**

Φ 45 x 25mm length

**TOOLS REQUIRED:**

Lathe, cutting tool, Scriber, Vernier caliper, Vernier height gauge, try square, Boring and thread cutting tool.

**MACHINE SPECIFICATION:**

| | | |
|---|---|---|
| Name of machine | : | PL – 4 Lathe |
| Type of drive | : | "V" pulley belt drive |
| Power required | : | 1 HP single phase |
| No. of spindle speed | : | 16 |
| Type of chuck | : | Three jaw self-centering chuck |
| Length of lathe bed | : | 1390mm |
| Height of the Centre | : | 163mm |
| Swing dia over carriage | : | 190mm |
| Swing dia over bed | : | 330mm |

**SEQUENCE OF OPERATIONS:**

1. Checking 2. Work piece setting
3. Tool setting 4. Facing
5. Drilling 6. Internal boring
7. Internal threading

**PROCEDURE:**

1. The work piece is held in the lathe spindle and it is rotated about lathe axis
2. The tool is held in the tool post and it is set to lathe axis
3. The facing and turning operations are carried out to the required dimensions
4. Then the axis of the work piece is shifted to the required eccentricity
5. The longitudinal feed is given to the required length and job is eccentrically turned.
6. Two or more cuts with suitable depth of cut are given to obtain required diameter
7. Then both ends of the job are chamfered by chamfering tool.

**RESULT:**

The given work piece machined as per the diagram by using the lathe machine.

| EX NO - 7 | STUDY OF WELDING |
|---|---|

**INTRODUCTION**

Welding is the process of joining two metal plates using a joining material by heat. It is commonly used to join metal plates in making boilers, vessels, furniture's, automobile parts,etc., Now welding is extensively used in construction industry, manufacturing industry, maintenance work etc.,

**TOOLS AND SAFETY EQUIPMENTS IN WELDING: GOGGLES:**

Goggles with glasses are used to protect the eyes of the welder from the light sparks produced during welding.

**FACE SHIELD:**

Face shield is used to protect the eyes of the welder from the light sparks produced during welding. It is normally held in hand.

**CHIPPING HAMMER:**

Chipping hammer is used to remove slag with from during welding.

**GROUND CLAMP:**

It is connected to the end of the ground cable. It is normally clamped to the welding table or the job itself to complete the electric circuit.

**WIRE BRUSH:**

Wire brush is used to clean the welded surface.

**TONGS:**

Tongs are used to handle the hot metal welding job while cleaning.

**HELMET:**

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

**TYPES OF WELDING METHODS / PROCESS**

I. Electric arc welding
II. Gas welding
III. Thermit welding
IV. Resistance welding
IV. Friction welding

**ARC WELDING**

Electric arc welding is widely used to join metal plates using a filler rod metals on the electric produced and welds the metal plates. However, only electric arc welding and gas welding is discussed here. In either process, the work pieces are melted along a common edge, to their melding point and then a filler metal is introduced to form the joint on solidification.

**TOOLS USED IN ARC WELDINGTRANSFORMER**

It will transform the given input power in to required voltage for welding.

**WELDING CABLES**

Two welding flexible cables are required, one from transformer to electrode holder and other from transformer to ground clamp / welding table.

**ELECTRODES**

It is made of metallic wire called core wire, having the same composition as metal to be welded; these are coated uniformly with a protective coating called flux. While welding flux vaporous and provides a gaseous shield to prevent atmospheric attack.

**ELECTRODE HOLDER AND GROUND CLAMP**

Electrode holder is connected to the end of the welding cable and holds the electrode. Ground clamp is connected to the end of another welding cable and clamps the work or welding table.

**ARC WELDING PROCEDURE**

1.The surface to be welded is cleaned and the edges of the plates may be filled for the perfect joint and more strength.

2.Check whether, the setting of welding current, electrode size according to the size of work pieces.

3.The welding rod is held in the electrode holder and the ground clamp is clamped to the plate to be welded.

4.The electric arc produced melts the welding rod and joints the two metal plates. Maintain the gap of 3 mm between the plate and welding rod.

5.Complete the welding process by removing slag using chipping hammer.

**GAS WELDING**

Gas welding is also widely used to join metal plates. The heat of flame produced using oxygen and acetylene gas mixture melts the filler rod and parent metal plates. The components used in gas welding

a) Oxygen and acetylene gas cylinder with pressure regulators and pressure gauges.

b) Welding torch where flames are obtained by mixing oxygen and acetylene.

c)Hoses in black and maroon colors to connect the gas cylinder and the gas cylinders and the welding torch.

**TYPES OF GAS FLAMES**

Depending upon the ratio of oxygen and acetylene three types of flames is obtained.

a. Neutral flame - equal amount of acetylene

b. Oxidizing flame - more oxygen less acetylene. The ratio is 1:1.2 to 1.5

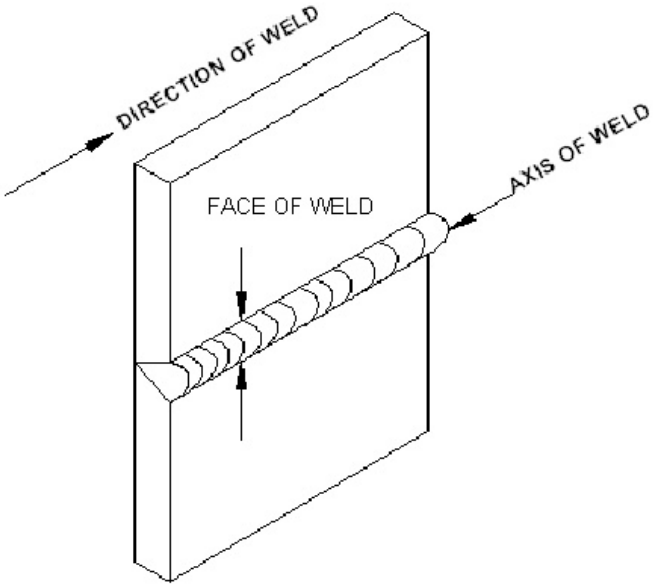
c. Carburizing flame – more quantity of acetylene. Ratio is 1:1.9

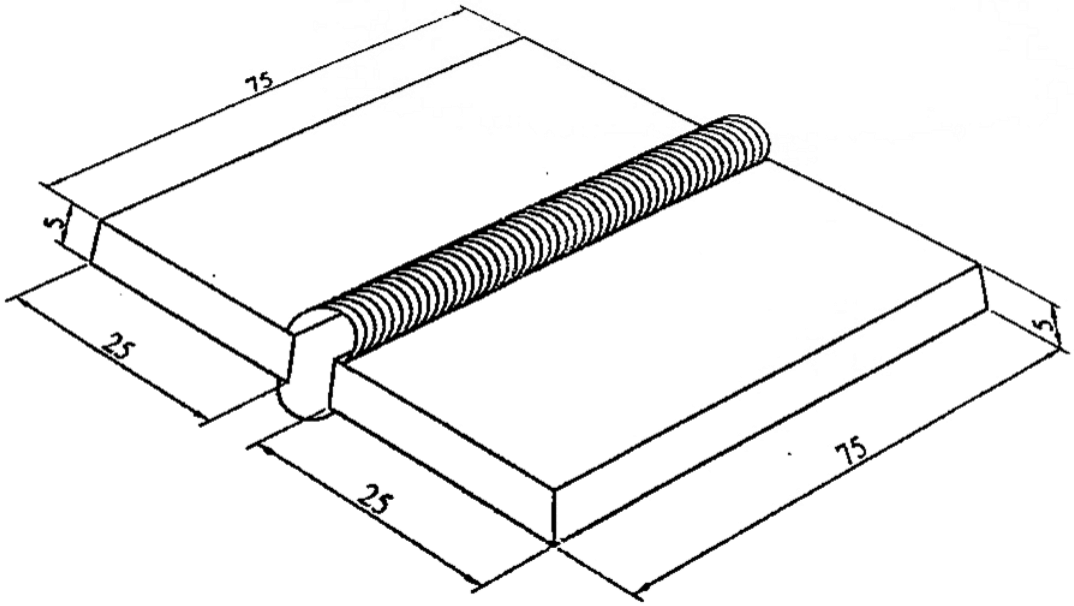
**GAS WELDING PROCEDURE**

1.The surface to be welded is cleaned.

2.Open the acetylene and oxygen cylinder valve slowly then open the acetylene valve in torch. Keep the tip of the torch away from the body and light it using lighter. Open oxygen and acetylene valves in torch slowly to get the required flame for welding.

3.Maintain the gap of 3mm between the plate and inner core of the flame. The torch and filler rod are moved backwards along the line to be welded.




**ALL DIMENSIONS ARE IN "mm"**

| EX NO - 8 | BUTT JOINT - HORIZONTAL WELDING |
|---|---|

**AIM:**

To make the butt joint using the two given metal strips.

**MATERIAL SUPPLIED:**

Mild steel 60 X 50 X 6 mm plate

**TOOLS REQUIRED:**

AC transformer
Hand shield
Holder
Apron
Gloves
Wire brush
Chipping hammer
Electrode
Flat file

**SEQUENCE OF OPERATIONS:**

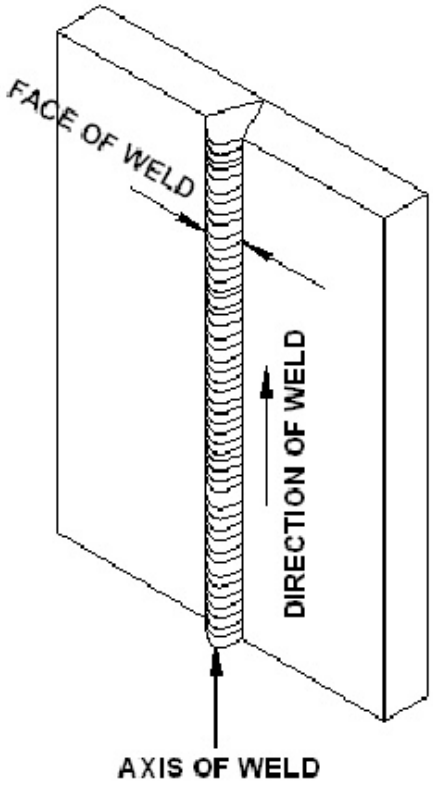
1. Checking
2. Edge preparation
3. Work piece positioning
4. Electrode positioning
5. Welding

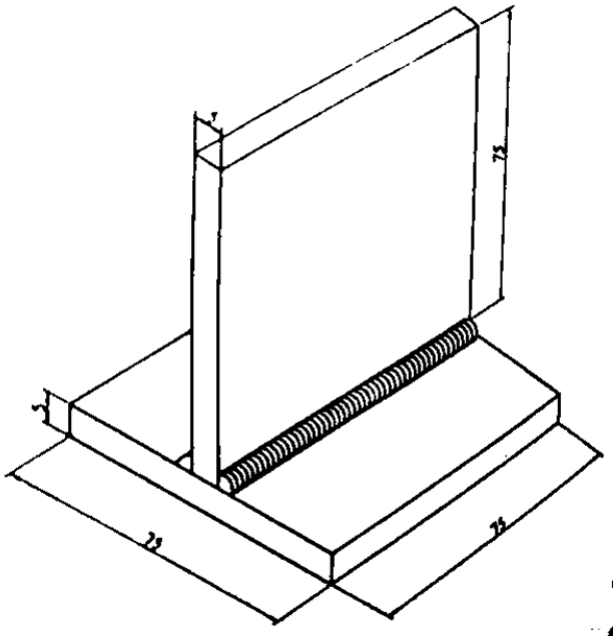
**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The edge preparation is done to the work piece in such a way that the root is 1.6 X 1.6.
3. The work piece is placed horizontally in such a way that the length is placed on the table.
4. The welding rod is held in the electrode holder and the ground clamp is clamped to the plate.
5. The torch is held in right hand side and the welding rod is in left hand side.
6. The plates to be welded are positioned touching each other and tag weld is done on the ends to avoid the movement of the plates during welding.
7. The electric arc produced melts the welding rod and joins the two metal plates.
8. Complete the welding process by removing slag using chipping hammer.

**RESULT:**

Thus, the job is welded in horizontal position by arc welding.




**ALL DIMENSIONS ARE IN "mm"**

| EX NO - 9 | BUTT JOINT - VERTICAL WELDING |
|---|---|

**AIM:**

To make the butt joint using the two given metal strips.

**MATERIAL SUPPLIED:**

Mild steel 60 X 50 X 6 mm plate

**TOOLS REQUIRED:**

AC transformer
Hand shield
Holder
Apron
Gloves
Wire brush
Chipping hammer
Electrode
Flat file

**SEQUENCE OF OPERATIONS:**

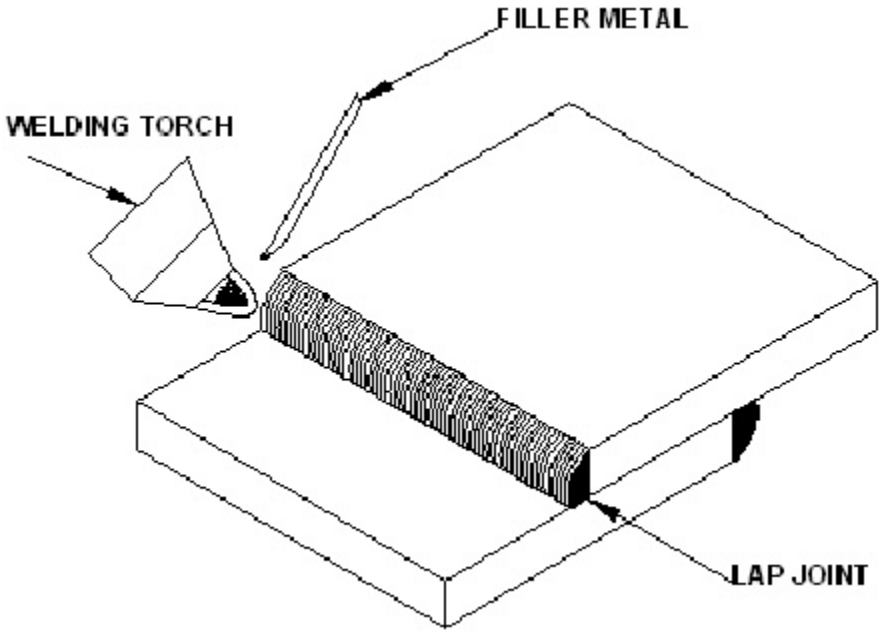
1. Checking
2. Edge preparation
3. Work piece positioning
4. Electrode positioning
5. Welding

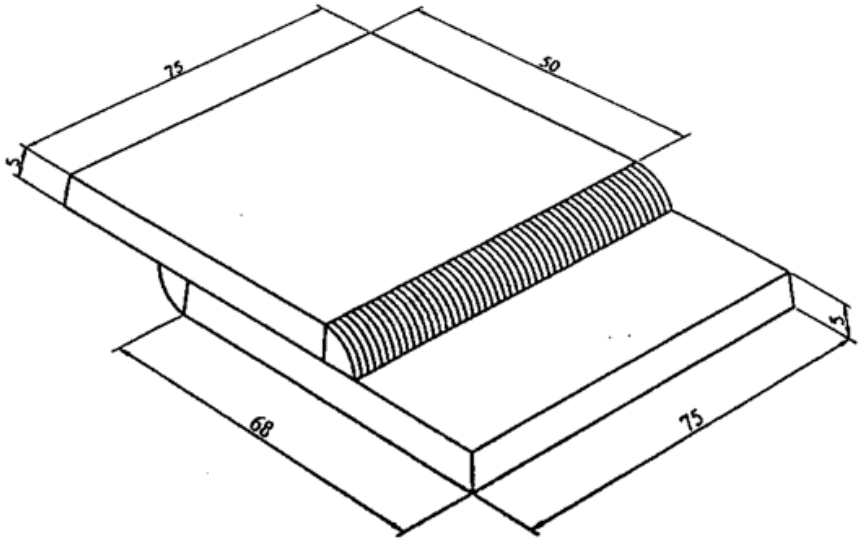
**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The edge preparation is done to the work piece in such a way that the root is 1.6 X 1.6.
3. The work piece is placed vertically in such a way that the breath is placed on the table.
4. The welding rod is held in the electrode holder and the ground clamp is clamped to the plate.
5. The welding torch is held in right hand side and filler rod in the left-hand side.
6. The plates to be welded are positioned touching each other and tag weld is done on the ends to avoid the movement of the plates during welding.
7. The electric arc produced melts the welding rod and joins the two metal plates.
8. Complete the welding process by removing slag using chipping hammer.

**RESULT:**

Thus, the job is welded in vertical position by arc welding.




**ALL DIMENSIONS ARE IN "mm"**

| EX NO - 10 | LAP JOINT USING GAS WELDING |
|---|---|

**AIM:**

To make lap joint using the two given metal strips.

**MATERIAL SUPPLIED:**

Mild steel 60 X 50 X 6 mm plate

**TOOLS REQUIRE**D:

Oxygen cylinder,
Acetylene cylinder,
Regulator,
Pressure gauge,
Flow pipe,
Welding paste,
Brass rod.

**SEQUENCE OF OPERATIONS:**

1. Checking
2. Edge preparation
3. Work piece positioning
4. Flaming
5. Welding

**PROCEDURE:**

1. The given work piece is checked first its dimensions.
2. The edge preparation is done to the work piece in such a way that the root is 1.6 X 1.6.
3. The work piece is placed horizontally in such a way that the length is placed on the table.
4. The oxygen and acetylene are mixed in the mixing chamber.
5. The gas mixture is ignited through the firing of spark.
6. The pressure gauge is continuously monitored for maintaining the pressure.
7. The flame temperature is 3200 C and which is used to heat the work piece form a molten metal pool.
8. The molten metal is added with filler metal to form a seam of higher strength.
9. The seam of continuously uniform bead is formed.

**RESULT:**

The required lap joint is obtained by gas welding.

| EX NO - 11 | 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.

## APPLICATIONS

Sheet metal work is used for making hopper, funnels, various duck, chimneys, ventilating pipes, machine tools 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. Beside 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.

## METALS USED IN SHEET METAL WORK

The most commonly used sheet metals are:

a) Black iron
b) Galvanized iron
c) Stainless steel
d) Copper
e) Aluminum
f) Tin plate
g) Lead etc.

Selection of these metals is based upon the type of process.

## TOOLS USED IN SHEET METAL WORK

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

## CUTTING TOOLSCHISELS:

Chisels are used in sheet metal work for cutting sheets, Rivets, bolts and chipping operations. Through there are many types of Chisels available, round nose chisel and flat chisel are mostly used for sheet metal work

## SNIPS (OR) SHEARS:

- ✓ Snips are hand shear, varying in length from 200mmto 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 outside curves and straight lines.

- ✓ Curved snips or bent snips are used for trimming along inside curves.

**STRIKING TOOLSHAMMERS:**

Hammers are used in sheet metal work for hollowing, stretching, leveling, riveting, strengthen of sheet metal joints etc. The following hammers are mostly used in sheet metalwork.

a) Ball peen hammer
b) Straight peen hammer
c) Riveting hammer
d) Mallet

**PUNCHES:**

In sheet metal work, punch is used for marking out work locating centers etc. The following two types of punches are widely used.

1) Dot punch
2) Center punch

**SUPPORTING TOOLS:**

**STAKES:** Stakes are nothing but sheet metal workers anvil used for bending, hemming, forming etc., using hammers or mallet.

**BENDING TOOLS:**

**PILERS:** 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.

**LAYOUT TOOLS:**

**STEEL RULE:**

It is used for measuring and laying out small work. It can measure with an accuracy of up to 0.5mm.

**SCRIBER:**

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

**DIVIDERS:**

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

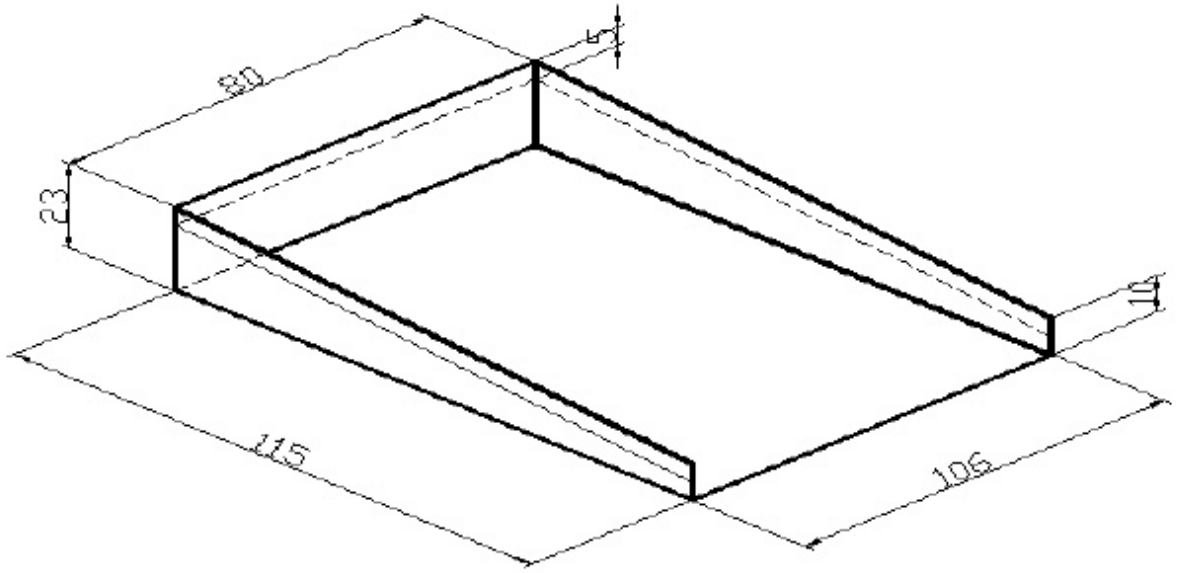
**TRAMMELS:**

It is used for making of arcs and circles. Maximum size of the arc that can be scribed depends on the length of the beam in scribers.

**SHEET METAL OPERATIONS**

The major types of operations are given below.

a) Shearing
b) Bending
c) Drawing
d) Squeezing




**ALL DIMENSIONS ARE IN “mm”**

| EX NO - 12 | FABRICATION OF TRAY |
|---|---|

**AIM:**

To making a tray from the given sheet metal.

**MATERIAL SUPPLIED:**

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

**TOOLS REQUIRED:**

1. Steel rule
2. Mallet
3. Ball peen hammer
4. Scriber
5. white paper
6. Groover
7. Straight snips
8. solder

**SEQUENCE OF OPERATIONS:**

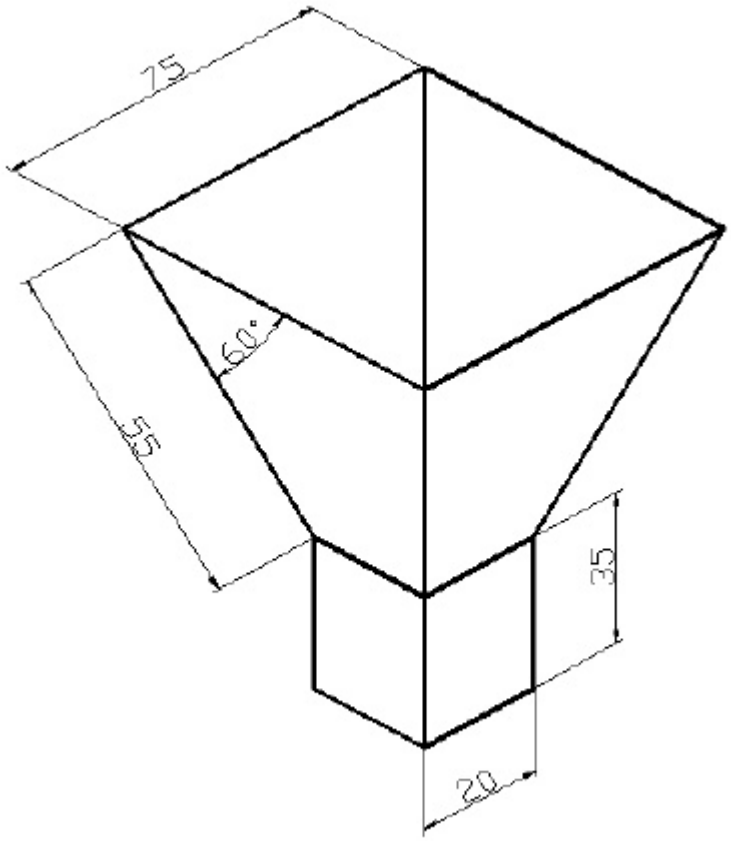
1. Checking
2. Leveling
3. Marking on Paper
4. Marking on sheet metal
5. Cutting
6. Folding
7. Hemming
8. Soldering

**PROCEDURE:**

1. The size of the given sheet metal is checked for its dimensions using 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 work piece to make the tray is made on the work pieces.
6. Then using groover, looked grooved joint is made for about 5mm. Also, hemming is done in the bottom of the sheet.
7. In between top and bottom face butt joint is made using solder.
8. Finally, trimming and finishing operations are being carried out.

**RESULT**

Thus, the tray of the required dimensions is made from the given sheet meat.




**ALL DIMENSIONS ARE IN “mm”**

| EX NO - 13 | FABRICATION OF FUNNEL |
|---|---|

**AIM:**

To making a funnel from the given sheet metal.

**MATERIAL SUPPLIED:**

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

**TOOLS REQUIRED:**

1. Steel rule
2. Mallet
3. Ball peen hammer
4. Scriber, white paper
5. Groover
6. Straight snips
7. Solder

**SEQUENCE OF OPERATIONS:**

1. Checking
2. Leveling
3. Marking on Paper
4. Marking on sheet metal
5. Cutting
6. Folding
7. Hemming
8. Soldering

**PROCEDURE:**

1. The size of the given sheet metal is checked for its dimensions using 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 work piece to make the funnel is made on the work pieces.
6. Then using groover, looked grooved joint is made for about 5mm. Also, hemming is done in the bottom of the shoot.
7. In between top and bottom face butt joint is made using solder.
8. Finally, trimming and finishing operations are being carried out.

**RESULT**

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

| EX NO - 14 | STUDY OF FOUNDRY |
|---|---|

## INTRODUCTION

Producing components by casting has been used since the earliest days of civilization. Lot of shapes and sizes can be prepared in a casting process. To make the casting of a component, a cavity of desired shape is to be produced in which the molten metal is poured. Mould is the cavity of the required shape made in moulding consists of all operations done to make a mould.

## PATTERN

Pattern is the model used to get required casting. It is used to produce the mould cavity in the sand.

## FOUNDRY

The place where moulding and casting are done.

## MOULDING SAND OR GREEN SAND

It is a mixture of sand and additives such as water, bentonite, inoculant, sodium silicate, etc., used to create mould cavity.

## COMPONENETS REQUIRED FOR MOULDING

The following components are essential for producing mould.

- Moulding sand
- Moulding boxes
- Pattern
- Moulding tools

## MOULDING SAND COMPOSITION

It is a special type of sand used for making mould. Moulding sand has three constituents. They are,

**SAND:** It has silica, clay and moisture. Silica is the main constituents of sand. Silica has80-90 % silicon dioxide. Silicon gives refractoriness to the sand.

**CLAY: It** is another constituent of sand. Clay gives more bonding strength to the sand. Generally, sand have 5-20% water is added to the sand.

**BLINDERS: It** is added to the moulding sand to bring the property of cohesiveness. The binder binds the sand together and brings strength.

**ADDITIVE:** By adding an additive, properties like strength, refractoriness and permeability can be increased. E.g. Sea coal, wood flour straw, cow dung, silica flour and sawdust.

## PROPERTIES OF MOULDING SAND

Good moulding sand must have the following properties,

- Porosity
- Plasticity
- Adhesiveness
- Cohesiveness
- Refractoriness

## PATTERN

A pattern is the replica of the desired casting, used to produce a mould cavity in to which liquid metal is poured. When pattern packed in a suitable material produces a cavity called the mould. This cavity when filled with molten metal produces the desired casting.

## PATTERN MATERIALS

The selection of pattern materials depends on the following factors,

- Type of production of casting and the type of moulding process.
- Flexibility in changing the design of pattern.
- Number of casting to be produced.
- The pattern material should be easily worked, shaped and joined.
- The patter should be strong, hard and durable. Also, the pattern should be able to take good surface finish.

The following pattern materials are widely used,

- Wood and wood products
- Metals and Alloys
- Plastics and Rubbers
- Plasters and Waxes

## PATTERN ALLOWANCES

The various pattern allowances are mentioned below,

- Shrinkage or Contraction allowance
- Machining or Finishing allowance
- Draft or Taper allowance
- Distortion allowance
- Shake or Rapping allowance

## PATTERN TYPES

Various types of pattern are explained below:

### ONE PIECE OR SOLID PATTERN

- It is simplest type of pattern.
- As the name suggest the pattern is made from one piece and does not contain loose piece or joints.
- It is expensive
- It is used for making a few large sizes simple casting s.
- One-piece pattern is usually made up of wood or metal depending upon the quantity of casting to be produced.
- Stuffing box of steam engine may be cast with the help of one-piece pattern.

### SPLIT PATTERN

- Patterns of complicated shape cannot be made of one piece because of inherent difficulties associate with moulding operation. Such patterns are made as split or two-piece pattern.
- The upper and the lower part of the split pattern are accommodated in the cope and drag portions of the mould respectively.
- Dowel pins are used for keeping the alignment between the two parts of the pattern.
- Taps and Water stop-cocks are produced with the help of split pattern.

**LOOSE PIECE PATTERN**

- Certain patterns cannot be withdrawn once they are embedded in the moulding sand; such patterns are usually made with one or more loose pieces for facilitating their removal from the moulding box and are known as loose piece pattern.
- Loose parts or pieces remain attached with the main body of the pattern with the help of dowel pins.

**MATCH PLATE PATTERN**

- When split patterns are mounted with one half on one side of a plate and the other half directly opposite on the other side of the plate, such pattern is called match plate pattern.
- The match plate with the help of locator holes can be clamped with the drag.
- The match plate has runner and gates also attached with it.
- After the cope and drag have been rammed with the moulding sand, the match plate pattern is removed.
- Cope and drag are then assembled and this completes the mould.
- Piston and rings of I.C engines are produced with the help of match plate pattern.

**CORE**

It is a sand mass used to make cavity or holes in a casting. The shape of the core is similar to the required hole in the casting. Core is made by core sand in core boxes.

**CORE PRINT**

It is the projection pattern. It forms a seat in the mould. The core is supported in the seat formed by the core print.

**CORE BOX**

A core box is a pattern made of either wood or metal, into which sand is packed to form the core. Wooden boxes are commonly used for making a core box but metal boxes are used when cores are to be made in large number.

**CORE MAKING PROCEDURE**

Core making is done in the following steps: Moulding a green sand coreBaking, Finishing, Coating

**MOULDING A GREEN SAND CORE:**

Core sand is mixed thoroughly with binder, additive and water. Core is moulded by hand or machine. Large cores are reinforced with rods for strength. Then the core sand is placed in a core box is separated. In this stage, the core is called green sand mould.

1. Baking: The green sand cores are heated in core baking ovens at temperature varying from200°c to 300°c. During heating, moisture is removed. The core becomes very strong.

2. Finishing: After baking, the rough surfaces of core and unwanted projections are removed by filling. If the core is made of two pieces, they are pasted together.

3. Coating: This finished core is given a surface coating. Coating gives smooth surface to the casting. Coating will prevent metal leaking in to the core. The coating material generally used is powdered graphite or silica or mica. Coating is applied by brushing and spraying.

**MOULDING BOXES**

Moulding box is also called moulding flask. It is a frame or box of wood or metal. Wood is cheaper and boxes can be made quickly. Wood wears out quickly. It is destroyed by contact with hot metal. Metal boxes in steel, cast iron and aluminium alloys are used in mass

production. Moulding boxes are used for making sand moulds. Moulding flasks may have two or more parts. The main types of flasks are:

- Snap flask
- Tight or box flask

**MOULDING TOOL**

1**. SHOVEL**

Shovel is a big tool used for mixing and transferring moulding sand. It is also used for carrying the moulding sand from the sand fit to the moulding box. It has a broad metal blade with long wooden handle.

**2. RIDDLE**

It is metal sieve used for removing foreign materials such as stones, nails etc., from the moulding sand. It has a circular or square wooden frame with a wire mesh at the bottom. The spacing between two components wires determines the fineness of sand particles.

**3. RAMMER**

It is a tool made of wood or cast iron used for packing or ramming the moulding sand in the moulding box. It has got two ends. One end is wedge shaped and it is known as pen. The other end is cylindrical in shape and known as butt end.

**4. TROWELS**

It is a metal blade usually rectangular and has round or square end used for smoothening the surface of mould. It is also used to repair the damaged portions of mould.

**5. SLICK**

It is a double ended tool used for repairing and finishing surfaces and to round corners of the mould

**6. LIFTER**

It is used to lift the openings of deep moulds. It is also used to repair broken surfaces and to round corners of the mould.

**7. STRIKE OFF BAR**

It is made of wood. It has a straight edge. It is used to remove excessive sand from the mould after ramming.

**8. SPRUE PIN**

It is a tapered cylindrical wooden piece. It is used for making a sprue hole in the mould, to facilitate pouring of metal. The size of the sprue pin depends upon the size of the mould.

**9. BELLOWS**

Bellows are used to blow off loose sand particles from the mould and pattern.

**10. SWAB**

Swab is a small brush. This is used for applying small amount of water around the pattern before removing it from the mould.

**11. GATE CUTTER**

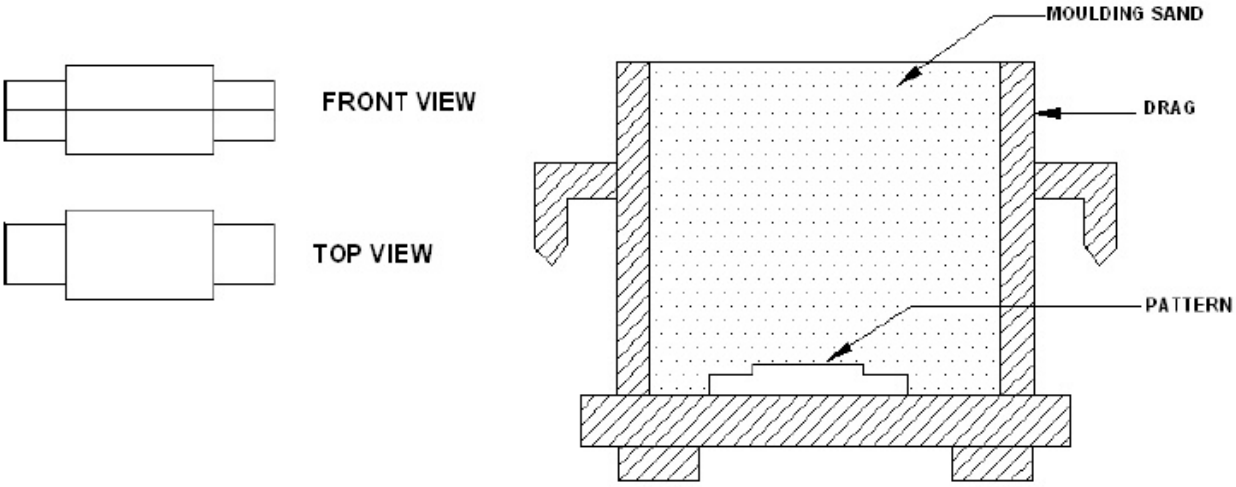
It is used for cutting gates and runners in the mould.

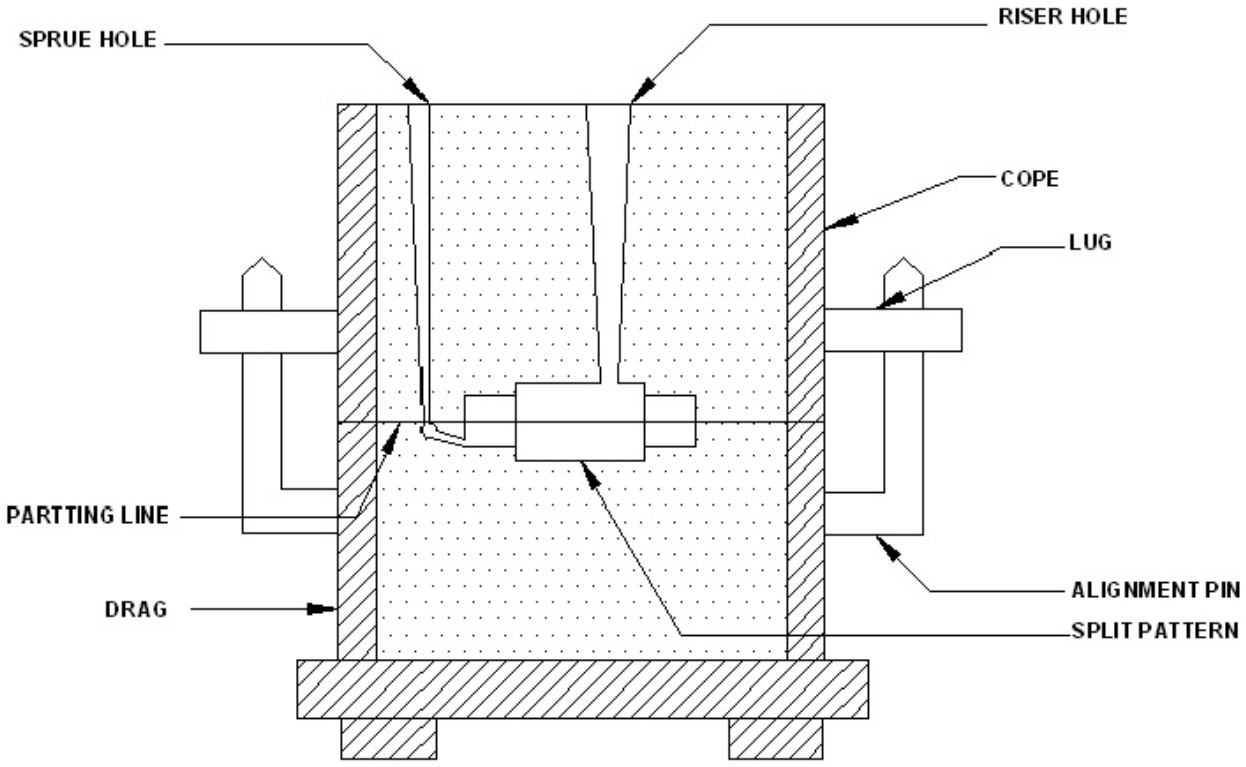
**12. DRAW SPIKE**

It is a pointed steel rod with a loop at one end. It is removed the pattern from the mould.

**13. VENT ROD**

This rod is used for making vent holes in the sand mould so that the molten gases released during pouring of molten metal, can easily escape from mould.


FRONT VIEW
TOP VIEW
MOULDING SAND
DRAG
PATTERN


SPRUE HOLE
RISER HOLE
COPE
LUG
PARTTING LINE
DRAG
ALIGNMENT PIN
SPLIT PATTERN

| EX NO - 15 | MOULD WITH SOLID PATTERN |
|---|---|

**AIM:**

To prepare a green sand mould for the solid, split pattern.

**TOOLS REQUIRED:**

1. Moulding board
2. Moulding box
3. Rammer
4. Trowel
5. Lifter
6. Gate cutter
7. Riser
8. Runner
9. Sprue pin and other moulding tools.

**INTRODUCTION:**

**ONE PIECE OR SOLID PATTERN**

- It is simplest type of pattern. As the name suggest the pattern is made from one piece and does not contain loose piece or joints.
- It is expensive. It is used for making a few large sizes simple casting s.
- One-piece pattern is usually made up of wood or metal depending upon the quantity of casting to be produced.
- Stuffing box of steam engine may be cast with the help of one-piece pattern.

**PROCEDURE:**

1.The mould box, pattern, tools and the table/floor are cleaned.

2.The drag is filled with green sand after positioning the round on the table.

3.The green sand is rammed carefully and the excess sand is struck off.

4.Tilt the drag upside down and sprinkle river sand on top of it.

5.The cope is positioned on top of the drag.

6.Position the square pin, then fill the cope with sand and ramming is done and the excess sand is struck off.

7.Remove the sprue pin and the riser pin carefully.

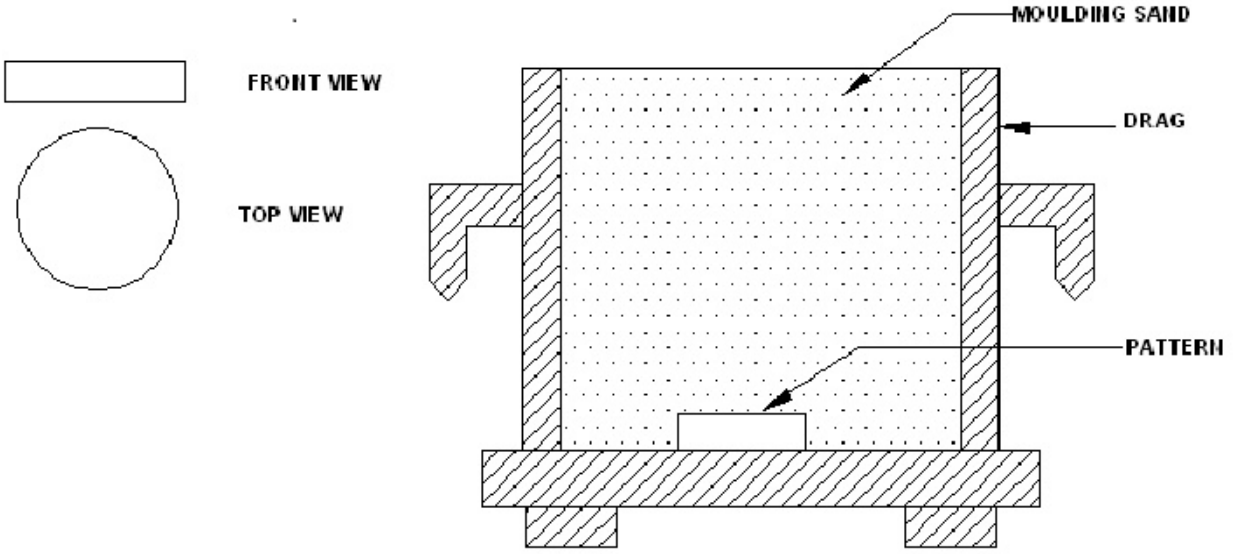
8.Apply water on the edges of the pattern and remove it carefully using the draw spike and then finish the cavity.

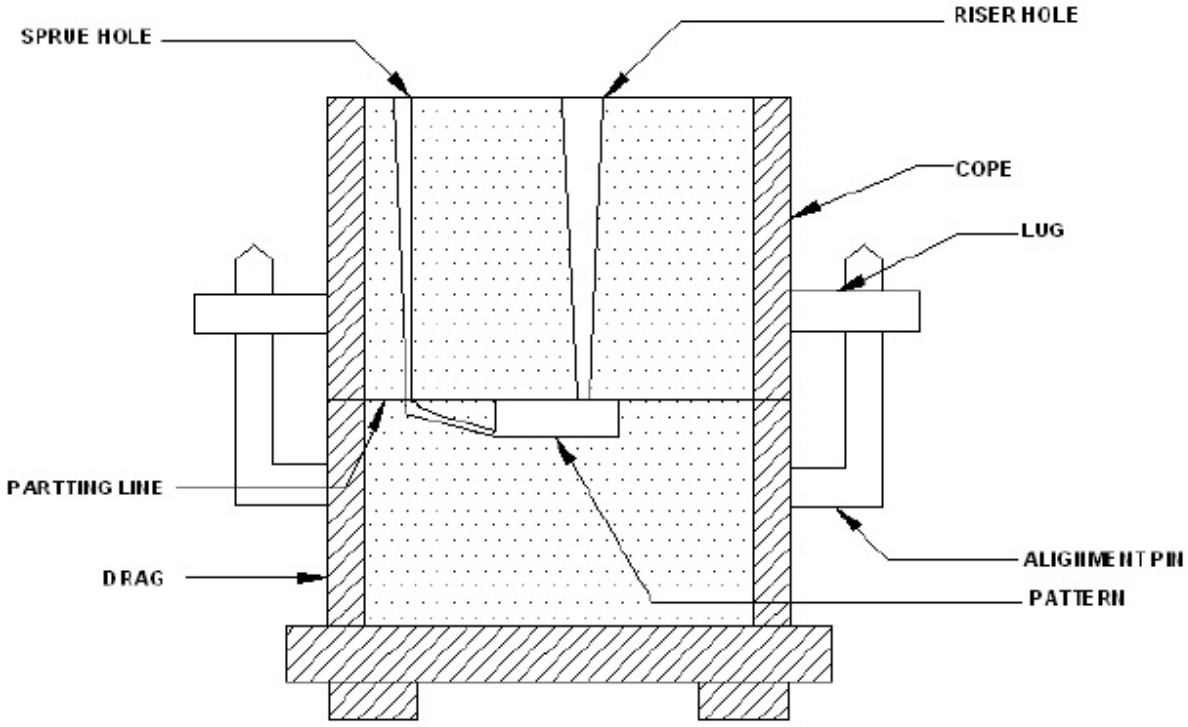
9.Vent holes are made using vent wire.

10.A funnel shaped opening and gate is made to pour the molten metal.

**RESULT:**

Thus, the mould cavity of the given solid pattern is obtained.


FRONT VIEW
TOP VIEW
MOULDING SAND
DRAG
PATTERN


SPRUE HOLE
RISER HOLE
COPE
LUG
PARTTING LINE
DRAG
ALIGNMENT PIN
PATTERN

| EX NO - 16 | MOULD WITH SPLIT PATTERN |
|---|---|

**AIM:**

To prepare a green sand mould for the solid, split pattern.

**TOOLS REQUIRED:**

1. Moulding board
2. Moulding box
3. Rammer
4. Trowel
5. Lifter
6. Gate cutter
7. Riser
8. Runner
9. Sprue pin and other moulding tools.

**INTRODUCTION:**

**SPLIT PATTERN**

- Patterns of complicated shape cannot be made of one piece because of inherent difficulties associate with moulding operation. Such patterns are made as split or two-piece pattern.
- The upper and the lower part of the split pattern are accommodated in the cope and drag portions of the mould respectively.
- Dowel pins are used for keeping the alignment between the two parts of the pattern.
- Taps and Water stop-cocks are produced with the help of split pattern.

**PROCEDURE:**

1.The mould box, pattern, tools and the table/floor are cleaned.

2.The drag is filled with green sand after positioning the round on the table.

3.The green sand is rammed carefully and the excess sand is struck off.

4.Tilt the drag upside down and sprinkle river sand on top of it.

5.The cope is positioned on top of the drag.

6.Position the square pin, then fill the cope with sand and ramming is done and the excess sand is struck off.

7.Remove the sprue pin and the riser pin carefully.

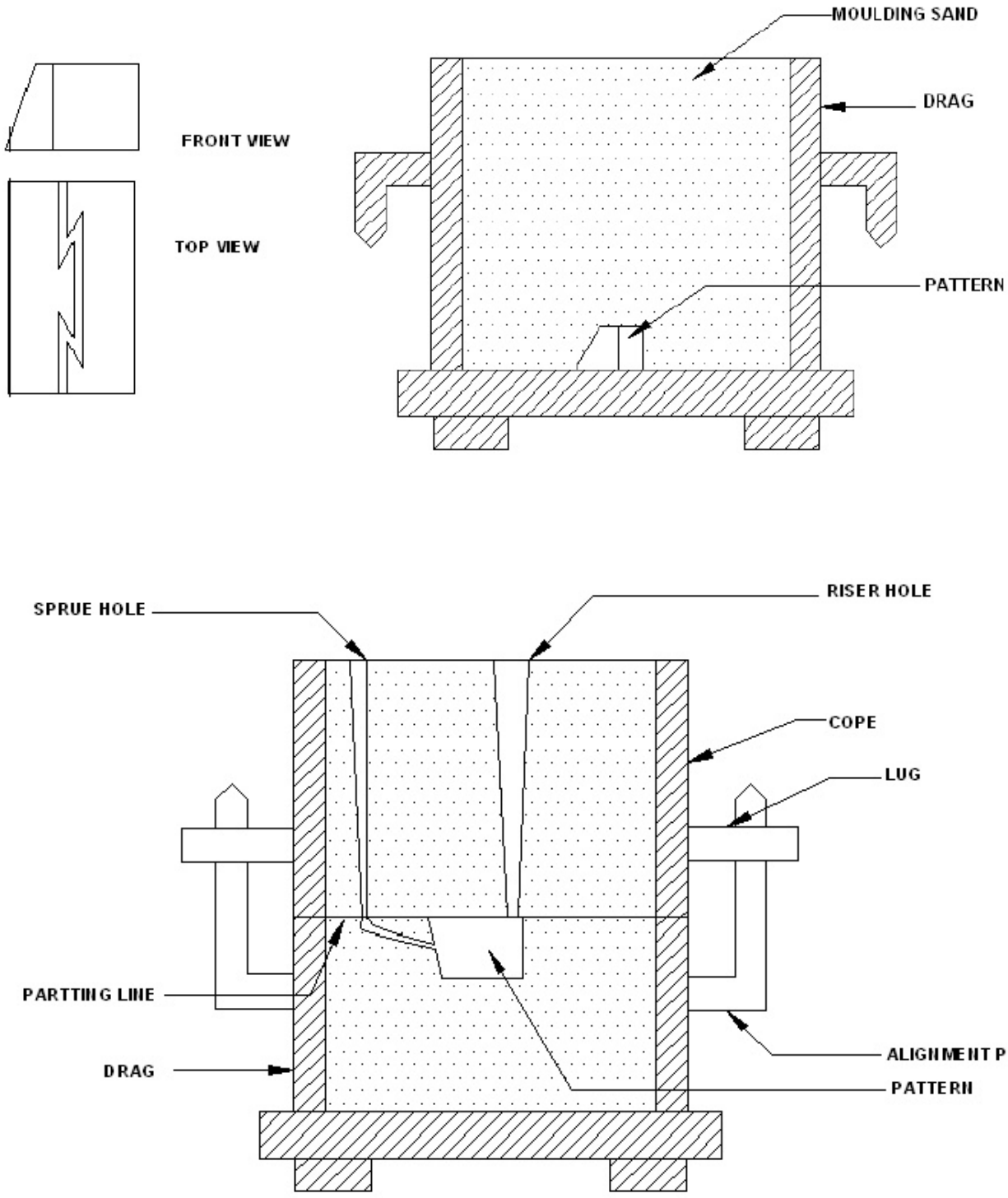
8.Apply water on the edges of the pattern and remove it carefully using the draw spike and then finish the cavity.

9.Vent holes are made using vent wire.

10.A funnel shaped opening and gate is made to pour the molten metal.

**RESULT:**

Thus, the mould cavity of the given split pattern is obtained.


FRONT VIEW
TOP VIEW
MOULDING SAND
DRAG
PATTERN
SPRUE HOLE
RISER HOLE
COPE
LUG
PARTTING LINE
DRAG
ALIGNMENT PIN
PATTERN

| EX NO - 17 | MOULD WITH LOOSE-PIECE PATTERN |
|---|---|

**AIM:**

To prepare a green sand mould using loose – piece pattern.

**TOOLS REQUIRED:**

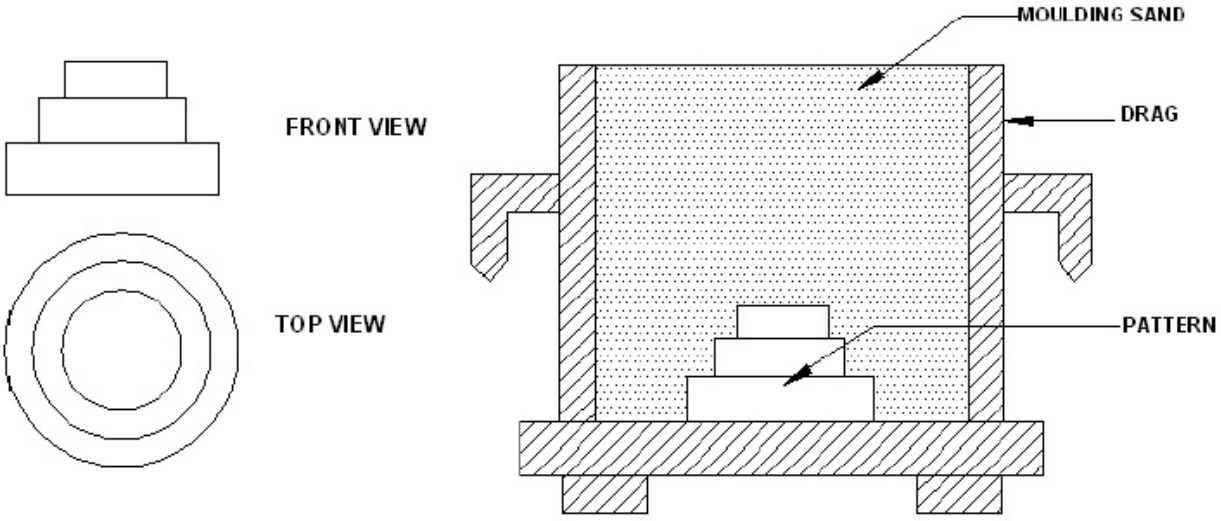
1. Moulding board
2. Moulding box
3. Rammer
4. Trowel
5. Lifter
6. Gate cutter
7. Riser
8. Runner
9. Sprue pin and other moulding tools.

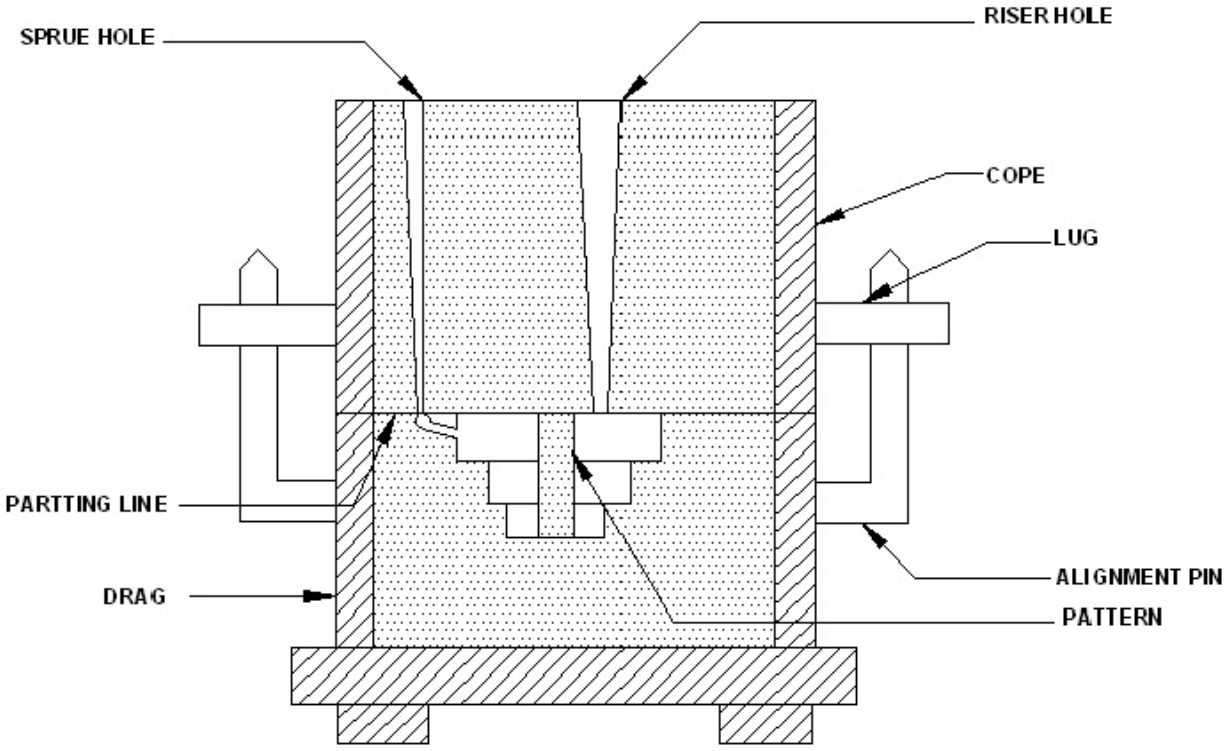
**PROCEDURE:**

1. The mould box, pattern, tools and the table/floor are cleaned.
2. The drag is filled with green sand after positioning the round on the table.
3. The green sand is rammed carefully and the excess sand is struck off.
4. Tilt the drag upside down and sprinkle river sand on top of it.
5. The cope is positioned on top of the drag.
6. Position the square pin, then fill the cope with sand and ramming is done and the excess sand is struck off.
7. Remove the sprue pin and the riser pin carefully.
8. Apply water on the edges of the pattern and remove it carefully using the draw spike and then finish the cavity.
9. Vent holes are made using vent wire.
10. A funnel shaped opening and gate is made to pour the molten metal.

**RESULT:**

Thus, the mould cavity of the given loose– piece pattern is obtained.


FRONT VIEW
TOP VIEW
MOULDING SAND
DRAG
PATTERN


SPRUE HOLE
RISER HOLE
COPE
LUG
PARTTING LINE
DRAG
ALIGNMENT PIN
PATTERN

| EX NO - 18 | MOULD WITH CORE |
|---|---|
| | |

**AIM:**

To prepare a sand mould using core.

**TOOLS REQUIRED:**

1. Moulding board
2. Moulding box
3. Rammer
4. Trowel
5. Lifter
6. Gate cutter
7. Riser
8. Runner
9. Sprue pin and other moulding tools.

**PROCEDURE:**

1. The mould box, pattern, tools and the table/floor are cleaned.
2. The drag is filled with green sand after positioning the round on the table.
3. The green sand is rammed carefully and the excess sand is struck off.
4. Tilt the drag upside down and sprinkle river sand on top of it.
5. The cope is positioned on top of the drag.
6. Position the square pin, then fill the cope with sand and ramming is done and the excess sand is struck off.
7. Remove the sprue pin and the riser pin carefully.
8. Apply water on the edges of the pattern and remove it carefully using the draw spike and then finish the cavity.
9. Vent holes are made using vent wire.
10. A funnel shaped opening and gate is made to pour the molten metal.

**RESULT:**

Thus, the mould cavity of the given core pattern is obtained.

| EX NO - 19 | STUDY OF SHAPEING MACHINE |
|---|---|

- INTRODUCTION
- SHAPING MACHINES OR SHAPER
- DRIVE
- CUTTING TOOLS USED IN SHAPING
- OPERATIONS PERFORMED ON SHAPERS
- QUESTIONS

## INTRODUCTION

Both shapers and planers are machine tools which produce a flat surface. They are capable of machining a horizontal, vertical or inclined flat surface. They employ single-point cutting tools which are essentially similar to single-point cutting tools used on lathe. In both these machine tools, the cutting tool is subjected to interrupted cuts, the tools cuts in forward direction and is idle in the return direction.

**NOTE:**

1.cutting tool is in moving condition whereas workpiece is stationary

2.small length work piece only workable in shapers these are the main difference between planer and shaper

## SHAPING MACHINES OR SHAPER

**Principle of Working**

principal parts of shaper are shown in fig.2.1

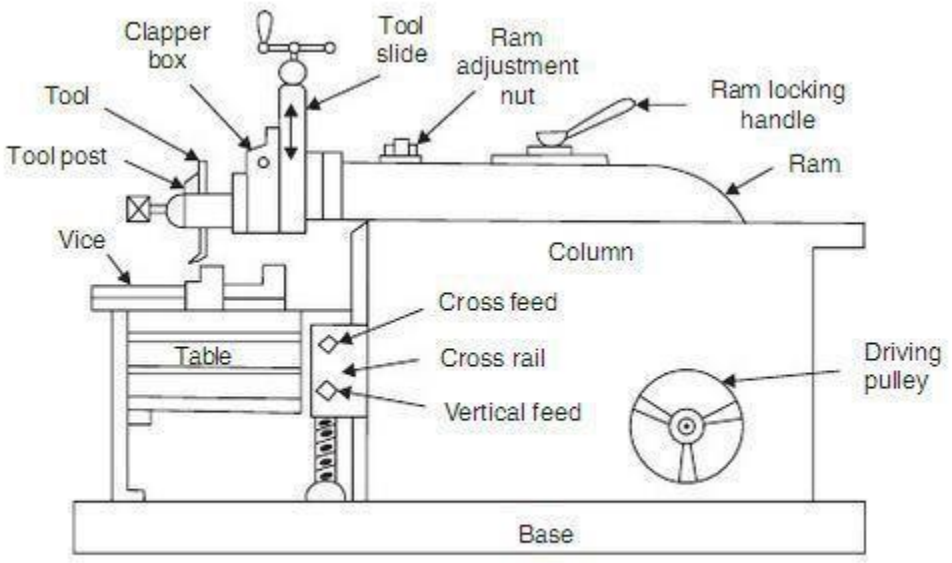



**Fig. 2.1** Principal parts of a shaper

- Shaper consists of a hollow machine bed made of cast iron which rests on the ground. Inside the hollow portion the machine drive mechanism is housed.
- This mechanism is called slotted lever quick return mechanism and it drives a horizontal ram which reciprocates in the guide ways provided on the top surface of the machine frame. In the front face of the ram, a tool post is fitted.
- This is a very special kind of tool post. It carries a slide which can be operated by a hand wheel and the entire tool post can be lowered or raised. Besides, the tool slide can be swiveled in a vertical plane and its inclination to the vertical (amount of swiveling) can be read off on a scale marked in degrees.
- The tool is inclined, when an inclined surface has to be machined. In the front portion of the base, a table is fitted.
- The table can be raised or lowered to vary its height. It can also be moved horizontally to left or right. A vice to hold the work piece is provided on the table top.
- The tool does useful work i.e., cutting only in the forward stroke of the ram. It does not cut i.e.; it is idle during the return stroke of ram.
- In order that while returning, the tool may not rub and spoil the strip of the metal machined in the forward stroke, a special device called the "clapper box" is provided in the tool post. It lifts the tip ofthe tool during the return stroke.

**DRIVE**

Since useful work is done only during the forward stroke of ram, the mechanism driving the ram is so designed that the return stroke is completed in much less time than the forward stroke. The slotted lever quick return mechanism is illustrated in Figs. 2.2(a) and 2.2(b).

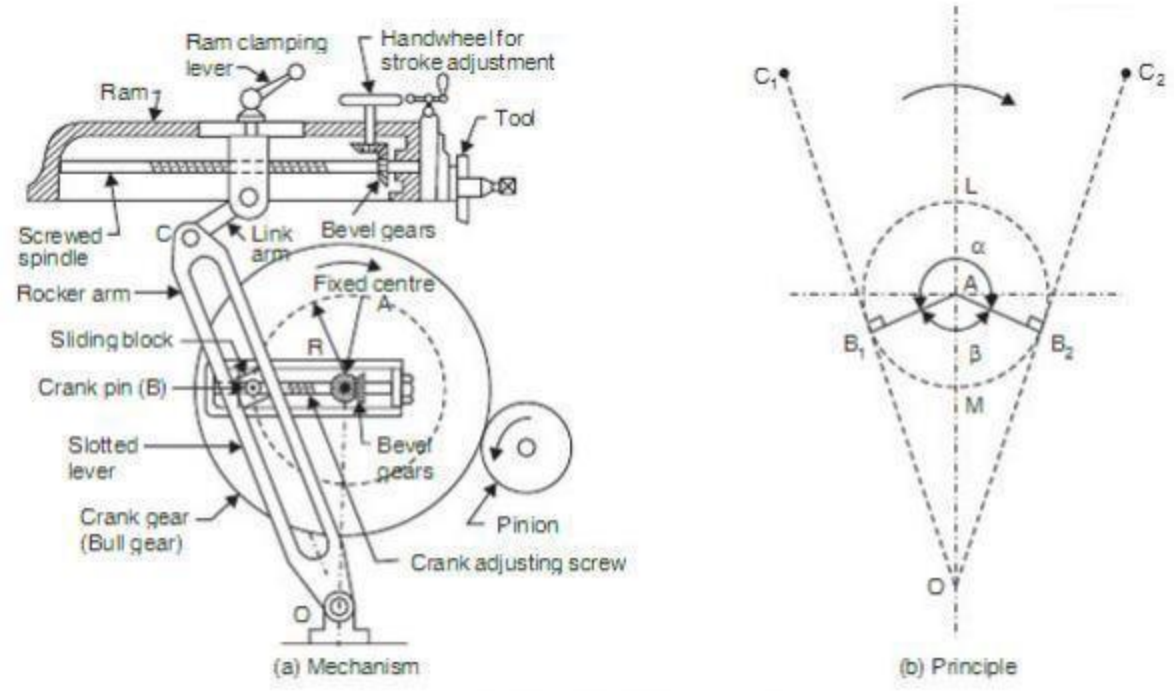



**Fig. 2.2** Quick return mechanism

- The crank AB (of adjustable length R) rotates with a uniform angular speed. The crank pin B is in the shape of a die block which is free to slide inside the slot in the slotted lever OBC.
- This slotted lever is pivoted at O and the other end C is connected to the ram by a short link arm as shown in Fig. 2.2 (a).
- When the crank AB rotates clockwise from position AB1to AB2, the ram moves forward from left to right and when it rotates from position AB2to AB1the ram returns back to its original position.
- Clearly the time taken to complete forward stroke is proportional to angle α (refer to Fig. 2.2 (b)) and the return stroke is completed in less time which is proportional to angle β.

## CUTTING TOOLS USED IN SHAPING

The cutting tools for shapers are generally made of H.S.S., either solid or with brazed tips. Due to interrupted cuts, tungsten carbide tools are not preferred for shaping work. These tools are made sturdy with fairly generous size for shank and tip. Various types of tools useful for shaping are shown in Fig. 2.3.

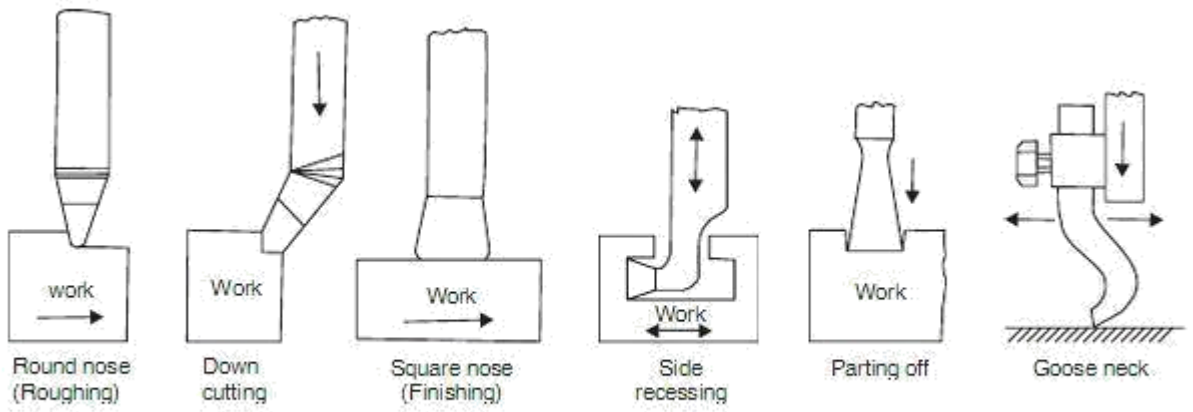



**Fig. 2.3** Cutting tools used in shaping work

## OPERATIONS PERFORMED ON SHAPERS

- On a shaping machine, relatively small jobs can be machined.
- The size of a shaper is denoted by the maximum length of stroke of its ram and work pieces longer than the maximum stroke cannot be machined.
- The first step in machining a job is to mount the job on the shaper-table and clamp it tightly in the vice or on the table by means of T -bolts etc.
- The second step is to adjust the stroke of ram according to the length of work piece. The ram stroke is kept about 60–70 mm longer than job.
- The stroke can be reduced or increased by altering the length of the crank AB (refer to Fig. 2.2). Now by changing the position of the location where short link arm is connected to the ram, the stroke is made to overlap the job, so that the stroke starts 30–35 mm before the job and covers the whole length of work piece and ends 30–35 mm beyond it.
- A tool is now selected and clamped in the tool post. The depth of cut is given by rotating the hand wheel and lowering the tool slide. Depth of cut is not given by raising the table height.

- Table height is adjusted only at the time of fixing the job according to the height of job. Feed is given by shifting the table laterally.
- The feed to the table can be given either manually or automatically.
- The feed is given during the return stroke of ram. Operations performed on a shaper can be easily understood from Fig. 2.4.

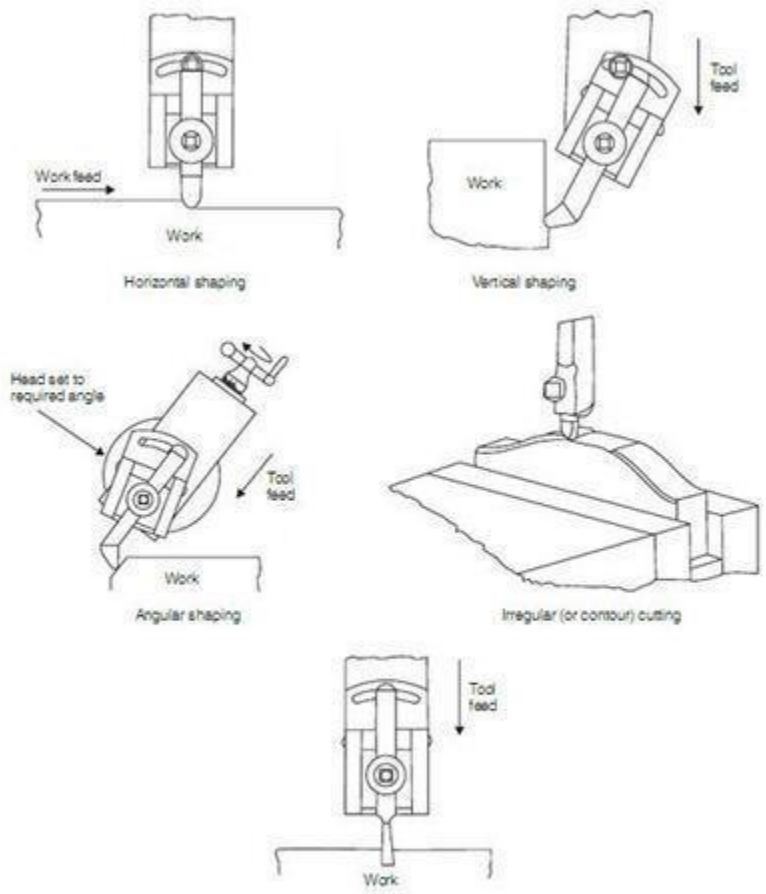
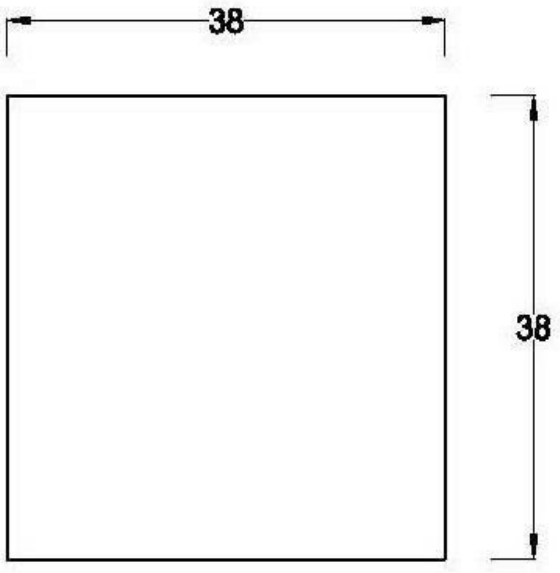



**Fig 2.4. Various operations performed on a shaping machine**

- Contour cutting is a very skillful job as it calls for simultaneous operation of horizontal table feed as well as vertical hand feed of the cutting tool. It can be performed only by a very skilled operator.

**CONCLUSION:**

- There are many accessories and fittings, which, if provided greatly improve the performance and range of work which can be carried out on a shaping machine.




**Materials Supplied: Mild steel: 40mmX 40mmX40mm**

**Tool Material: High Speed Steel (H.S.S)**

**ALL DIMENSIONS ARE IN "mm"**

| EX NO - 20 | SQUARE HEAD SHAPING |
|---|---|

**AIM**

To machine the given rectangular block in the shaping machine

**TOOLS REQUIRED**

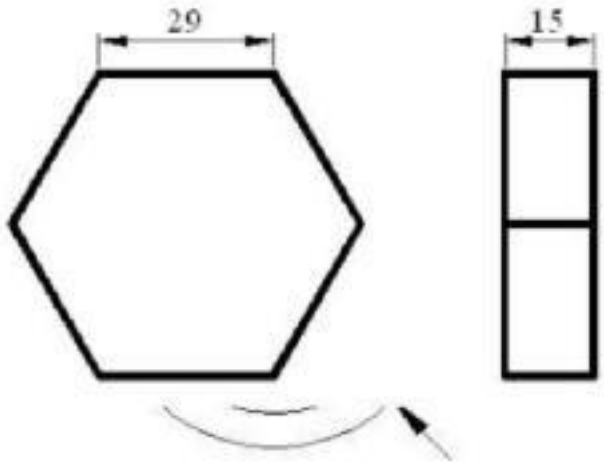
- Round nose tool - 1 No
- Vernier caliper - 1 No
- Steel Rule - 1 No
- Hammer - 1 No
- Punch - 1 No
- Scriber - 1 No
- Try square - 1 No
- Vernier height gauge - 1 No

**PROCEDURE**

1. The given raw material rectangular block is measured. The machining allowances are noted. Then the job is coated with white chalk for marking purpose.
2. The job is position in the marking table. The vernier height gauge is set to the correct dimensions as per the part drawing dimensions
3. After, the height -- mm is corrected in the vernier height gauge; the vernier scriber is marked in the face sides of the rectangular block.
4. To identify the dimensions of the job, the marking lines are punched
5. The work piece is placed in the shaping machine work holding device in correct position. Tool is held in the head in suitable position.
6. The stroke length and initial cutting position are corrected by adjusting the ram and table manually
7. The tool is held in the tool post in vertical position
8. Now, the machine is switched ON. The tool moves over the work, the materials is removed from the work by the tool cutting force.
9. By giving cross-feed movement to the table, the total length of work is machined, after completion of one cut, the depth of cut is adjusted in the tool head. Then the next cut is taken.
10. By repeating the above same procedure, the other faces are machined to the required dimensions
11. After completion of six faces, the work is removed from the vice, cleaned and inspection is carried out. The job No / Roll No are punched in the face side of the work.

**RESULT**

The given work piece rectangular block is machined as per the dimension in the shaping machine.




**Materials Supplied: Mild steel: 40mmX 40mmX40mm**

**Tool Material: High Speed Steel (H.S.S)**

**ALL DIMENSIONS ARE IN "mm"**

| EX NO - 21 | HEXAGONAL HEAD SHAPING |
|---|---|

AIM:

To machine a hexagon in the given work piece to the dimensions as shown in the figure using Shaping Machine

**TOOLS REQUIRED**

- Round nose tool - 1 No
- Vernier caliper - 1 No
- Steel Rule - 1 No
- Hammer - 1 No
- Punch - 1 No
- Scriber - 1 No
- Try square - 1 No
- Vernier height gauge - 1 No

**PROCEDURE:**

1. The given work piece is measured for its initial dimensions.
2. With the help of scriber, mark the hexagon dimensions in the work piece.
3. Fix the work piece in the vice of the shaping machine.
4. After fixing the work piece and the shaping tool, allow the ram to reciprocate.
5. Start the shaping process by giving the required depth by lowering the tool.
6. Slowly increase the depth of cut and repeat the procedure to make the hexagon shape.
7. The work piece is now checked for final dimensions.

**RESULT:**

Thus, a hexagon is machined in the given work piece to the dimensions as shown in the figure using Shaping Machine.