

LAKKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous & Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi,)

NAAC Accredited with 'A' grade, accredited by NBA,

Certified by ISO 9001:2018, 500001:2018, 14001:2015.

L B Reddy Nagar, Mylavaram-521 230, NTR District, Andhra Pradesh.

DEPARTMENT OF AEROSPACE ENGINEERING

B. Tech II Year - II Semester

R23 Regulation

MANUFACTURING TECHNOLOGY LAB MANUAL-23AE53



Prepared by

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M. Tech

Asst. Professor, ASE

Mr. S. INDRASENA REDDY,

M. Tech. (Ph. D),

Sr. Assistant Professor, ASE

Name:

Roll Number:

Semester:

Academic year:

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Certificate

This is to certify that it is a bonafied record of Practical work done by Sri/Kum. _____ bearing the Roll No _____ of _____ Class _____ Branch in the _____ laboratory during the Academic year _____ under our supervision.

Lecture In-Charge

INDEX

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LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L.B.Reddy Nagar, Mylavaram – 521 230, N.T.R. District, Andhra Pradesh, India
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DEPARTMENT OF AEROSPACE ENGINEERING

Estd.: 1998 Website: <https://www.lbrce.ac.in/ase/index.php> Email: hodaero@lbrce.ac.in Phone:08659-222933 Ext:624/623

Name of Course Instructor:

Mr. G V SURYA NARAYANA,

Course Name & Code:

Mr. S. INDRASENA REDDY,

Regulation:

Manufacturing Technology Lab-23AE53

L-T-P Structure:

R20

Credits:

0-0-3

Program/Sem/Sec:

1.5

B.Tech/IV-SEM

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- To acquire basic knowledge of casting process
- To demonstrate various joining processes using welding
- To demonstrate lathe machine and special machine operations

COURSE OUTCOMES (COs):

CO1	Develop a product using casting (Apply-L3) .
CO2	Fabricate machine components with suitable welding, lathe, and other machining operations (Apply-L3) .
CO3	Manufacture plastic components using various plastic processing techniques (Apply-L3) .

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	-	-	-	-	-	-	-	1	2	3
CO2	3	1	1	1	-	-	-	-	-	-	-	1	2	3
CO3	3	1	1	1	-	-	-	-	-	-	-	1	2	3
1 - Low					2 -Medium					3 - High				

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems.
PEO 2	To train students with good scientific and engineering breadth so as to analyze, design, and create novel products and solutions for the real-life problems
PEO 3	To prepare students to excel in competitive examinations, postgraduate programs, advanced education or to succeed in industry/technical profession
PEO4	To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context
PEO5	To provide student with an academic environment with awareness of excellence, leadership, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures, and Flight Dynamics in Aerospace vehicle design.
PSO 2	prepare the students to work effectively in Aerospace and Allied Engineering organizations.



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LIST OF EXPERIMENTS

23AE53 - MANUFACTURING TECHNOLOGY LAB	L	T	P	Cr.
	0	0	3	1.5

I. METAL CASTING LAB

1. Pattern Design and making - for one casting drawing.
2. Moulding, Melting and Casting - 1 Exercise

II. WELDING LAB

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 2 Exercises

III PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

IV MACHINE TOOLS LAB

1. Lathe Operations
2. Special Machines: Drilling, Shaping, Milling Grinding (Surface Grinding).
3. Preparation of Single Point Cutting Tool

PEODUCTION TECHNOLOGY LAB

Exp No:

**PREPARATION OF MOULD CAVITY
(SAND CASTING)**

Date:

Aim: To prepare a mould for a given split piece pattern

Material Required:

Moulding sand,
Facing sand, baking sand,
Parting sand, core,
Pattern,
Cope box,
Drag box,
Bottom board.

Tools Required:

Sprue, Riser,
Chaplets,
Gate cutter,
Trowel,
Vent rod,
Sleek,
Bellow.

Flask: A moulding flask is one which holds the sand mould intact. Depending upon the position of the flask, in the mould structure it is referred to by various names as drag cope and check. It is made up of wood for temporary applications or more generally of metal for long term use.

Drag: lower moulding flask.

Cope: Upper moulding flask.

Check: Intermediate moulding flask used in three moulding

Pattern: Pattern is a replica of the final object to be made with some modifications. The mould casting is made with the help of the pattern.

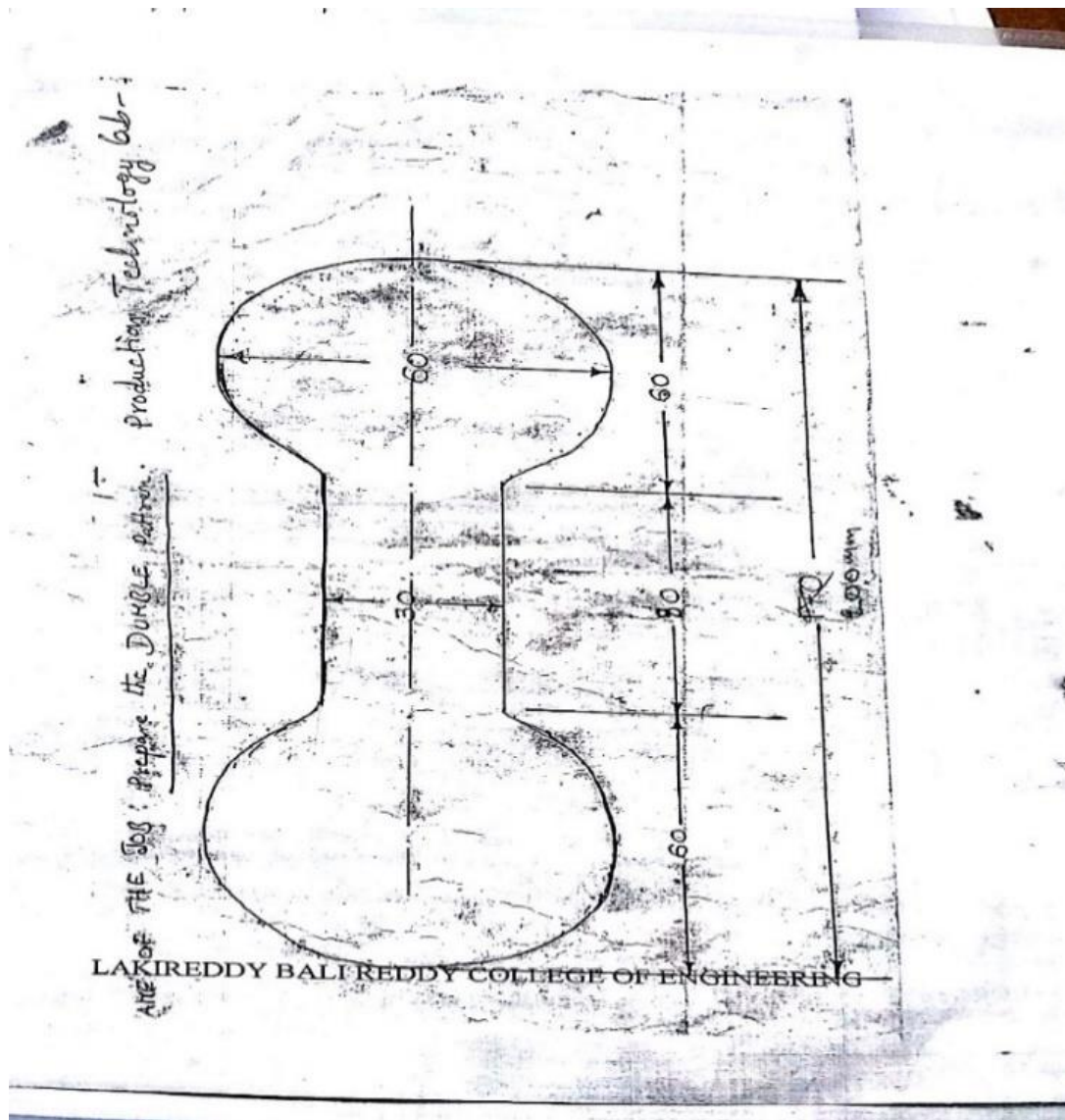
Parting Line: This is the dividing line between the two moulding flasks that makes up the sand mould. In split pattern it is also the diving line between the two halves of the pattern.

Bottom Board: This is a board normally made of wood which is used at the start of the mould making. The pattern is first kept on the bottom board sand is poured on it and then the ramming is done in the drag.

Facing Sand: It is specially prepared sand which is placed around the pattern which has superior properties with regards to refractoriness permeability etc. this will ensure better surface on the castings.

Coal Dust: The small number of carbonaceous materials sprinkled on the inner surface of the moulding cavity to give better finish to castings.

Diagram:



All Dimensions are in "mm".

Moulding Sand: It is a mixture of silica, clay and moisture in appropriate proportions to get the desired results and it surrounds the pattern facing sand while making the mould. The moulding sand is the mixture.

Backing Sand: It is that constitutes most of the refractory material found in the mould. This is made up of used and burnt sand.

Core: It is used for making hollow cavities in castings.

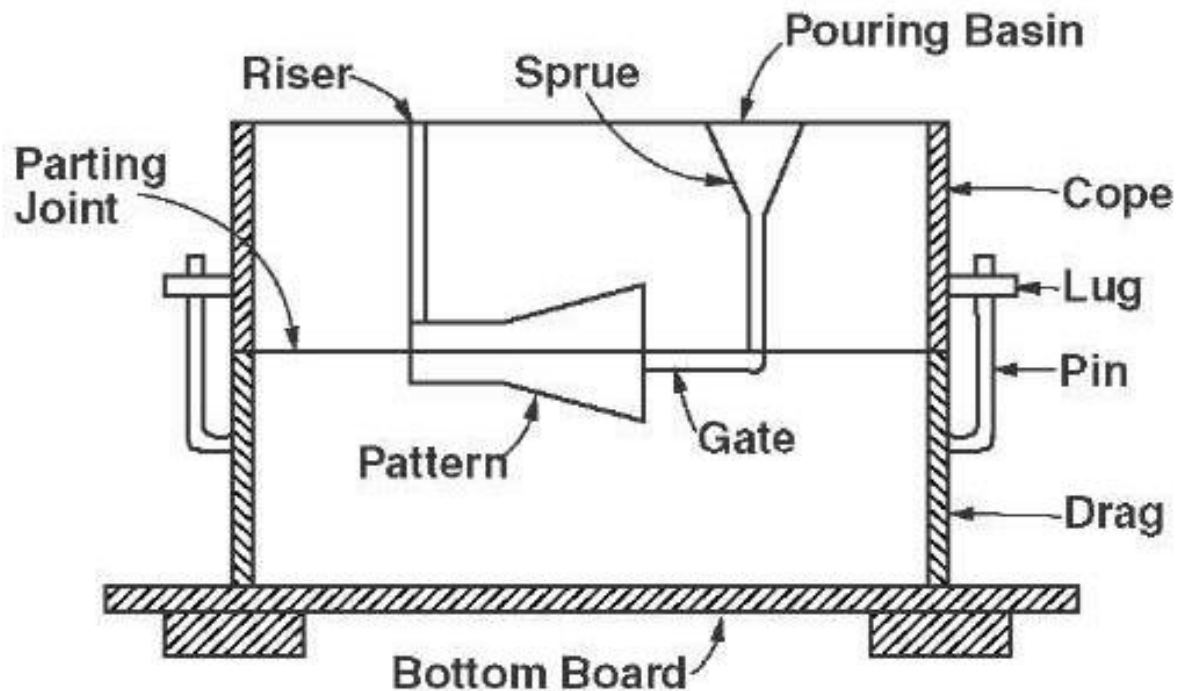
Sprue: The passage through which the molten metal from the pouring basin reaches the mould cavity. In many cases it controls the flow of metal into the mould.

Runner: The passageways in parting plane through which molten metal flow is regulated before they reach the mould cavity through the In - Gate.

Ingrate: The actual entry point through which molten metal enter mould cavity.

Riser: It is a reservoir of molten metal provided in the casting so that hot metal can flow into the casting when there is a reduction in volume of metal due to solidification.

Diagram:

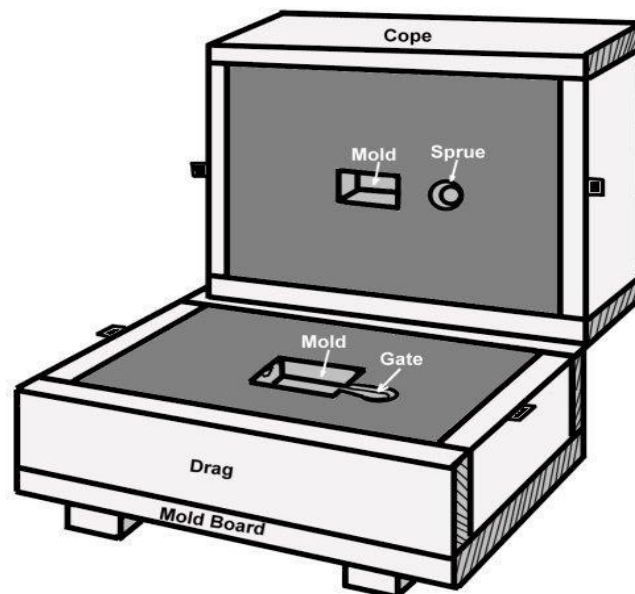


Chill: Chill are metallic objects which are placed in the mould to increase the cooling rate of molten metal.

Procedure:

- Preparation of the green sand: Sift the silica with the fine metal mesh and mix with the Bentonite clay in a large container. The mixture should be moist to the touch. Test wetness by grabbing a handful of the mixture and squeezing it. If there is water, it is too wet and more silica should be added. If it crumbles, then it is too dry and more clay should be added. The green sand is ready to be used when you can squeeze it and no water is visible and it can retain its shape without falling apart. Once it's ready place a top on the container in order to seal it and prevent it from drying out.
- Place the drag, bottom portion of the flask, on a hard surface.
- Place model into the middle of the drag and layout the runner so that it touches your model. The model and runner should lay flat and be at least 1 inch from either side of the drag's edge. Sprinkle on parting powder. This makes it easier to remove them after the green sand is packed
- Lightly sprinkle the green sand mixture into the drag slowly covering the model and runner. Once completely covered pack the edges using the rammer and then the top until sand is completely compacted.
- Carefully Flip the drag onto its bottom side and attach the cope. Spread more parting compound onto the surface.
- Place the riser and pouring cup into the flask and lightly spread green sand into it.

- Once the sand has completely covered the surface use the rammer to pack the sand once again
- Once the sand is safely compacted open the flask and carefully remove the cope.
- Remove the pouring cup and riser pieces from the cope as well as the model, runner and gating system from the drag. Take care to remove everything carefully to ensure that you do not disturb the mold.
- Use a fine pain brush to eliminate any particles of sand that has fallen into the molded areas. Gas vents can be placed using a very small file on the cope if needed.
- Attach both pieces of the flask together. Your mold is ready for use. Keep it covered while you are preparing the molten metal.



Precautions:

- There should be enough clearance between the pattern and the walls of the flask.
- The ramming of the sand should be done properly so as not to compact it too hard, which makes the escape of gases difficult.
- Ensure sand quality and bonding are adequate for a stable mould cavity.
- Align the pattern carefully to prevent dimensional inaccuracies.
- Control moisture content in the sand to avoid gas-related defects.
- Apply parting powder to the pattern for easy removal without damage.
- Provide adequate vent holes for gas escape during metal pouring.

Result: Mould for single piece pattern is prepared.

Exp No:

Pattern Making

Date:

AIM: To prepare a wooden pattern detailed below with allowance.

TOOLS & EQUIPMENT REQUIRED:

Peering chisel	Outside chisel
Firmer chisel	Try square
Wood rasps half round file	Handsaw
Outside gauge	Mallet
Sandpapers	Steel rule
Mortise chisel	outside calliper
Inside chisel	

MATERIAL REQUIRED: Teak wood given sizes.

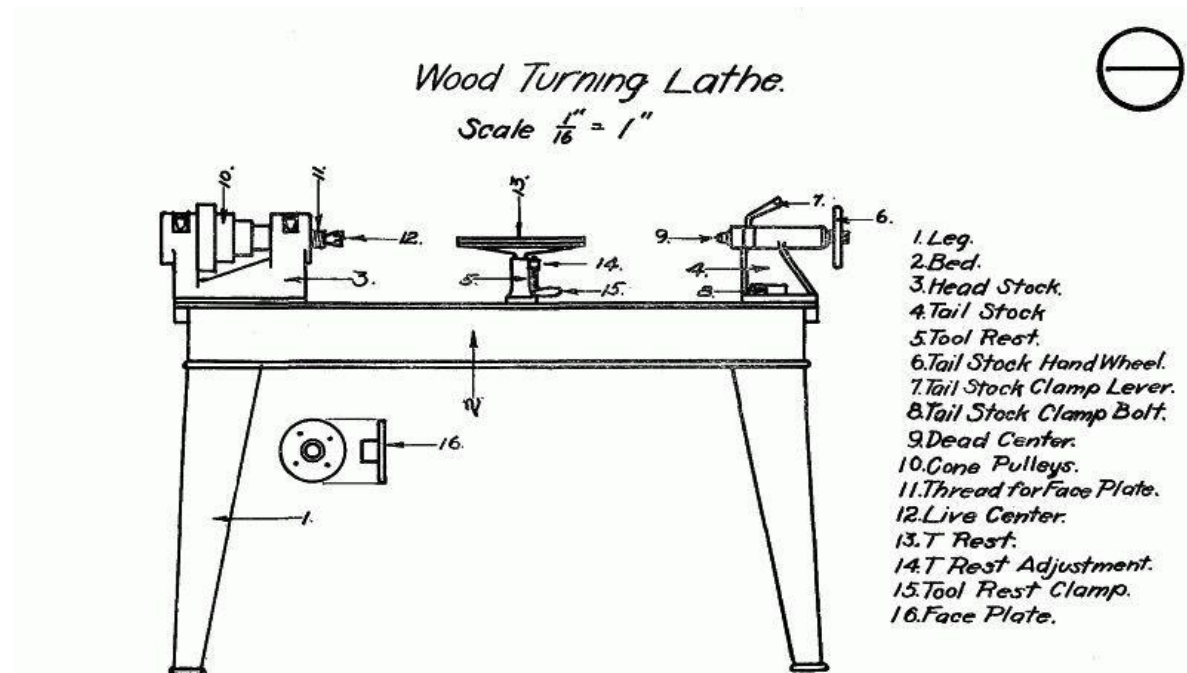
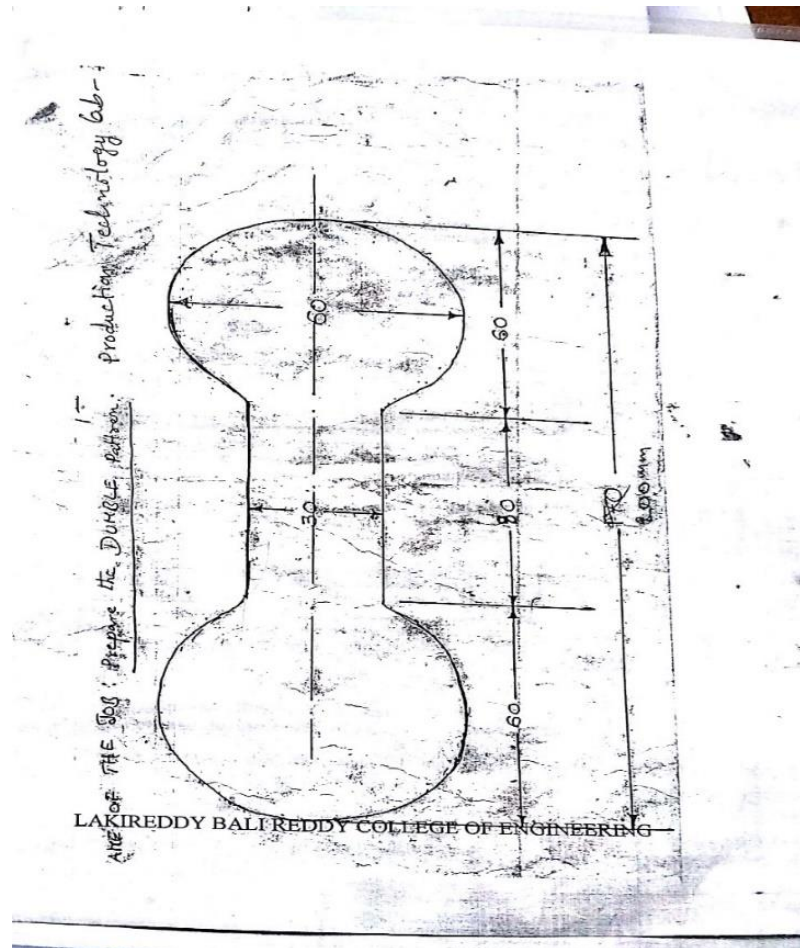
PROCEDURE:

- Match the two rectangular wood pieces of stock and fix them together by wood screws at either end in the excess portion of wood.
- This must give a firm clamping of the wood pieces to turn into single piece. In body portion of the pattern mark a centre line using marking gauge and extend it to the dressed end.
- Using the rule with counter sunk make indentations at the centre of each end to form locations for the head stock and tail stock centre.
- The wood stock is turned on the wood turning lathe using appropriate gauge and finally finished the dimensions.
- Sanding paper No. 1/2 or No.0 does smooth finishing. The sandpaper should be moved laterally on the rotating work.

PRECAUTIONS

- The tools are kept sharp to cut freely without burning and without much pressure to cause chipping.
- Maintain proper turning angles.
- Be alerted to avoid accidents.
- Choose durable materials to ensure pattern longevity and accuracy.
- Include shrinkage allowance to avoid dimensional errors in the casting.
- Add a draft angle to facilitate easy removal from the mould.
- Provide extra material for machining on precision surfaces.
- Ensure proper surface finish on the pattern to enhance mould cavity quality.

Diagram:



RESULT:

The Required Split pattern is prepared by using of various tools like steel rule, chisels, wood rasp files etc.

Exp No:

PREPARATION OF BUTT JOINT USING ARC WELDING

Date:

AIM: To prepare Joints for welding suitable for butt- welding and lap welding.

TOOL & EQUIPMENT REQUIRED:

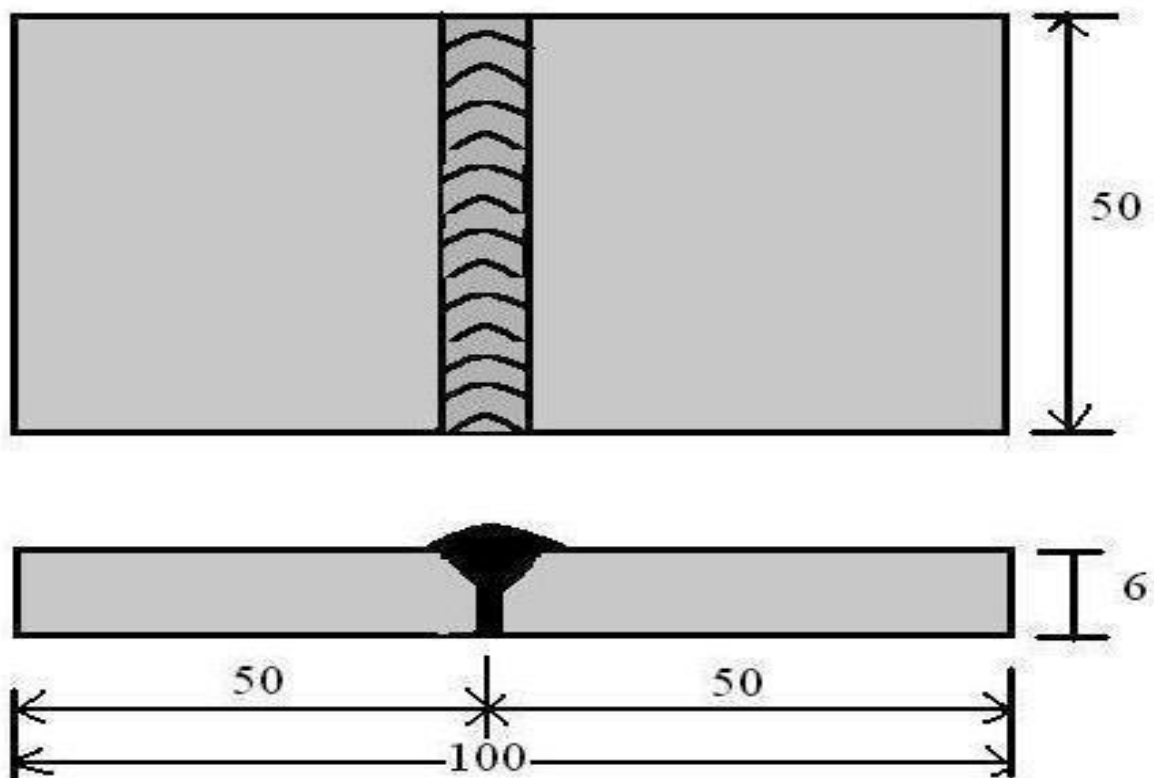
Scale
Scriber
Hand hack saw
Flat file
Swing scale protector

Welding machine
Shield, gloves
Wire brush
Chipping hammer
Welding rod

MATERIAL REQUIRED: Mild steel plate of 5 mm thickness.

EXPERIMENT DIAGRAM FOR V BUTT JOINT:

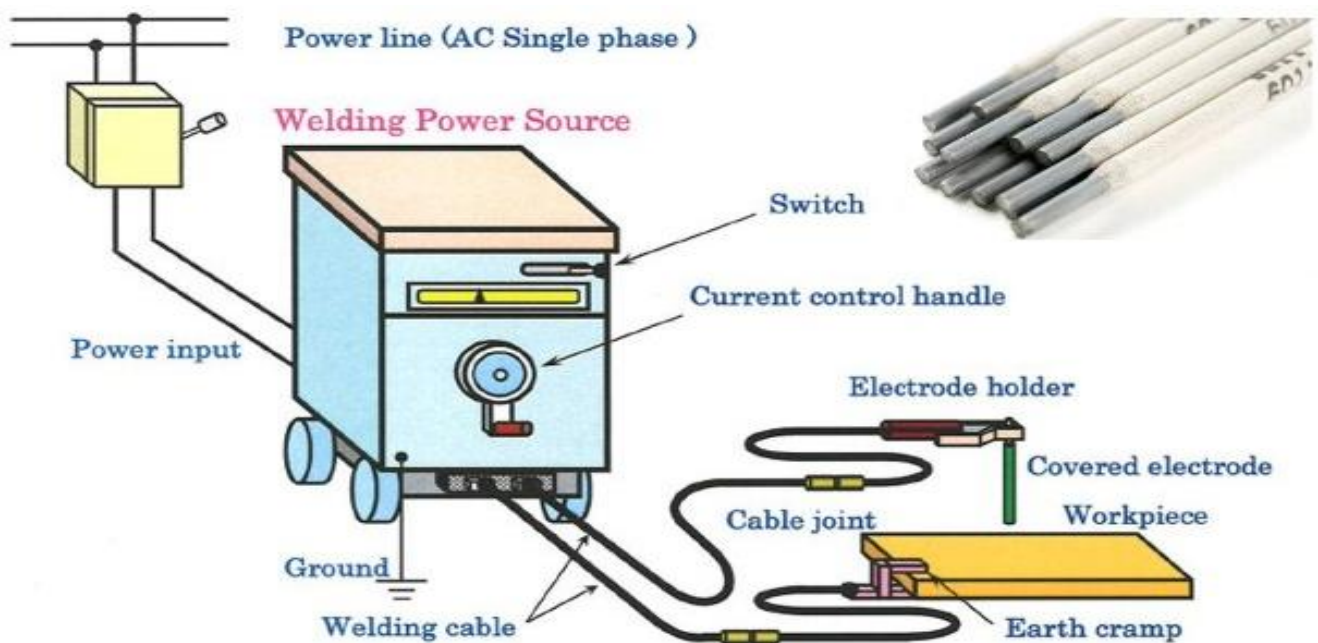
Joint Two M.S.Plates by V Butt Arc Welding



All dimensions in "mm"

Procedure:

- Given 2 M.S. plates are filled at an angle of 45° at 2 surfaces to be joined (V groove is formed)
- Electrode is fixed to electrode holder.
- Connections to be given such that electrode- negative and work piece positive.
- Welding is to be done carefully for the half-length of the plates.
- The work piece is to be cut into two halves by power hacksaw.
- The beads are polished, etched with two percent nital solution and studied under the microscope whose magnification factors 10X for the heat affected zone.
- By gripping the beads b/w the jaws of Tensile testing machine and load is applied until the work piece breaks and the readings is to be noted.
- The same procedure is repeated for the remaining half which is welded by reverse polarity and the results are to be compared.

**PRECAUTIONS:**

1. Wear apron, shoes, nose mask, gloves and tight fitted clothes. Be careful and attentive while working on welding job.
2. During welding don't see the welding light range directly without the gaggle face shield.
3. Do not cool the welding piece in water.
4. Do not keep electrode holder on the welding machine.
5. No inflammable material should be present in welding shop.

Result: To prepared Joints for welding suitable for butt- welding by using of various tools and equipment's

Exp No:**PREPARATION OF LAP JOINT USING ARC
WELDING****Date:**

AIM: To prepare Joints for welding suitable for lap welding.

TOOL REQUIRED:

Scale

Scriber

Hand hack saw

Flat file

Swing scale protector

gloves

Welding machine

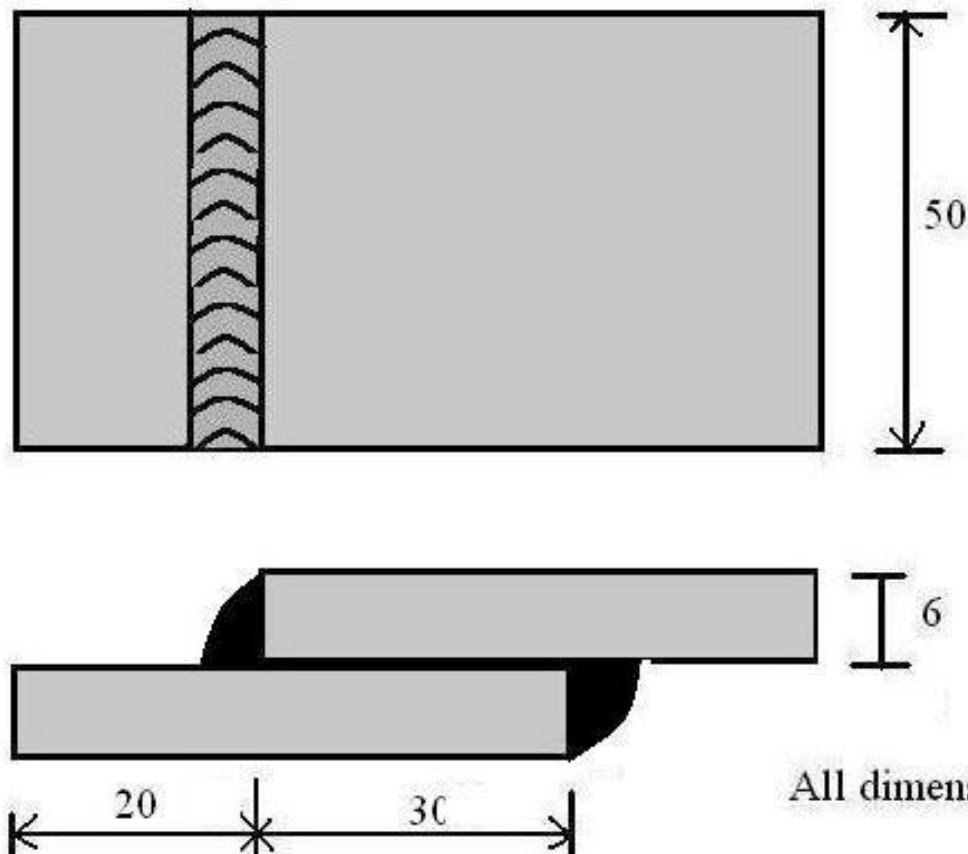
Shield

Wire brush

Chipping hammer

Welding rod

MATERIAL REQUIRED: Mild steel plate of 5 mm thickness.

EXPERIMENT DIAGRAM FOR LAP JOINT:

PROCEDURE FOR LAP JOINT:

- Two pieces are cut to size and surfaces to be welded are cleaned properly.
- Electrode is held in electrode holder and earth clamp is clamped to be work piece.
- The pieces are positioned overlapping each other for lap joint and tack weld is done at two end points.
- 2-3 mm spark gap is maintained, and welding is done smoothly.
- Slag is removed using chipping hammer and weld is cleaned using wire brush.

PRECAUTIONS:

- 1 Wear apron, shoes, nose mask, gloves and tight fitted clothes. Be careful and attentive while working on welding job.
- 2 During welding don't see the welding light rage directly without the gaggle face shield.
- 3 Do not cool the welding piece in water.
- 4 Do not keep electrode holder on the welding machine.
- 5 No inflammable material should be present in welding shop.

RESULT:

To prepared Joints for welding suitable for lap welding.

Exp No:

**PREPARATION OF LAP JOINT USING SPOT
WELDING
(CHINE JOINT AND ZIGZAG JOINT)**

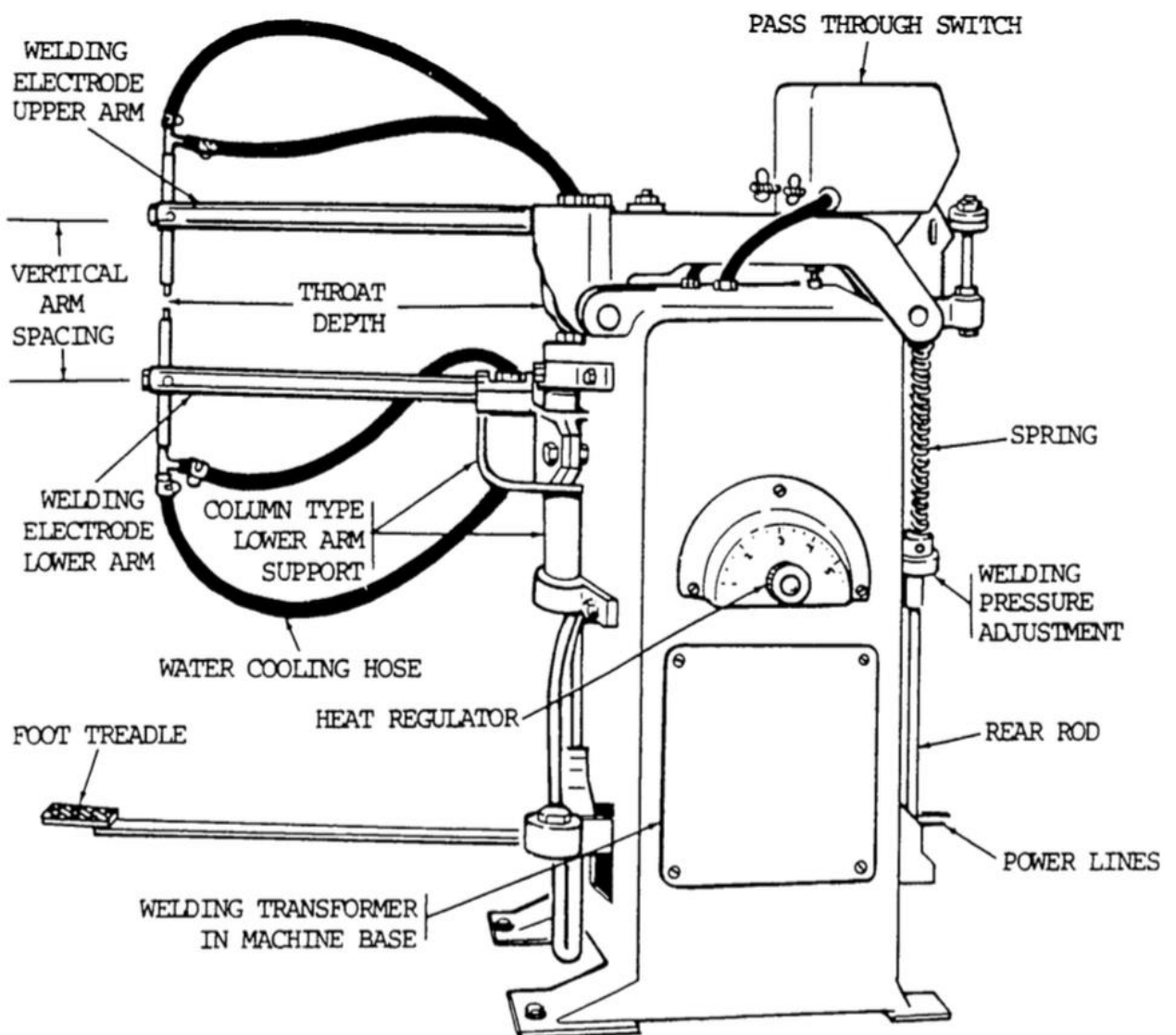
Date:

Aim: To study the effect of the current on weld strength-using spot-welding process

Equipment: Spot welding machine

Material Required: Two metal pieces of size 4"x2"

Description of the Equipment:



- **Spot Welding Machine:** A specialized device that generates a high electric current through the weld area to fuse overlapping metal sheets. It typically has adjustable current and pressure settings to suit different materials and thicknesses.

- **Electrodes:** Copper or copper alloy electrodes are used to conduct electricity and apply pressure to the sheets being joined. They come in various shapes, commonly flat or domed, to create the proper weld nugget for the joint.
- **Electrode Holder and Arm:** These support and position the electrodes, often adjustable to apply the correct pressure for effective welding. The arms are insulated to prevent unintended current flow outside the welding area.
- **Power Supply and Control Panel:** Supplies high current and allows precise control over welding parameters, including current, duration, and electrode force. The control panel enables operators to set specific welding cycles and power levels for consistent welds.
- **Cooling System:** Spot welding generates significant heat, so the equipment usually has a water-cooling system to prevent electrode and machine overheating, maintaining consistent weld quality and prolonging equipment life.

THEORY:

Resistance welding: the category resistance welding (RW) covers a number of processes in which the heat required for welding is produced by means of electrical resistance across the two components to be joined. These processes have major advantages, such as not requiring consumable electrodes, shielding gases, or flux. The heat generated in resistance welding is given by the general expression

$$H = I^2RT,$$

Where

H = heat generated (in joules (watt-seconds))

I = current (in amperes),

R= resistance (in ohms), and

T= time of current flow (in seconds)

The actual temperature rise at the joint depends on the specific heat and on the thermal conductivity of the metals to be joined.

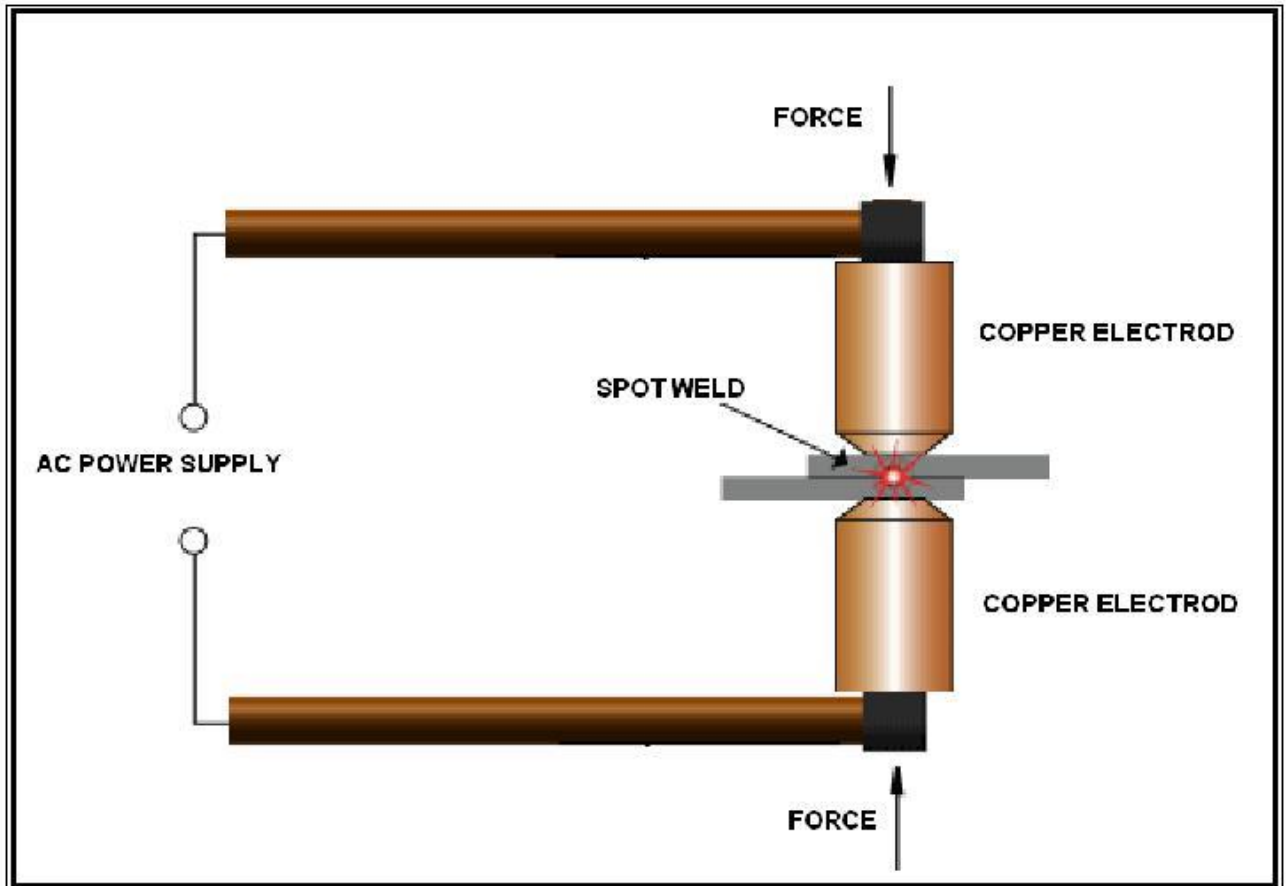
The tips of two opposing solid cylindrical electrodes touch a lap joint of two sheet metals, and resistance heating produces a spot weld. In order to obtain a strong bond in the weld nugget, pressure is applied until the current is turned off. Accurate control and timing of the electric current and of the pressure are essential in resistance welding.

The strength of the bond depends on surface roughness and on the cleanness of the mating surface. Oil, paint, and thick oxide layers should, therefore, be removed before welding. The presence of uniform, thin layers of oxide and of other contaminants is not critical.

The weld nugget is generally 6 to 10 mm in diameter. The surface of the weld spot has a slightly discoloured indentation. Currents range from 3000 A to 40000 A: the level depends on the materials being welded and on their thicknesses.

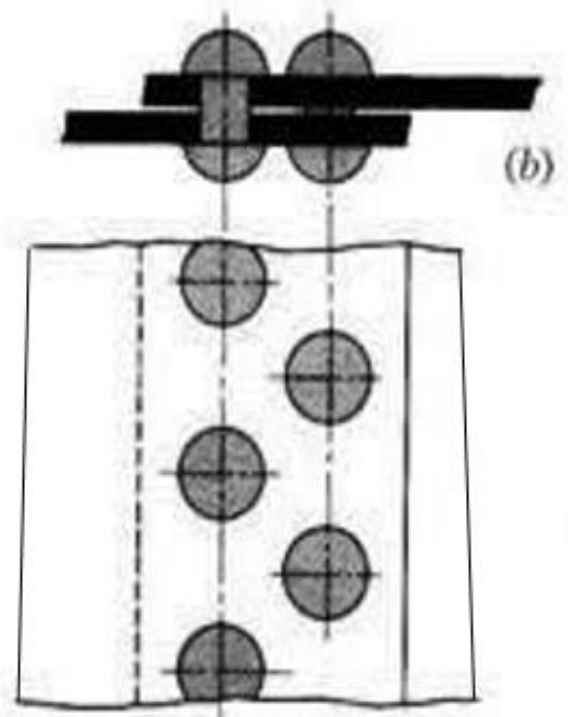
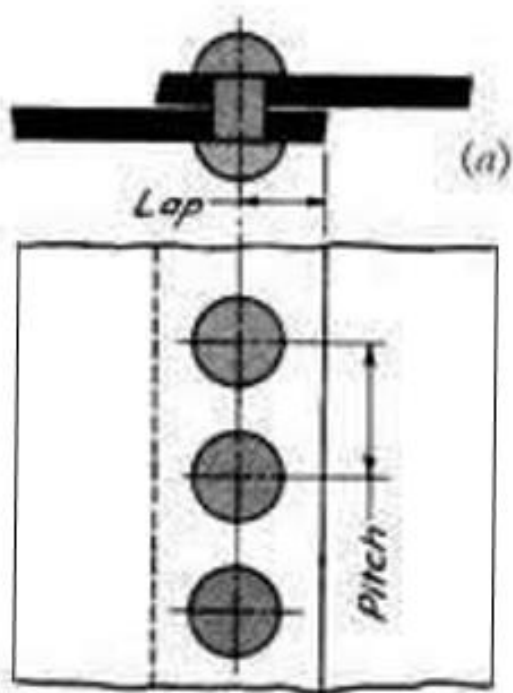
PROCEDURE:

- Switch on the machine and set the current in the machine to 2 Ampere.
- Set the timer to two seconds.
- Overlap the two metal pieces to the required size and place them between the two electrodes.
- Apply pressure by foot on the lever such that two electrodes come into contact if the overlapped metals.
- After 2 seconds remove the pressure on the lever slowly.
- Now the joint is ready for use.
- Repeat the same procedure at various amperes.
- Test the strength of the joints using universal testing machine.

**PRECAUTIONS:**

1. Ensure that the electrodes should not be touched.
2. Don't touch the welded portion by hand immediately after the welding is done.
3. Ensure proper alignment of metal sheets before initiating the spot-welding process.
4. Regularly inspect and maintain electrodes to prevent wear and ensure consistent weld quality.
5. Adjust welding parameters based on material thickness and type for optimal results.
6. Monitor the cooling system to prevent overheating of electrodes and equipment.
7. Use appropriate personal protective equipment (PPE) to safeguard against sparks and heat during welding.

EXPERIMENT DIAGRAM:



RESULT: Effect of current on strength of spot weld is studied.

Aim: To Prepare a Plastic product using Injection Moulding machine

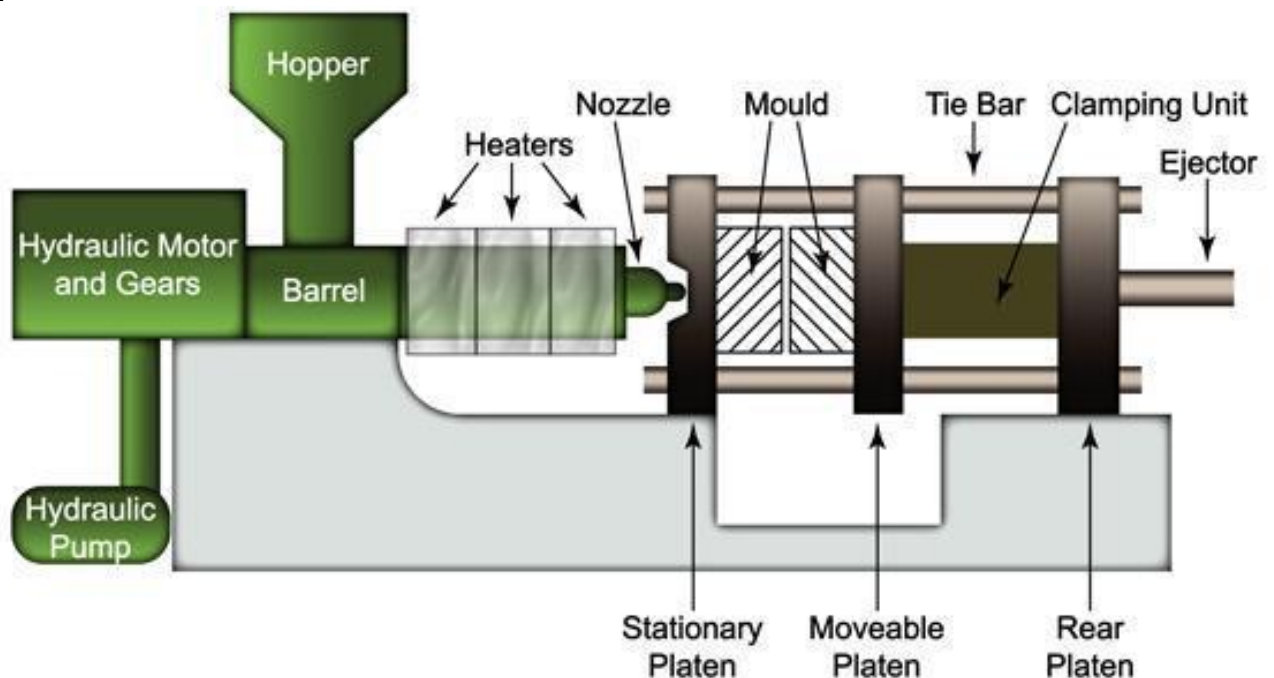
Equipment: Injection moulding machine.

Material Required:

- **Thermoplastic or Thermosetting Resins:** The primary raw materials used, which can include materials like polyethylene, polypropylene, polystyrene, ABS, nylon, and various other specialized plastics.
- **Colorants and Additives:** Dyes, pigments, and other additives (such as UV stabilizers, impact modifiers, and flame retardants) to enhance the properties and appearance of the final product.
- **Mold Material:** Typically made from steel or aluminium, the mould is designed to shape the injected material into the desired final product.
- **Lubricants:** Used in the mould to facilitate the release of the moulded part and reduce wear on the mould surfaces.
- **Cooling Agents:** Water or other cooling fluids circulate through channels in the mould.

Description of the Equipment:

Hydraulic Plastic Injection Moulding machine, Model JIM-1HD has been designed for moulding variety components up to 45 Gms capacity in polystyrene. The machine is robustly built to ensure consistent high quality and volume production of precision components. Operator fatigue due to injection process is completely eliminated by use of hydraulic power for both the injection and releases operations.



Locking Unit: This locking made by Hydraulic Cylinder.

Injection Unit: Injection Unit consists of two guide rods, nuts, top and bottom plates with injection cylinder and barrel. Injection cylinder is designed to develop 3 Tons load. Barrel diameter 30mm is attached with the machine as standard.

Hydraulics: Hydraulic pump is driven by 3 HP Induction motor for a rated delivery of 14 lp, at 1440 Rpm and at 80kg/cm². The maximum pressure in the hydraulic system is present in our works and is not to be altered. The oil tank capacity is 60 liters. All hydraulic system manufacturers' safety precautions are provided to hydraulic system by using section strainer, which will prevent the contamination entering into the system.

Oil Cooler: Oil cooler provided to keep the oil temperatures below 50°C which will give more life to hydraulic oil in continuous use.

Electricals: Electrical control panel with automatic temperature controller is fixed on the right-hand side of the machine for clear viewing of the temperature and for easy to operate the switches. Designed with safety measure, which will protect the motor from overload.

Working Procedure:

- The granular moulding material is loaded hopper where it is metered out in a heating cylinder by a feeding device.
- The exact amount of material is delivered to a cylinder, which is required to fill the mould completely.
- Set the die in position Provide spacing plates if necessary. Clamping the Die using hydraulic operate ram.
- Set the injection pressure by rotating (clockwise) the regulator knob to suit the requirement of moulding the container.
- Switch on the heater. Set the required timings to the timers, for top and middle Heater. Set the temperature by adjusting automatic temperature controller to control the bottom heater. Allow sufficient time to stabilize. When temperature reached, operate the hand lever valve to inject the material.
- Apply injection pressure on the heated material using plunger rod.
- The injection ram pushes the material in to the heating cylinder and in doing so pushes a small amount of heated material out of the other end of the cylinder through the nozzle and screw bushing and into the cavity of closed mould.
- The material is cooled in a rigid state in the mould.
- Release the injection pressure. In clamp the Die using hydraulic operated ram.
- The mould is then opened and piece is ejected out.

Diagram:

Result: Required product is made using injection moulding process.
Draw the component diagram:

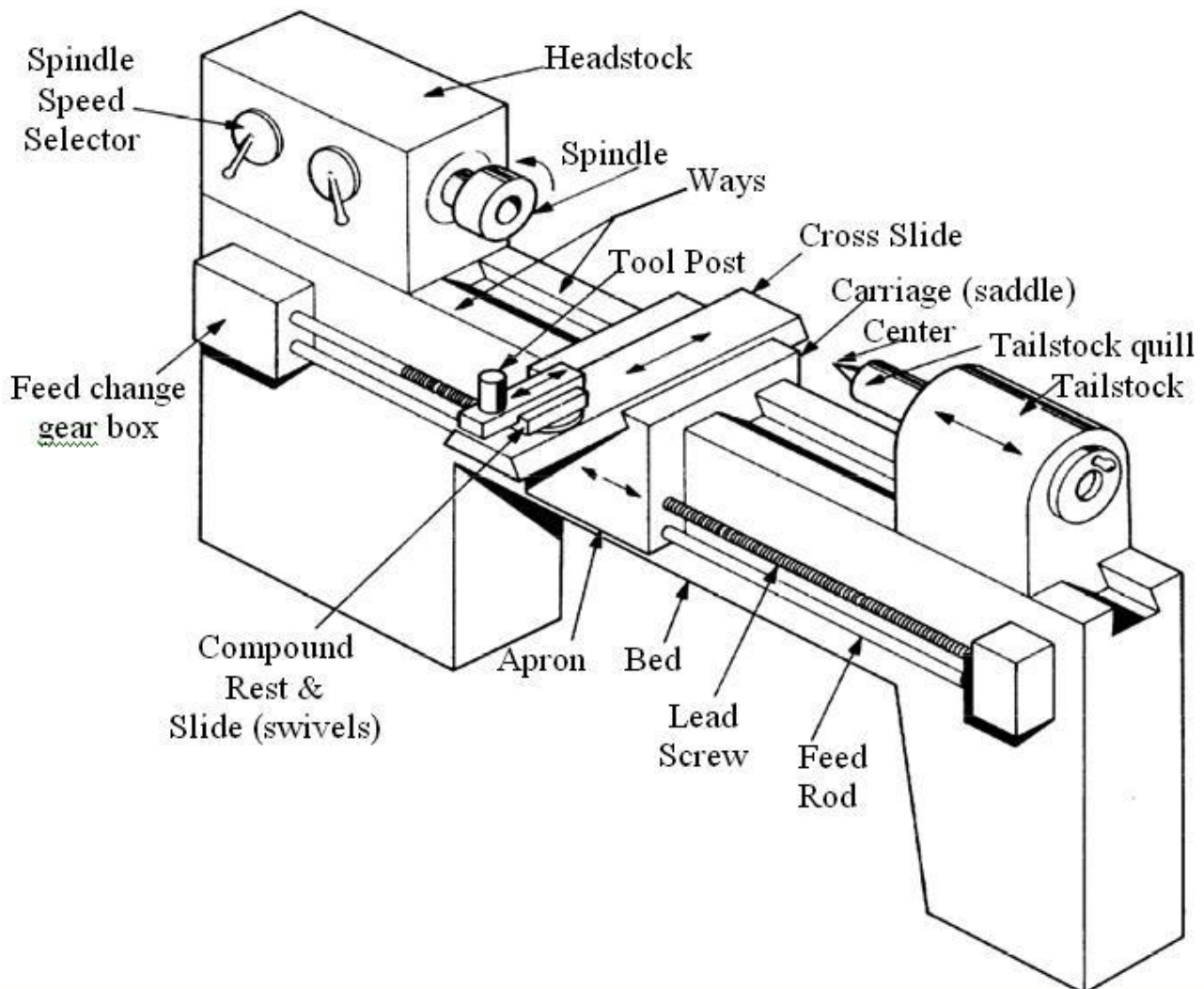
Machin Tools Lab

INTRODUCTION OF GENERAL PURPOSE OF MACHINES

Various machining purpose used these all type of mechanical machining machines is Lathe machine, Shaper machine, slotting machine, planing machine, drilling machine, boring machine, milling machine, grinding machine, lapping machine Honing machine and Broaching machine.

These machines are to producing various operations like namely Facing, Chamfering, Step turning, Taper turning, Plain turning, Knurling, Grooving, Thread cutting, Drilling, Tapping, Precision grinding, cylindrical grinding, Surface grinding, grinding of tool angles etc...

LATHE MACHINE:



A lathe is a machine tool which rotates the work piece on its axis to perform various operations such as cutting, sanding, knurling, drilling, or deformation with tools that are applied to the work piece to create an object which has symmetry about an axis of rotation.

Lathes are used in woodturning, metalworking, metal spinning, and glass working. Lathes can be used to shape pottery, the best-known design being the potter's wheel. Most suitably equipped metalworking lathes can also be used to produce most solids of revolution, plane surfaces and screw threads or helices. Ornamental lathes can produce three-dimensional solids of incredible complexity. The material can be held in place by either one or two centres, at least one of which can be moved horizontally to accommodate varying material lengths. Other work holding methods include clamping the work about the axis of rotation using a chuck to a faceplate, using clamps or dogs.

LATHE MACHINE PARTS

- Bed
- Headstock
- Tail stock
- Carriage
- Saddle
- Cross Slide
- Compound rest
- Tool Post
- Apron
- Chuck
- Feed rod
- Lead Screw
- Spindle

Saddle:

It is an H-shaped casting mounted on the top of the lathe ways. It provides support to cross-slide, compound rest, and tool post.

Cross Slide:

Cross slide is provided with a female dovetail on one side and assembled on the top of the saddle with its male dovetail.

The top surface of the cross slide is provided with T slots to enable fixing of rear tool post or coolant attachment. Carriage basically provides a mounted or automatic cross-movement for the cutting tool.

Compound Rest:

Compound rest is present on the top of the cross slide. It supports the tool post and cutting tool in its various positions. Compound rest is necessary for turning angles and boring short tapers and forms on forming tools.

Tool Post:

The tool post is mounted on the compound rest. It is used to hold various cutting tool holders. The holders rest on a wedge which is shaped on the bottom to fit into a concave-shaped ring (segmental type),

Which permits the height of the cutting edge to be adjusted by tilting the tool. It is fixed on the top slide. It gets its movement by the movement of the saddle, cross slide, and top slide.

The three types of tool post which are commonly used are:

- Ring and rocker tool post: It consists of a circular tool post with a slot for accommodating the tool or tool holder.
- Quick change tool post
- Square head tool post.

Apron:

The Apron is fastened to the saddle and hangs over the front of the bed. Apron consists of the gears and clutches for transmitting motion from the feed rod to the carriage, and the split nut which engages with the lead screw during cutting threads.

Two types of Aprons are extensively used:

- Incorporating drop worm mechanism.
- Friction or dog clutches.

Chuck:

Chuck is basically used to hold the workpiece, particularly of short length and large diameter or of irregular shape which can't be conveniently mounted between centres. It can be attached to the lathe by screwing on the spindle nose.

Four different types of chucks are most used in Lathe:

1. Three jaw chuck
2. Four jaw chuck
3. Lathe center and lathe dog
4. Collect chuck.
5. Faceplate
6. Magnetic chuck

Independent or four-jaw chuck:

It is used for irregular shapes, rough castings of square or octagonal in such jobs, where a hole is to be positioned off the centre. It consists of four jaws and each jaw is independently actuated and adjusted by a key for holding the job.

Three jaw or universal chuck:

It consists of three jaws that move simultaneously by turning a key and the workpiece automatically remains in the centre of the chuck opening. It is used for holding a round, hexagonal bar or other symmetric work.

Collet chuck:

It is mostly used in the places where production work is required such as in Capstan Lathe or automats. It is used for holding the bars of small sizes (below 63mm).

Magnetic chuck:

They are of permanent magnet type or electrically operated. In Lathe, it does not have widespread use.

Feed Rod:

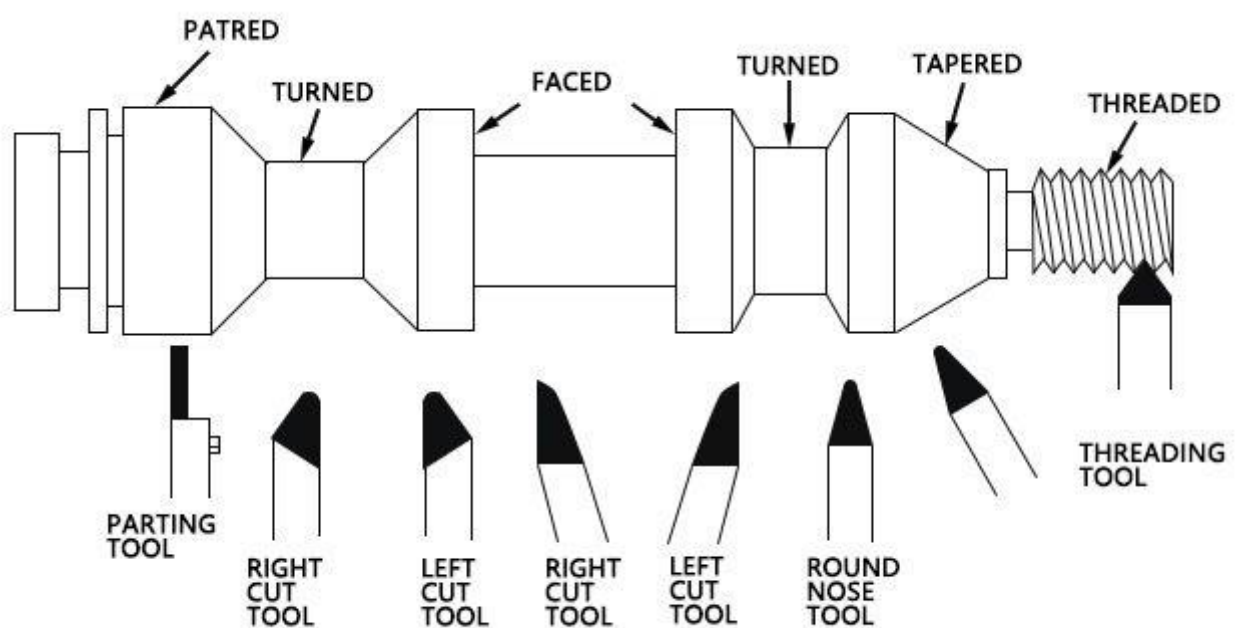
Feed rod is a power transmission mechanism used for precise linear movement of the carriage along the longitudinal axis of the lathe. In some lathe machines instead of feed rod lead screws are used.

Lead screw:

The lead screw is used mostly in the case when the threading operation is to be performed on a lathe. As we know for threading operation requires rotational movement of the job (workpiece) and the linear movement of the tool (tool post). So, rotation of the job is obtained by the chuck and the desired linear motion of the tool-post (as the lead screw drives the saddle when it is engaged) is provided with the help of a lead screw.

LATHE TOOLS:

- Turning Tool
- Cutting Tool Holder
- Boring Tool
- Threading Tool
- Parting Tool
- Grooving Tool
- Knurling Tool
- Facing Tool
- Reaming Tool
- Drilling Tool
- Chamfering Tool
- Lathe Tool Bits



CUTTING SPEEDS:

Definition: Lathe cutting speed (V_c) is the speed at which the cutting tool moves along the surface of the rotating workpiece. It is typically measured in surface feet per minute (SFM) or meters per minute (m/min).

Formula: The cutting speed can be calculated using the following formula:

$$V_c = \frac{\pi \times D \times N}{12}$$

Where:

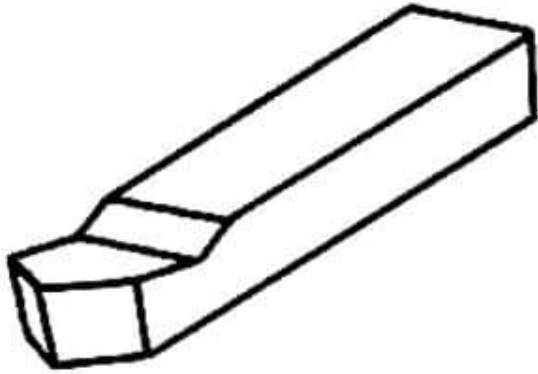
- V_c = Cutting speed (SFM)
- D = Diameter of the workpiece (in inches)
- N = Spindle speed (in RPM)

Different Operation Performed on Lathe Machine:

- Turning Operation
- Tapered Turning
- Shoulder Turning
- Facing Operation
- Thread cutting operation.
- Parting Operation
- Chamfering Operation
- Knurling Operation
- Drilling Operation
- Boring Operation
- Counter Boring Operation
- Countersinking Operation and
- Reaming Operation

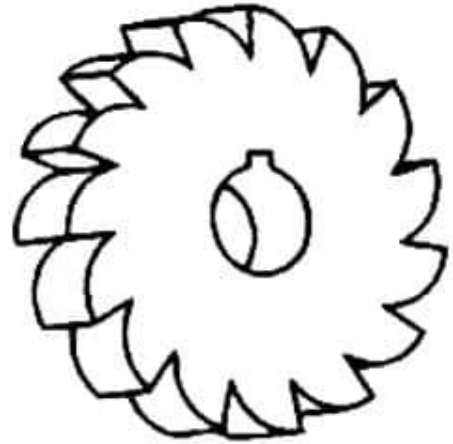
Single Point Tools

Used in turning operations.



Multipoint Tools

Used in milling and drilling operations.



Exp No:

STEP TURNING

Date:

AIM: To perform various lathe operations such as facing, plain turning, step turning on a given material made of Mild steel.

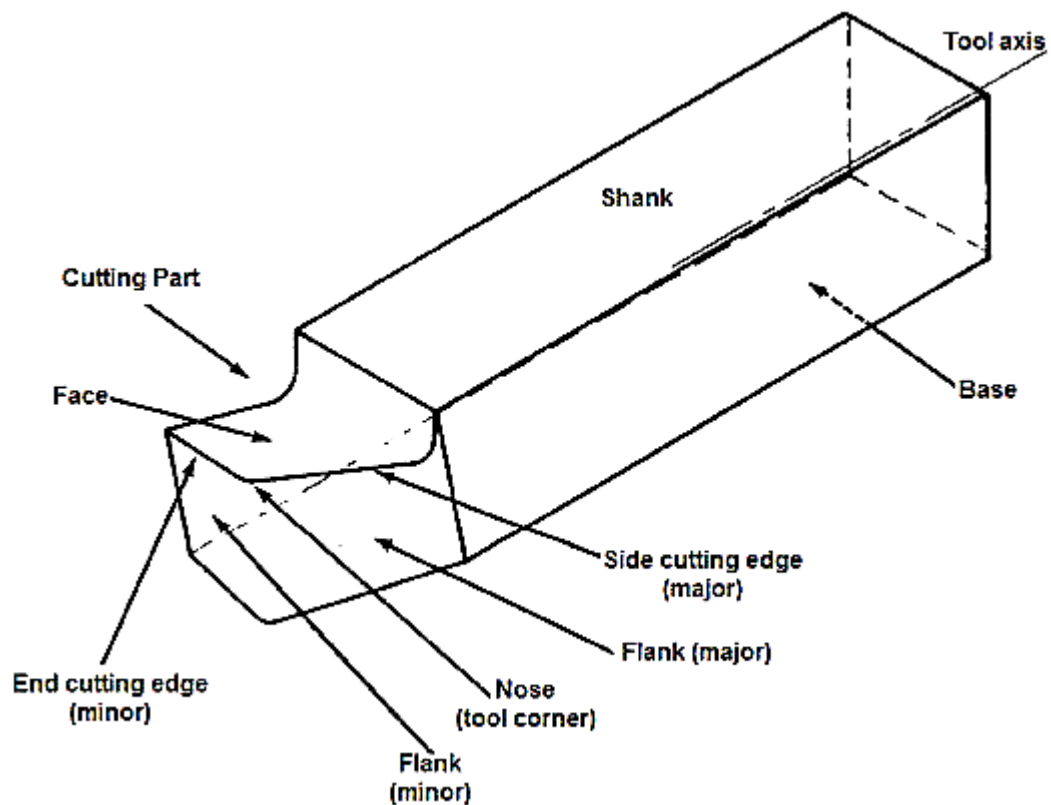
MATERIAL REQUIRED: A mild steel bar of 25 mm diameter and 100 mm length.

TOOLS AND EQUIPMENT USED:

- H.S.S. single point cutting tool,
- Chuck key,
- Tool post key,
- Outside calliper,
- Steel rule.

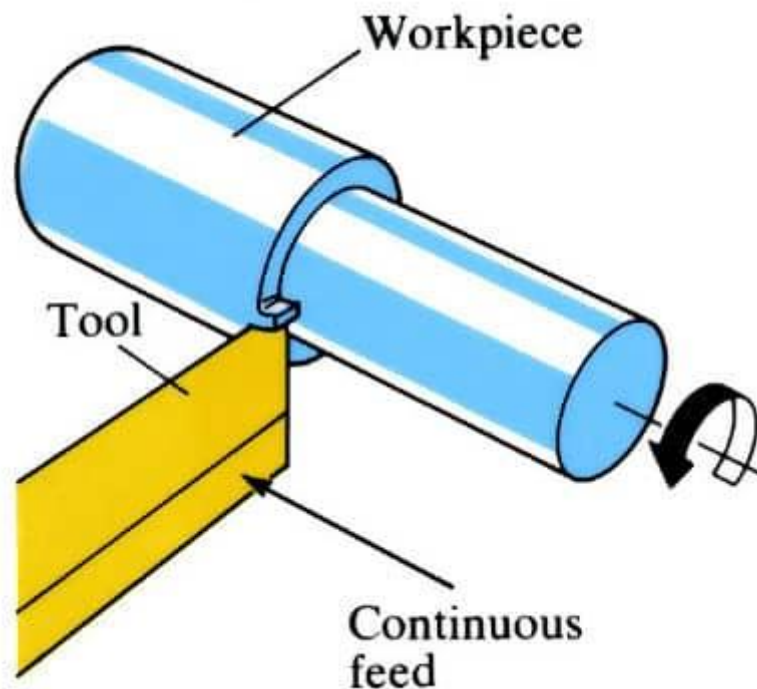
SEQUENCE OF OPERATIONS

1. Facing H.S.S Single Point tool
2. Rough turning H.S.S Single Point tool
3. Finish turning H.S.S Single Point tool.
4. Step turning H.S.S Single Point tool.
5. Taper turning H.S.S Single Point tool.



PROCEDURE:

- The work piece is fixed in a 3 – jaw chuck with sufficient overhang.
- Adjust the machine to run the job to a required cutting speed.
- Fix the cutting tool in the tool post and cantering operation is performed so that the axis of the job coincides with the lathe axis.
- Give the feed and depth of cut to the cutting tool.
- Facing operation is performed from the centre of the job towards outwards or from the circumference towards the centre.
- Plain turning operation is performed until the diameter of the work piece reduces to 23 mm.
- Check the dimensions by using vernier callipers.
- Perform the plain turning operation on the same work piece for the required length in order to reduce the diameter to 18 mm so as to get the step turning.
- Using a V – cutting tool grooving operation is performed according to the given dimensions and finishes the groove using parting tool.
- Finally check the dimensions by using vernier callipers.



PRECAUTIONS

- The work piece should be held rigidly in the chuck before operating the machine.
- Tool should be properly ground, fixed at correct height and properly secured, and work also be firmly secured.
- Before operating the machine see whether the job and tool is firmly secured in devices or not.
- Optimum machining conditions should be maintained.
- Chips should not be allowed to wound around a revolving job and cleared as often as possible.
- Apply cutting fluids to the tool and work piece properly.



RESULT:

The MS circular component is machined as per the sketch.

Exp No:

TAPER TURNING

Date:

AIM: To perform various lathe operations such as facing, plain turning, step turning and taper turning on a given material made of Mild steel.

MATERIAL REQUIRED: A mild steel bar of 25 mm diameter and 100 mm length.

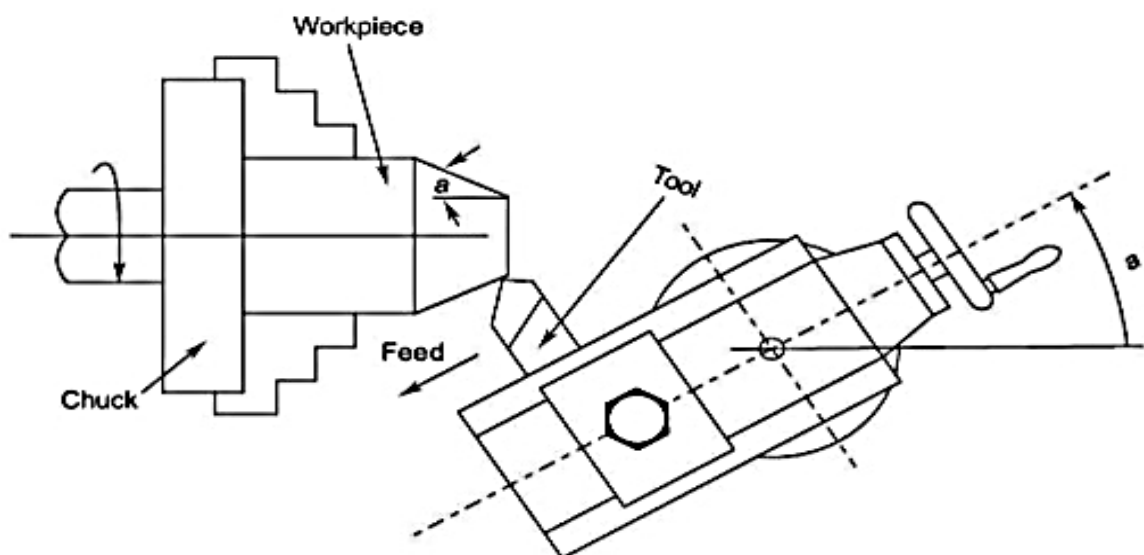
TOOLS AND EQUIPMENT USED:

- H.S.S. single point cutting tool,
- Chuck key,
- Tool post key,
- Outside calliper,
- Steel rule.

SEQUENCE OF OPERATIONS:

1. Facing H.S.S Single Point tool
2. Rough turning H.S.S Single Point tool
3. Finish turning H.S.S Single Point tool.
4. Step turning H.S.S Single Point tool.
5. Taper turning H.S.S Single Point tool.

Taper turning by swiveling the compound rest



PROCEDURE

- The work piece is fixed in a 3 – jaw chuck with sufficient overhang.
- Adjust the machine to run the job to a required cutting speed.
- Fix the cutting tool in the tool post and cantering operation is performed so that the axis of the job coincides with the lathe axis.
- Give the feed and depth of cut to the cutting tool.
- Facing operation is performed from the Center of the job towards outwards or from the circumference towards the Center.
- Plain turning operation is performed until the diameter of the work piece reduces to 23 mm.
- Check the dimensions by using vernier callipers.
- Using a V – cutting tool grooving operation is performed according to the given dimensions and finishes the groove using parting tool.
- Swivel the compound slide to the required angle and perform taper turning operation by rotating the compound slide wheel.
- The angle can be measured by using the formula:

$$\tan \alpha = (D - d) / 2L.$$

- Finally check the dimensions by using vernier callipers.

PRECAUTIONS:

- The work piece should be held rigidly in the chuck before operating the machine.
- Tool should be properly ground, fixed at correct height and properly secured, and work also be firmly secured.
- Before operating the machine see whether the job and tool is firmly secured in devices or not.
- Optimum machining conditions should be maintained.
- Chips should not be allowed to wound around a revolving job and cleared as often as possible.
- Apply cutting fluids to the tool and work piece properly.

MODEL CALCULATIONS:

The amount by which the compound rest has to be swivel is estimated using the taper angle. Taper angle is calculated as follows.

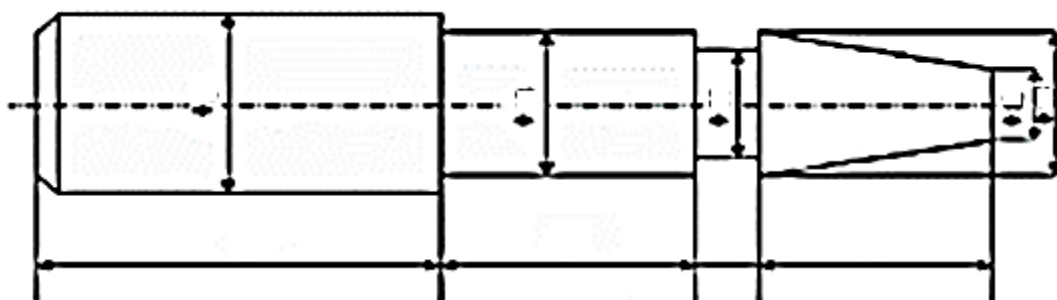
$$\text{Taper angle } (\alpha) = \tan^{-1} \frac{(D-d)}{2L}$$

Where,

D = Diameter of bigger end, mm

d = Diameter of smaller end, mm

L = Length of taper, mm



STEP TURNING AND TAPER TURNING

ALL DIMENSIONS ARE IN MM

RESULT: The MS circular component is machined as per the sketch.

Exp No:

KURNLING AND THREAD CUTTING

Date:

AIM: To perform Thread cutting and Knurling operation on the given work piece.

MATERIAL REQUIRED: Mild Steel rod of 25 mm diameter and 100 mm long

TOOLS REQUIRED:

Vernier callipers,
Steel rule,
Spanner,
Shuck spanner
H.S.S. Single point cutting tool.

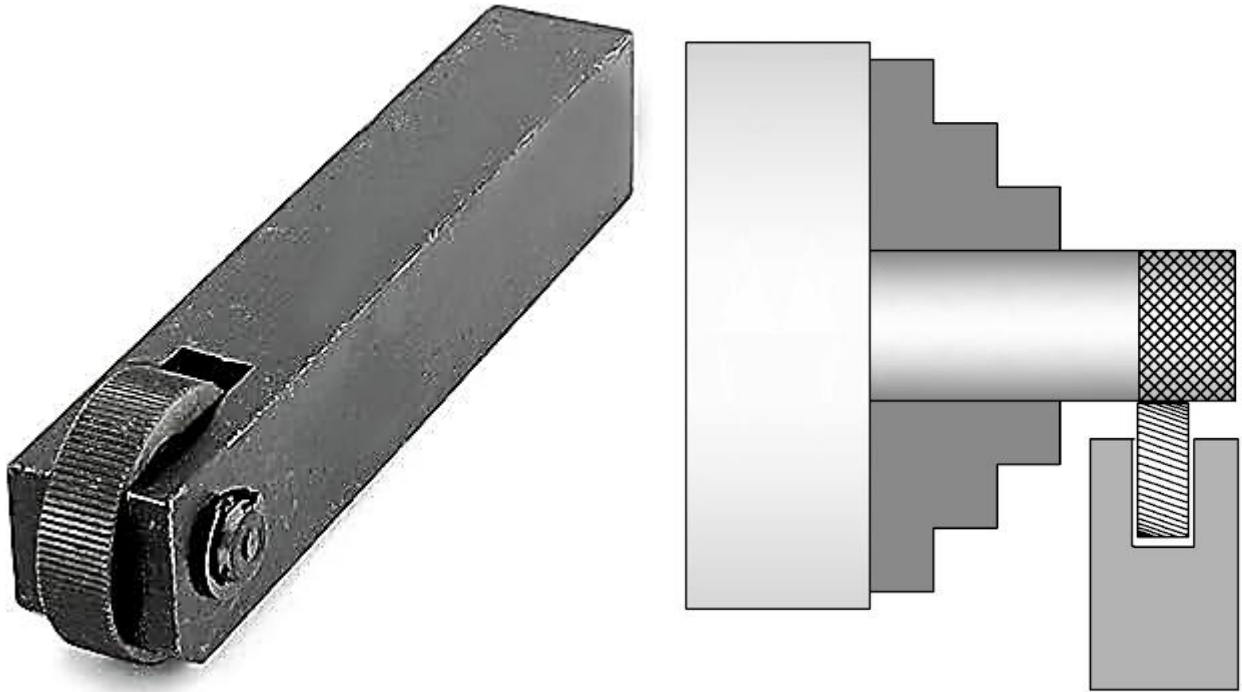
PROCEDURE:

- The work piece is fixed in a 3 – jaw chuck with sufficient overhang.
- Adjust the machine to run the job to required cutting speed.
- Fix the cutting tool in the tool post and cantering operation is performed so that the axis of the job coincides with the lathe axis.
- Facing is performed by giving longitudinal depth of cut and cross feed.
- Perform plain turning operation until the diameter of the work piece reduced to 20mm.
- Using V-cutting tool and parting off tool perform grooving operation to the required dimensions.
- Reduce speed of the spindle by engaging back gear and use Tumbler feed reversing mechanism to transmit power through the lead screw.
- And calculate the change gears for the required pitch to be made on the work piece.
- Using half nut mechanism perform thread cutting operation (right hand threading) according to the given dimensions and continues it until required depth of cut is obtained.
- At the same speed knurling operation is performed using knurling tool.
- For every operation check the dimensions using vernier callipers.

PRECAUTIONS:

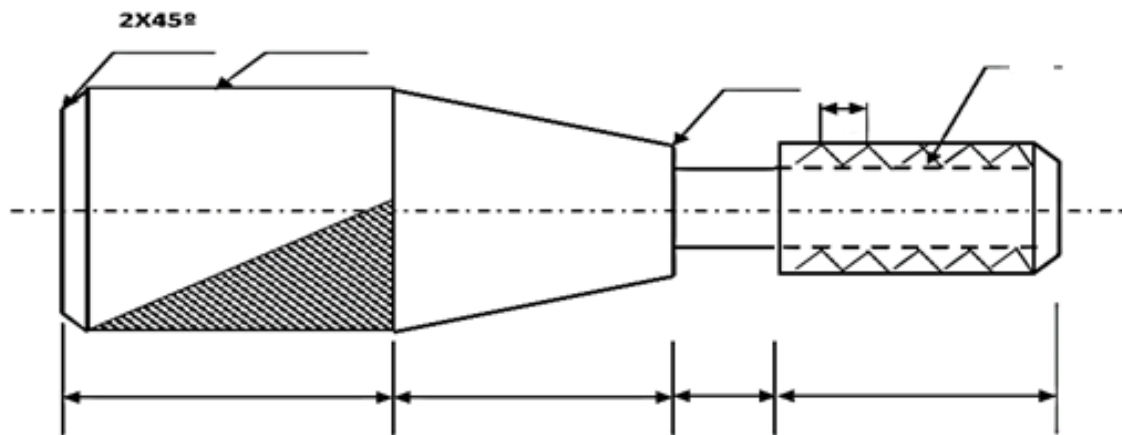
- Before starting the spindle by power, lathe spindle should be resolved by one revolution by hand to make it sure that no fouling is there.
- Tool should be properly ground, fixed at correct height and properly secured, and work also be firmly secured.
- Chips should not be allowed to wind around a revolving job and cleared as often as possible.

- Before operating threading operation, V-tool should be properly ground to the required helix angle.
- Apply cutting fluids to the tool and work piece property.
- No attempt should be made to clean the revolving job with cotton waste.
- On hearing unusual noise, machine should be stopped.



SKECTH:

JOB DRAWING



All dimensions are in mm

Materials Supplied: Mild Steel Rod Ø25x 102mm

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

Result: The MS circular component is machined as per the sketch.

SHAPER MACHINE

Introduction:

A shaper Machine is a reciprocating type of machine that is used for producing horizontal, vertical flat surfaces. The workpiece is fixed on the table and the Ram holds the single point cutting tool. During forwarding stroke, (the single point tools attached to the ram and workpiece is fixed on a table).

Shaper Machine is a production machine in which the single point cutting tools are attached and the workpiece is fixed and while moving forward the tool cuts the workpiece and in return, there is no cut on the workpiece and used for producing flat and angular surfaces.

Shaper Machine Parts:

- Base
- Column
- Table
- Cross rail
- Ram
- Clapper Box
- Elevating Screw

Base:

The base is the most important part of the shaper because it holds all the loads of the machine. It is made up of cast iron. It absorbs vibration and other forces that occur while performing shaping operations.

Column:

The column is mounted on the base. It is also made up of cast iron. Column supports the ram that is moving forward and backward for operation. It also acts for covering the drive mechanism.

Table:

It is mounted on the saddle. It is also one of the important parts of the machine. The table can be moved crosswise by rotating the cross feed rod and also for vertical by rotating the elevating screw. It is a box-like casting with an accurately machined side and top surfaces.

These surfaces having T-Slots for clamping the work. In heavier type shaper machines, the table clamped with table support to make it more rigid.

Cross rail:

It is also mounted on the column on which the saddle is mounted. The vertical movement and Horizontal movement is given to the table by raising or lowering the cross rail using the elevating screw and by moving the saddle using the cross feed screw.

Ram:

The Ram reciprocates and it carries the tool head in which single point cutting tool is attached.

The tool head is in the clapper box, which causes cutting action only in a forward stroke of the ram. The feed or depth of cut of the tool is given by down feed screw.

Shaper Machine Operation:

- Vertical Cutting Operation
- Horizontal Cutting Operation
- Inclined Cutting and
- Angular or Irregular Cutting Operation

Shaper Machine Types:

- Standard Shaper
- Vertical Shaper
- Horizontal Shaper
- Geared Shaper
- Universal Shaper
- Crank Shaper
- Draw cut Shaper.
- Hydraulic Shaper and
- Contour Shaper Machine

Shaper Machine Specification:

- Weight of the Machine.
- Floor space required.
- Maximum stroke of Ram
- Drive types (Hydraulic, Gear and Crank type)
- Input Power
- Cutting to Return Stroke ratio
- Angular Movement of the table and
- Feed

Exp No:**SHAPING****Date:**

AIM: To cut dovetail groove and slot on a given mild steel block using shaping machine,

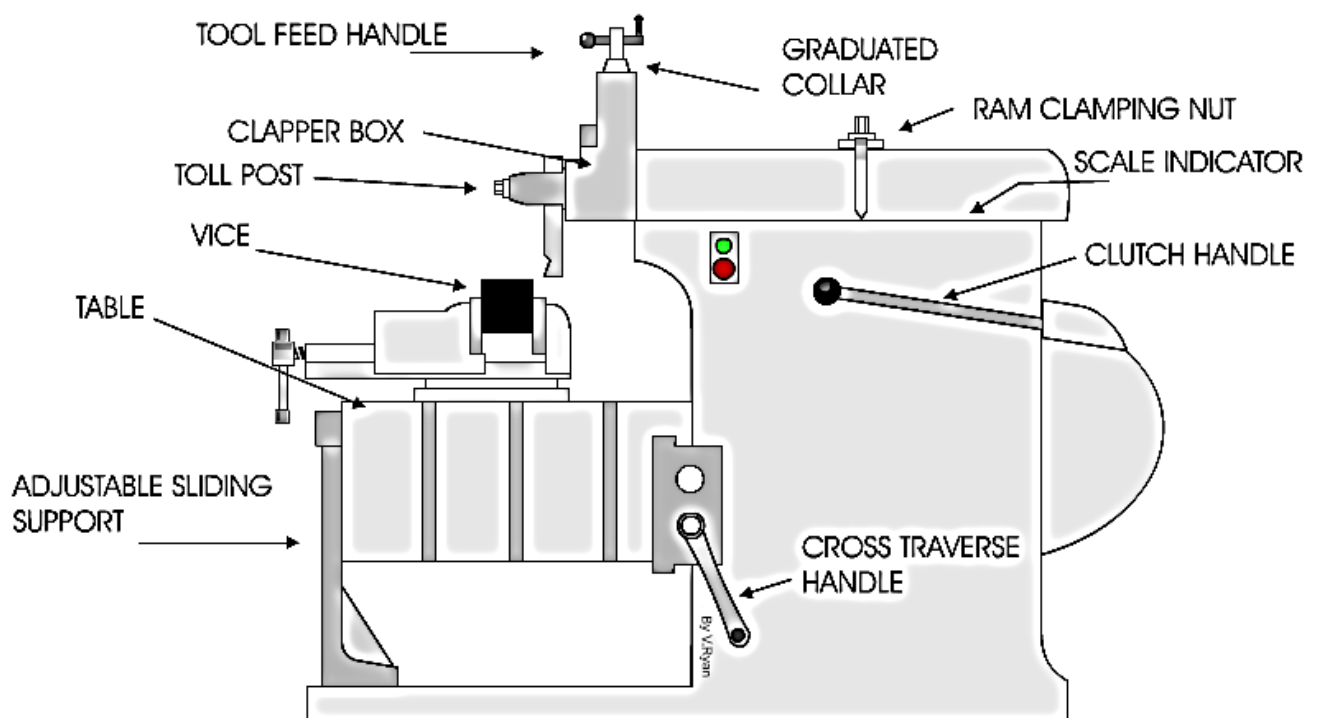
MATERIAL REQUIRED: Mild steel block of 82 x 60 x 40 mm.

TOOLS REQUIRED:

Roughing tool, Finishing tool, Dovetail cutting tool, parting or slotting tool, Try square, vice, scriber, vernier height gauge, surface plate and grinding wheel.

EQUIPMENT REQUIRED: Shaper

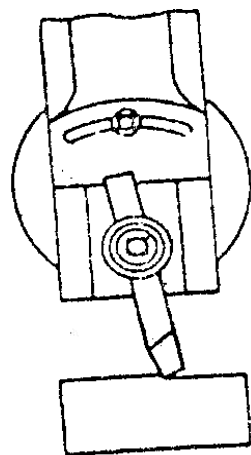
MEASURING INSTRUMENTS REQUIRED: Vernier calliper, steel rule.

**Theory:**

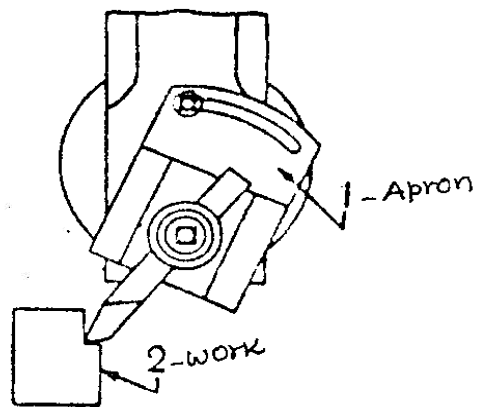
Shaping is a manufacturing process of material removal in which the workpiece reciprocates against a stationary cutting tool producing a plane or sculpted surface. Shaping is analogous to shaping. The main difference between these two processes is that in shaping the tool reciprocates across the stationary workpiece. Planning motion is the opposite of shaping. Both planning and shaping are rapidly being replaced by milling.

The mechanism used for this process is known as a planer. The size of the planer is determined by the largest workpiece that can be machined on it. The cutting tools are usually carbide tipped or made of high-speed steel and resemble those used in facing and turning.

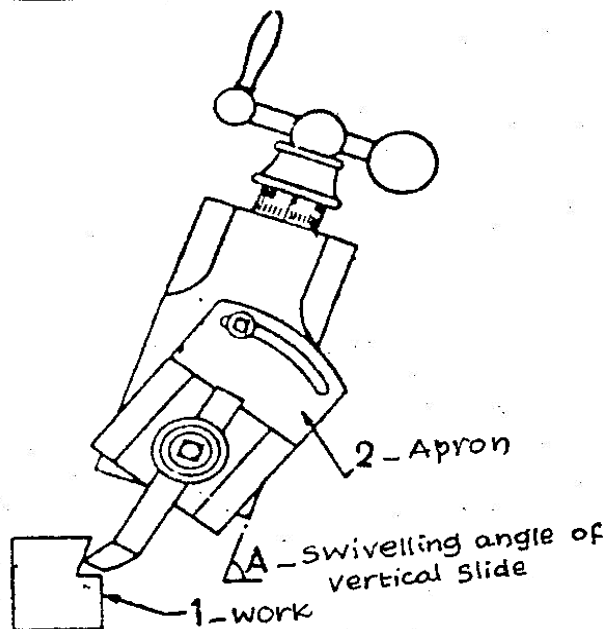
In shaping, the tool is brought into position with the workpiece. The tool then repeatedly moves in a straight line while the workpiece is incrementally fed into the line of motion of the tool, this produces a flat, smooth, and sculpted surface. For shaped pieces the tool reciprocates across the stationary workpiece. The tools are usually tilted or lifted after each stroke. This is done hydraulically or manually in order to prevent the tool surface from chipping when the workpiece travels back across.



Machining Horizontal
Surface



Machining vertical
Surface



Machining angular
Surface

**Figure:25.Types of
operating performed in
shpaer machine**

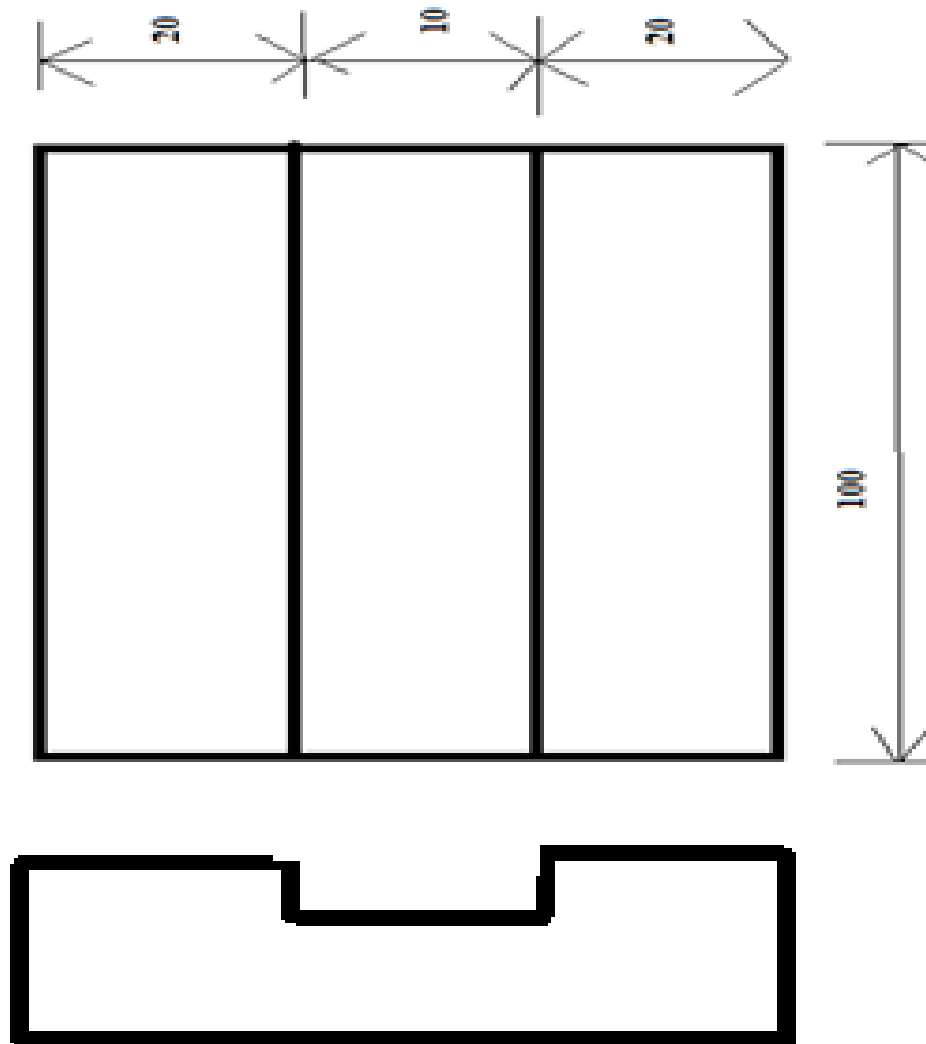
PROCEDURE:

- i. The work piece is firmly held in a vice fitted to the table and a roughing tool is set in the tool post with minimum overhang.
- ii. Excess material on the horizontal surface [approximately 2mm depth] is removed in one or two cuts using roughing tool.
- iii. Roughing tool is replaced by finishing tool and the horizontal surface is finished up to about 0.5mm depth.
- iv. Finishing tool is replaced by side cutting tool and vertical surfaces of the work piece are machined to ensure squareness of the block.
- v. The work piece is removed from the vice and its squareness is checked using try- Square.
- vi. Slot and dovetail grooves are marked on the work piece using vernier height gauge, surface plate and scribe. Again, the work piece is firmly held in a vice fitted to the shaper table.
- vii. Side cutting tool is replaced by slot cutting tool and the vertical slide of the tool head is swivelled to 90 ° angle to the horizontal plane towards right.
- viii. Angular surface or slot groove is machined at the right end of the work piece.
- ix. Slot groove on the other side is machined by changing the position of the work piece in the vice.
- x. The job is checked for its dimensions.
- xi. Finally, the machine surfaces of the work piece are finished on the surface grinder.

PRECAUTIONS:

- a) Lubricant should be used during slotting to prevent the cutting edge of the tool from wear due to dragging.
- b) Work surface to be machined should be carefully aligned with the axis of the ram.
- c) The length and position of stroke should be carefully adjusted.

RESULTS: Required specimen obtained according to specified operations (shaping operations) with given dimensions



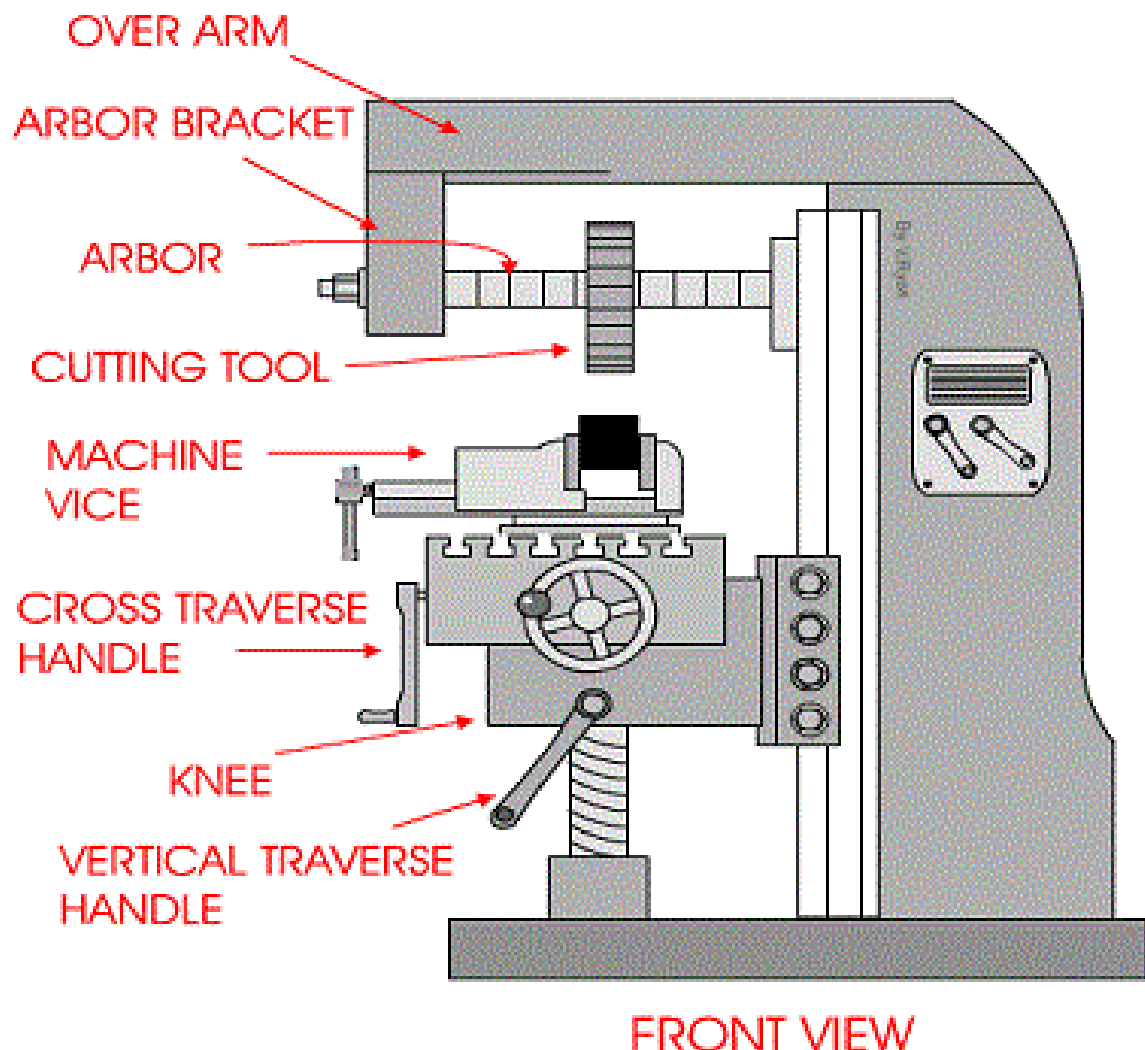
MILLING

Introduction:

Milling machines are one of the most influential and versatile kinds of machines found in the manufacturing industry. Milling is the most widely used machine in machine shops and modern manufacturing industries all over the world. It is a type of machining process in which a cutter having multiple cutting edges is used to remove the material from the workpiece. This machine tool makes up about 85 percent of all material removal processes.

Milling Machine:

The milling machine is a type of machine which removes the material from the workpiece by feeding the work past a rotating multipoint cutter. The metal removal rate is higher very high as the cutter has a high speed and many cutting edges. It is the most important machine in the tool room as nearly all the operations can be performed on it with high accuracy. MRR (Material Removal Rate) can be further increased by increasing the number of teeth on the cutter.



Milling Machine Parts:

The Milling Machine consists of Base, Column, Knee, Saddle, Table, Over-Arm, Spindle or Arbor, Arbor supports, Ram, and Milling Head.

1. Base:

The base is the part upon which the whole machine parts are being mounted. It is a type of foundation for the machine.

The base is mostly made up of cast iron, so it has good strength and rigidity. It also helps in the absorption of shocks. Cutting fluid can also be stored in the base.

2. Column:

The main supporting frame which consists of all the driving mechanisms and the motor is called the column.

The driving mechanism usually consists of a cone pulley mechanism in which the v-belt is being used to connect it to the motor.

Further by using this driving mechanism the speed of the machine can control as per our requirement.

3. Knee:

The knee shape is quite similar to that of the human body knee. This is an important part of this machine that supports the other parts like the saddle and table. It is attached to the column and has guideways by which it can move up and down with the help of the elevating screw for adjusting its height.

4. Saddle:

The saddle is present on the top of the knee which further carries the table. Its basic function is to support the table. A saddle can slide on the guideways which are exactly at 90 degrees to the column face. Saddle moves crosswise (in or out) on guideways provided on the knee.

5. Table:

The table is present on the top of the saddle. The table consists of T-slots or sometimes fixtures are used for holding up the workpiece on the table. A table can travel longitudinally in a horizontal plane.

6. Over-arm:

It is also called the over-hanging arm. Overarm is present at the top of the column. The basic function of the over-arm is to support the Arbor and spindle.

7. Spindle or Arbor:

The top portion of the column contains the spindle. The spindle is also an important part of the machine as it is the part where the multipoint cutter is attached. Power required for the rotation of the spindle is obtained from the motor through the belt, gear, and clutch assembly.

Milling Machine Working Principle:

- Milling machine employed in the metal removing operation in which the work is rigidly clamped on the table of the machine and the revolving cutter which has multiple teeth is mounted on the arbor.
- The cutter revolves at high speed and the work is fed slowly past the cutter.
- The work can be fed in a vertical, longitudinal, or cross direction depending upon the type of milling machine being used.

- As the work proceeds, the cutter-teeth removes the metal from the surface of the job(workpiece) to produce the desired shape.
- **High speed:** In Milling, the rate of metal removal is very high as the cutter rotates at a high speed and has multiple cutting edges.
- **Better surface finish:** The surface finish of the materials machined on the milling machine is better because of the multi-cutting edges.
- **Increased Productivity:** CNC Milling Machines are the machines in which the milling operation is being controlled by software. It has increased the overall production with better finish and accuracy.
- **High Accuracy:** In the milling machine, the products machined are of high accuracy, especially in the case of the most advanced form of milling machine which is the CNC Machine.
- **Huge Application:** The indexing head makes it suitable for so many applications as the exact rotation of the job is possible by the use of it. Milling can be used for machining flat surfaces, irregular surfaces, contoured surfaces, slotting, gear cutting, and many more.

Milling Machine Operations:

- Plain or Slab Milling Operation
- UP and DOWN Milling Operation
- Face Milling Operation
- End Milling Operation
- Gang Milling Operation
- Straddle Milling Operation
- Groove Milling Operation
- Gear Milling Operation
- Side Milling Operation and
- T-Slot Milling Operation

Exp No:

MILLING OPERATION

Date:

AIM: To perform plane milling operation on the given specimen (mild steel)

MATERIALS REQUIRED: Mild steel specimen.

MACHINE REQUIRED: Milling machine.

MEASURING INSTRUMENTS: Vernier calliper

CUTTING TOOLS: Plane (face) milling cutter

MARKING TOOLS:

- Work holding fixtures: work piece supporting fixtures.
- Miscellaneous tools: Hammer, brush, Allen keys
- Steel rule, scribe

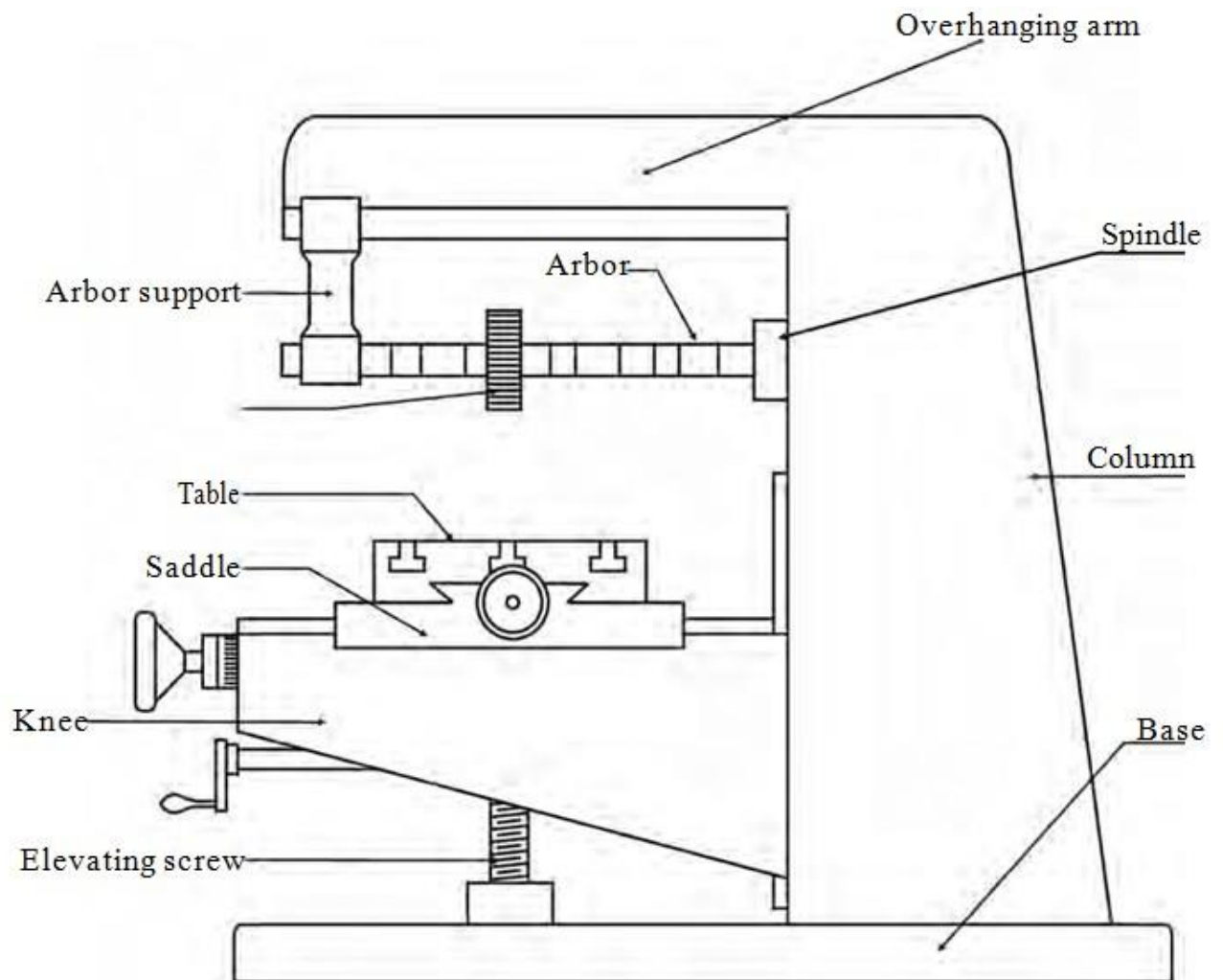
SEQUENCE OF OPERATIONS:

- Measuring of specimen
- Fixing of specimen in the milling m/c.
- Giving the correct depth and automatic feed cut the specimen.
- Check the specimen with Vernier calliper at the end.

PROCEDURE

- Select and cut a piece of stock to make the blank. Allow at least 1/8-inch excess material on the diameter and thickness of the blank for clean-up cuts.
- Mount the stock in a chuck on a lathe. At the centre of the blank, face an area slightly larger than the diameter of the required bore.
- Drill and bore to the required size (within tolerance). Remove the blank from the lathe and press it on a mandrel.
- Set up the mandrel on the milling machine between the centres of the index head and the footstock. Dial in within tolerance.
- Select a involute gear cutter and mount and centre it. Set the index head to index 24 divisions. Start the milling machine spindle and move the table up until the cutter just touches the gear blank.
- Set the micrometre collar on the vertical feed handwheel to zero, then hand feed the table up toward the cutter slightly less than the whole depth of the tooth. Cut one tooth groove.
- Then index the work piece for one division and take another cut. Check the tooth dimensions with a vernier gear tooth calliper as described previously.
- Make the required adjustments to provide an accurately "sized" tooth. Continue indexing and cutting until the teeth are cut around the circumference of the work piece.

- The top surface of the job is milled in stages; giving finish cuts towards the end such that, the height of the job is exactly 40 mm.
- The burrs if any along the edges are removed with the help of the flat file.

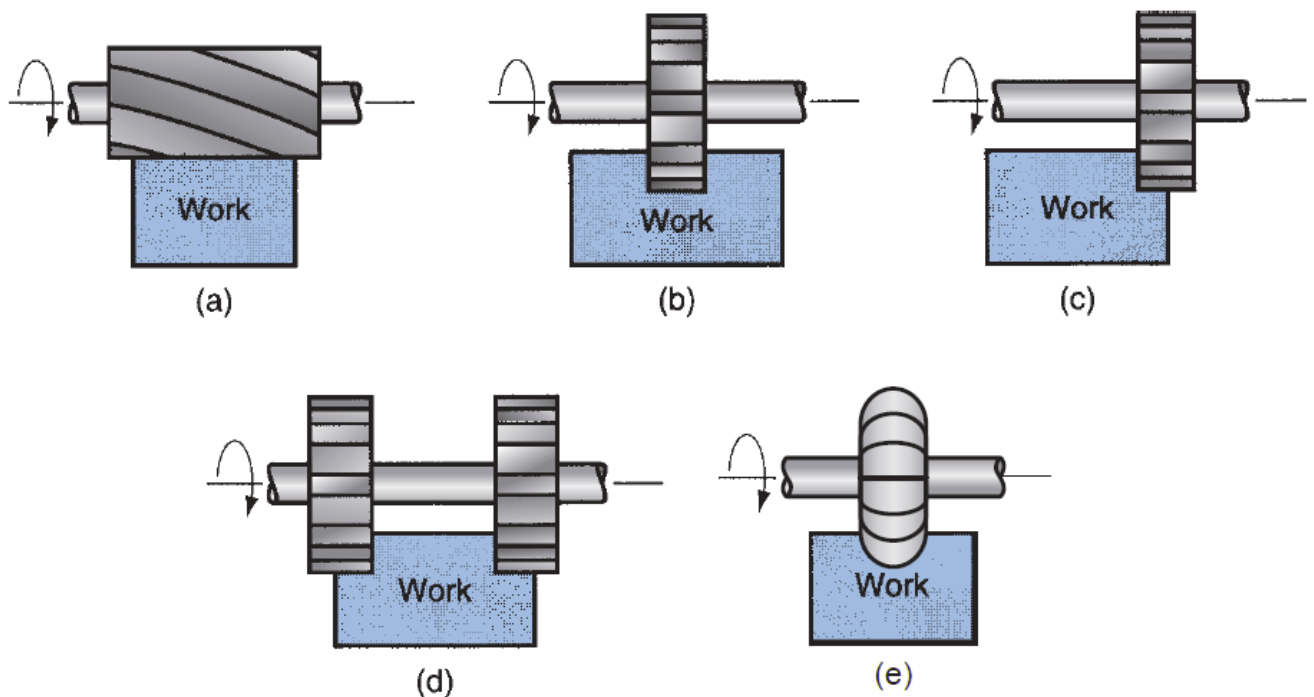


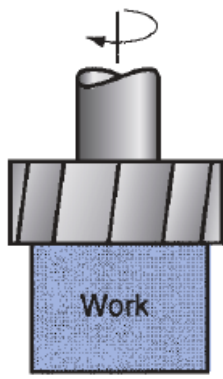
Horizontal Milling Machine

PRECAUTIONS

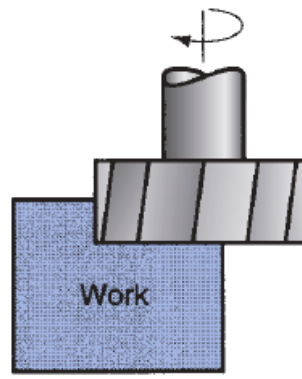
- The milling machine must be stopped before setting up or removing a work piece, cutter or other accessory.
- Never stop the feeding of job when the cutting operation is going on, otherwise the tool will cut deeper at the point where feed is stopped.
- All the chips should be removed from the cutter. A wiping cloth should be placed on the cutter to protect the hands. The cutter should be rotated in the clockwise direction only for right-handed tools.
- The work piece and cutter should be kept as cool as possible (i.e. coolant should be used where necessary to minimize heat absorption).
- The table surface should be protected with a wiping cloth.
- Tool must be mounted as close to the machine spindle as possible.

Diagram:

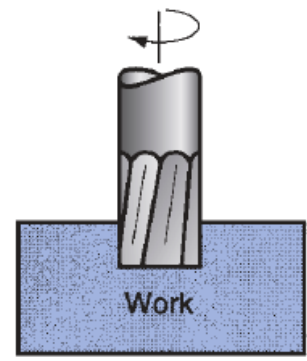




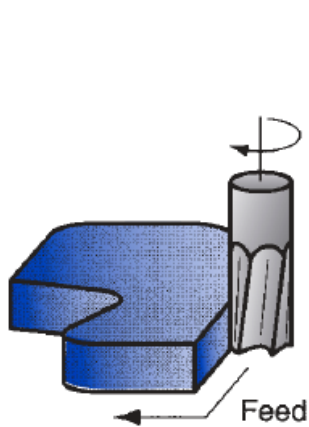
(a)



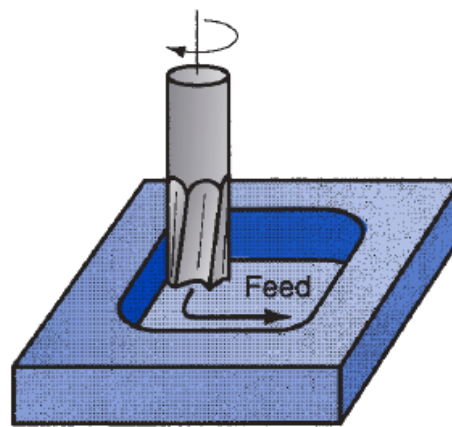
(b)



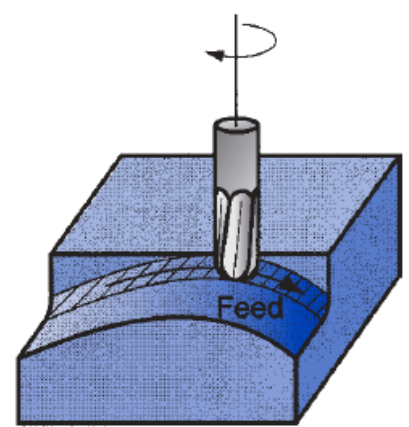
(c)



(d)

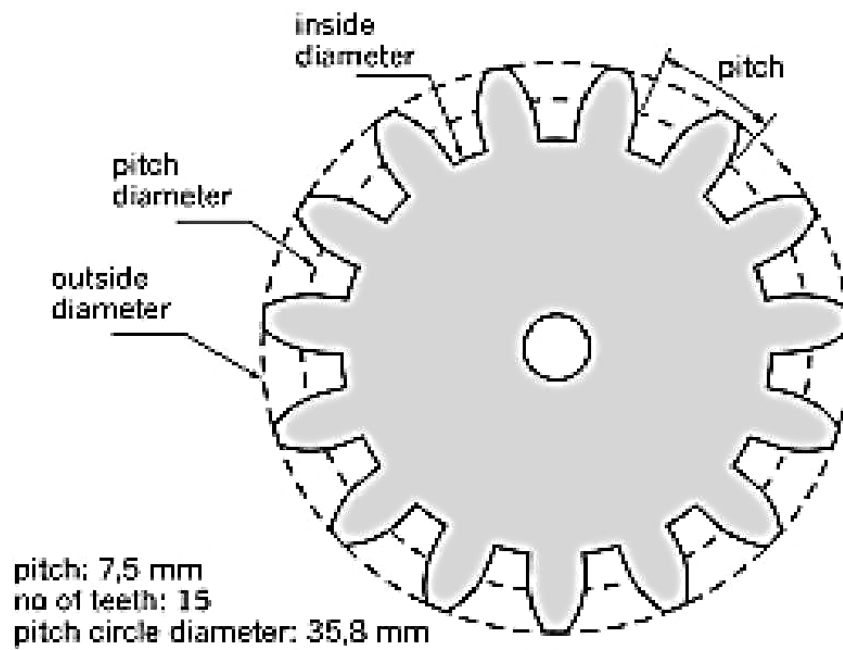


(e)



(f)

Specifications:



Result: The MS flat is machined as per the sketch.

AIM: To perform surface grinding operation on the given work piece.

MATERIALS REQUIRED: mild steel specimen.

MACHINE REQUIRED: surface grinding machine.

WORK HOLDING FIXTURES: Magnetic chuck.

MEASURING INSTRUMENTS:

- Vernier callipers,
- Micrometre.

MISCELLANEOUS TOOLS:

- Wire brush (for cleaning the formed chips),
- Diamond point dressing block
- Coolant

Surface grinding is the most common of the grinding operations. It is a finishing process that uses a rotating abrasive wheel to smooth the flat surface of metallic or non-metallic materials to give them a more refined look by removing the oxide layer and impurities on work piece surfaces. This will also attain a desired surface for a functional purpose.

The surface grinder is composed of an abrasive wheel, a work holding device known as a chuck, and a reciprocating or rotary table. The chuck holds the material in place while it is being worked on. It can do this one of two ways: ferromagnetic pieces are held in place by a magnetic chuck, while non-ferromagnetic and non-metallic pieces are held in place by vacuum or mechanical means. A machine vise (made from ferromagnetic steel or cast iron) placed on the magnetic chuck can be used to hold non-ferromagnetic workpieces if only a magnetic chuck is available.

Factors to consider in surface grinding are the material of the grinding wheel and the material of the piece being worked on.

Key Components of a Surface Grinding Machine:

1. **Grinding Wheel:** The main component responsible for the cutting action.
2. **Spindle:** Rotates the grinding wheel at high speeds for precise material removal.
3. **Table:** Holds the workpiece, usually equipped with a magnetic chuck or clamps.
4. **Feed Mechanism:** Controls the depth of cut and movement of the table to ensure even grinding.
5. **Coolant System:** Delivers fluid to reduce heat, prevent thermal distortion, and enhance finish quality.

Types of Surface Grinding Machines:

1. **Horizontal Spindle, Reciprocating Table:** The most common type, ideal for flat surfaces.
2. **Vertical Spindle, Rotary Table:** Suitable for large, heavy parts and cylindrical shapes.
3. **CNC Surface Grinder:** Provides programmable controls for complex or repetitive operations.

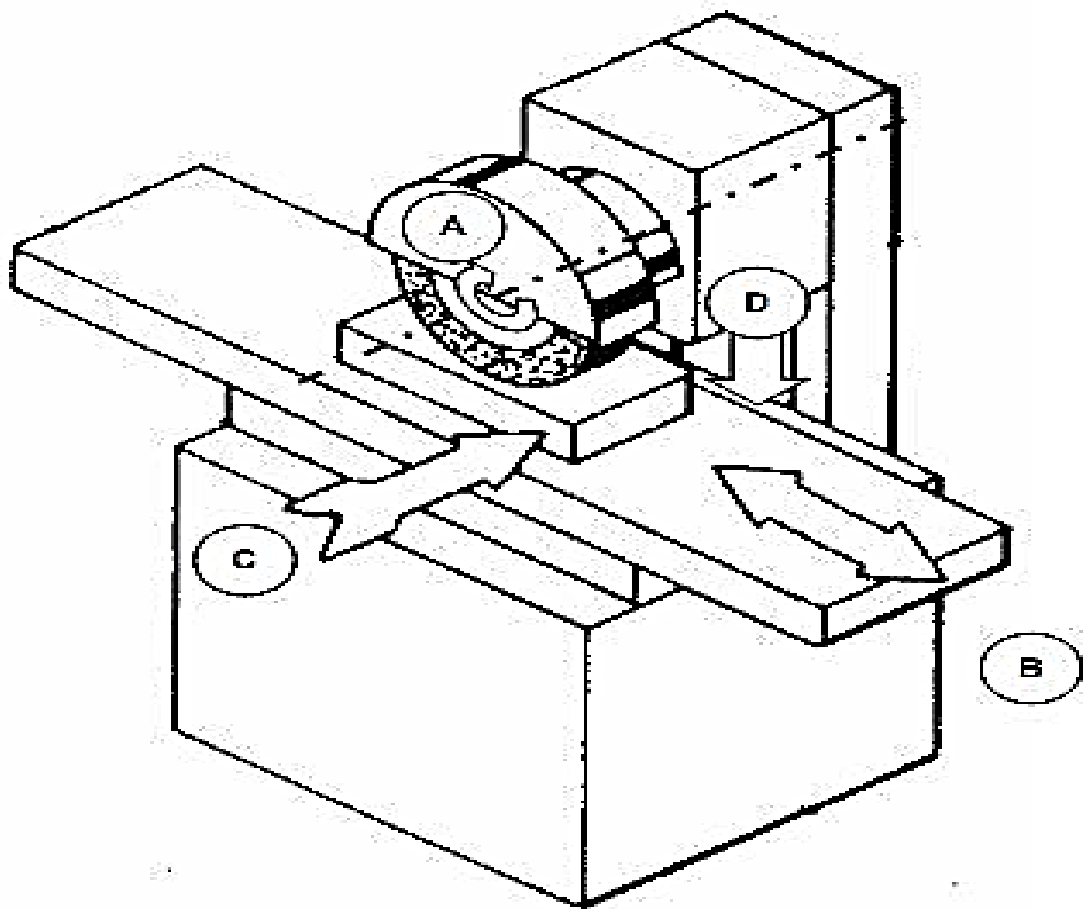
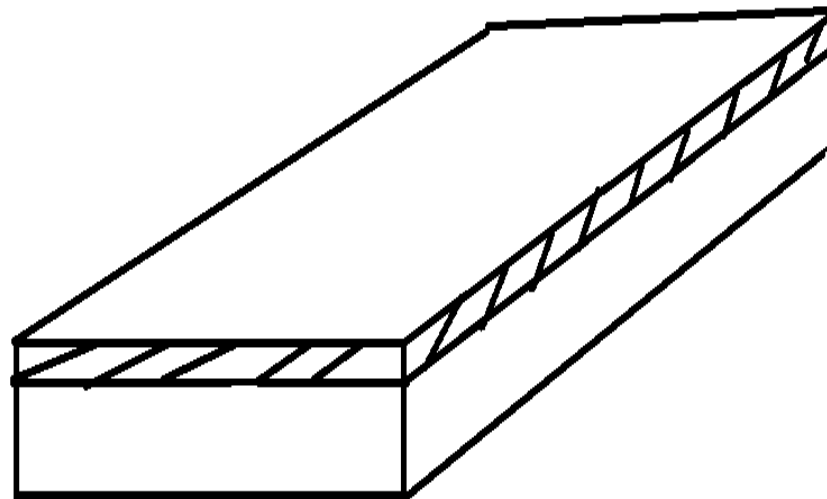
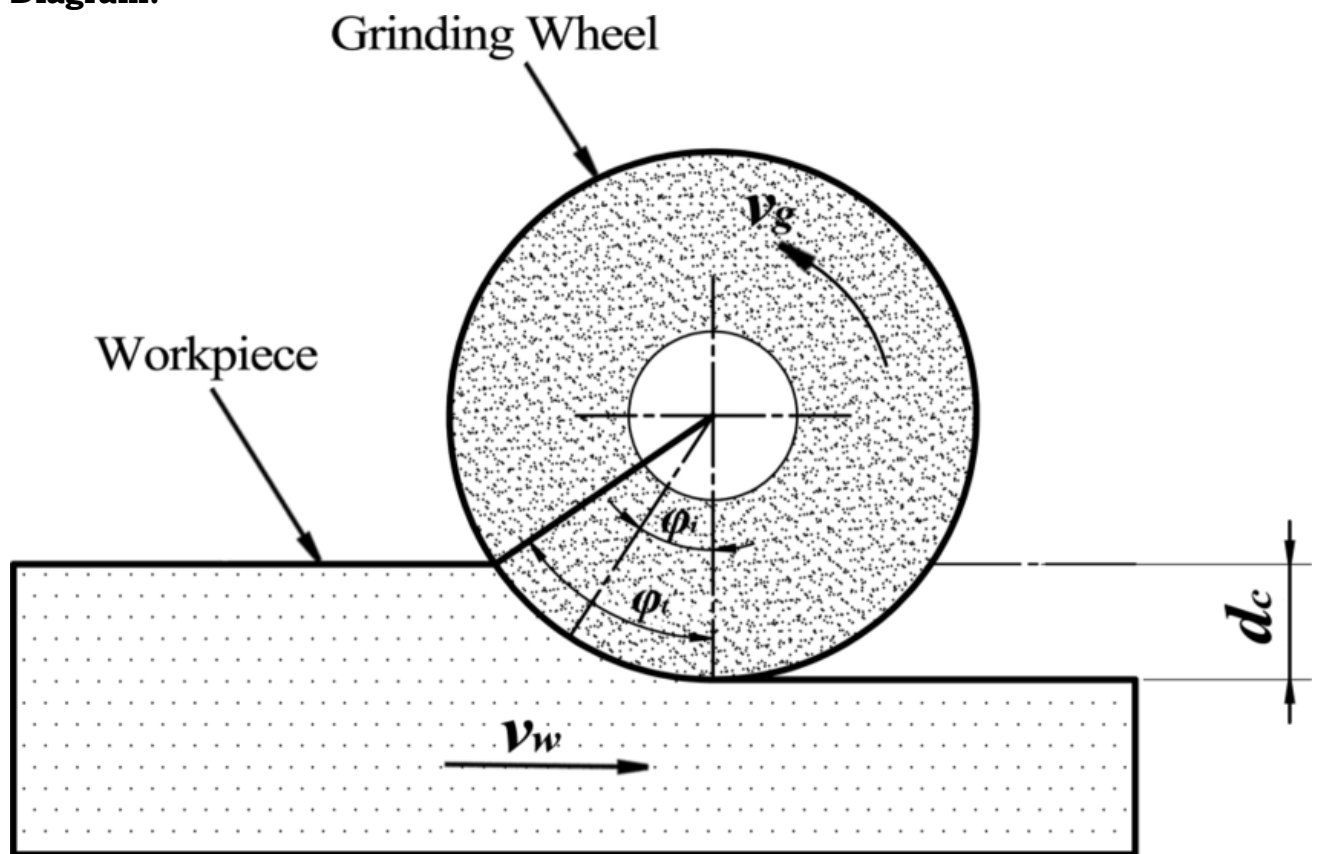


Fig. surface grinding machine.

Diagram:



Specifications:

SEQUENCE OF OPERATIONS:

1. **Inspect Workpiece and Determine Requirements:** Check material, size, and required finish to choose the appropriate grinding wheel.
2. **Select and Mount Grinding Wheel:** Secure the wheel on the spindle, balancing it for smooth operation.
3. **Dress the Wheel:** Use a dresser to ensure a sharp, clean cutting surface and correct shape.
4. **Clean Magnetic Chuck:** Remove debris from the chuck surface to ensure proper alignment of the workpiece.
5. **Mount and Secure Workpiece:** Place the workpiece on the chuck and hold it firmly in place.
6. **Set Grinding Parameters:** Adjust spindle speed, feed rate, and depth of cut based on the workpiece material.
7. **Start Coolant Flow:** Activate coolant to reduce heat and prevent workpiece warping.
8. **Rough Grinding Passes:** Begin with deeper cuts and a faster feed rate to remove material efficiently.
9. **Finish Grinding Passes:** Use lighter cuts and finer feed to achieve the desired surface finish and precision.
10. **Final Inspection and Cleaning:** Check surface finish and dimensions, deburr, and clean the workpiece.

RESULT: The MS flat is machined as per the sketch

Exp No:

DRILLING AND TAPPINIG

Date:

AIM: To perform drilling and tapping operations on the given M.S Flat work piece.

APPARATUS:

1. Drilling Machine with standard accessories
2. Work piece

MATERIAL:

Mild Steel flat plate 50 mm × 50 mm × 10 mm

Drilling Machine:

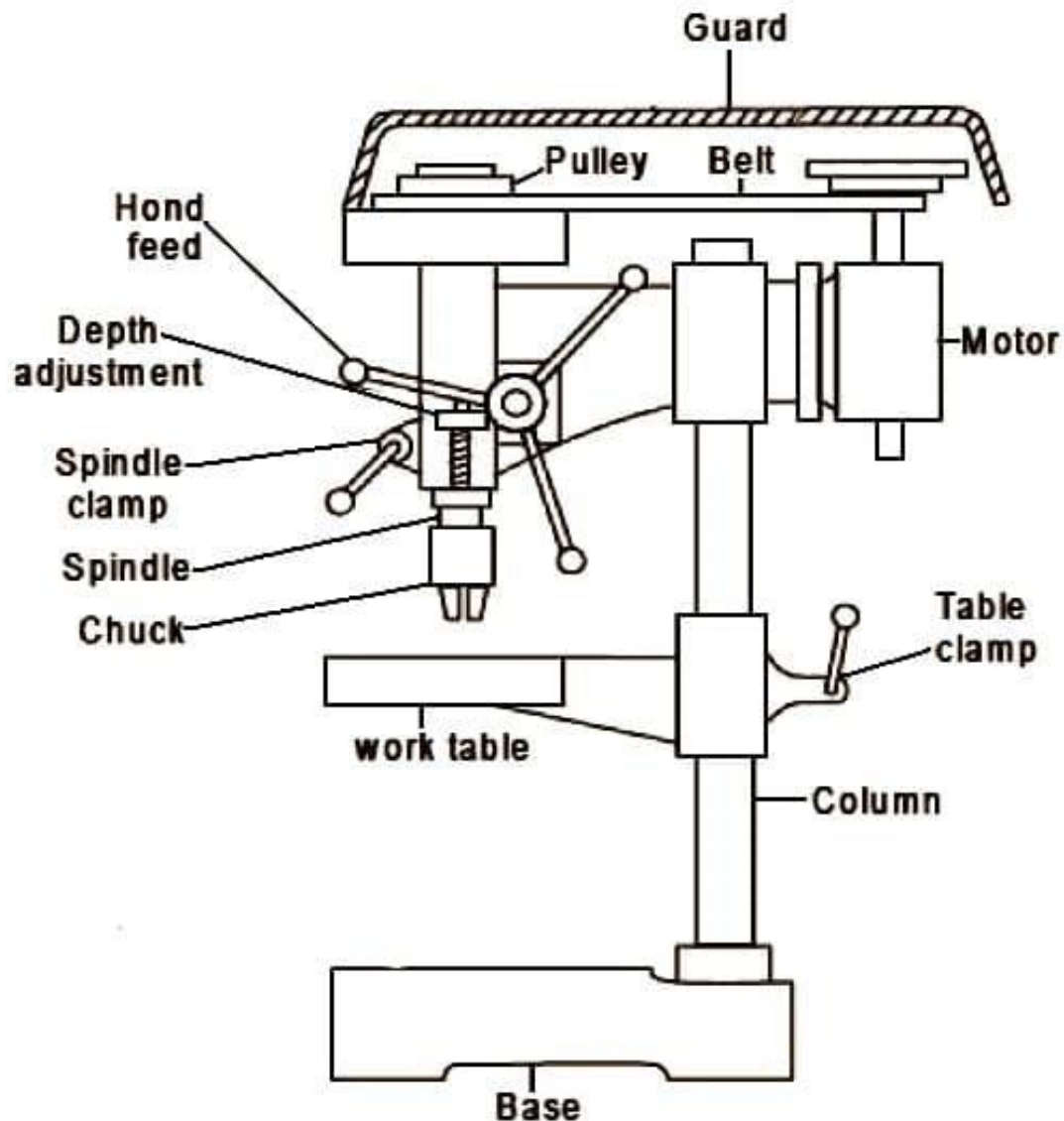
A drilling machine, commonly referred to as a drill press, is a versatile machine tool used to create round holes in a wide range of materials, including metal, wood, plastic, and composites. It operates by rotating a cutting tool, called a drill bit, which removes material from the workpiece to produce holes of various sizes and depths. Drilling machines are fundamental in manufacturing, construction, woodworking, metalworking, and other fields where precise and controlled hole creation is essential.

Basic Features of a Drilling Machine:

1. **Powerful Motor:** Drives the drill bit to rotate at high speeds, enabling efficient material removal.
2. **Adjustable Table:** Allows the workpiece to be positioned accurately at different heights and angles.
3. **Spindle and Chuck:** Holds and spins the drill bit, providing stability and accuracy during drilling.
4. **Feed Mechanism:** Controls the depth and speed of the drill bit, allowing for precise drilling.

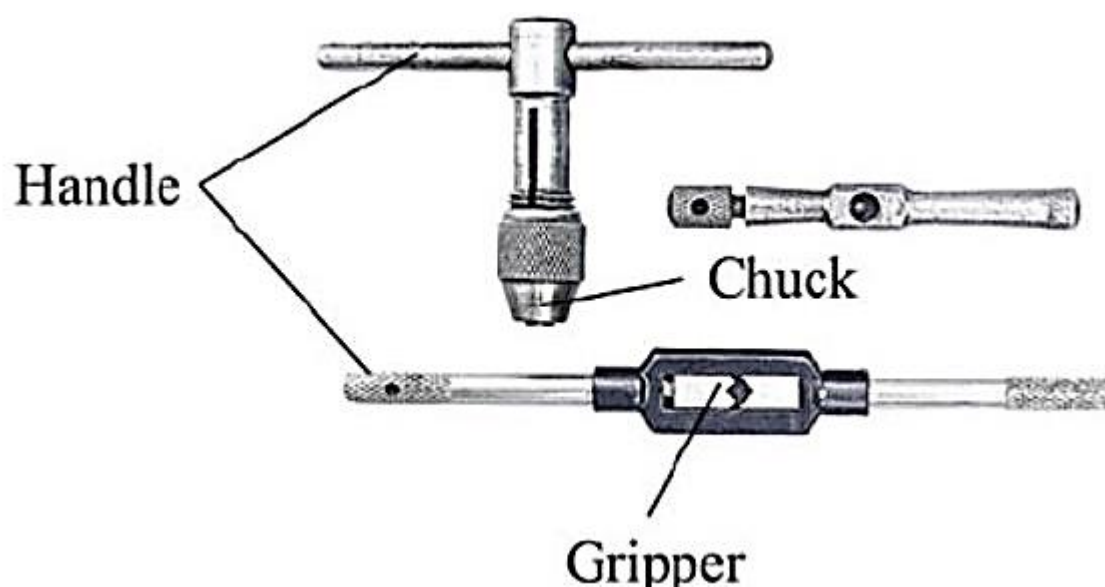
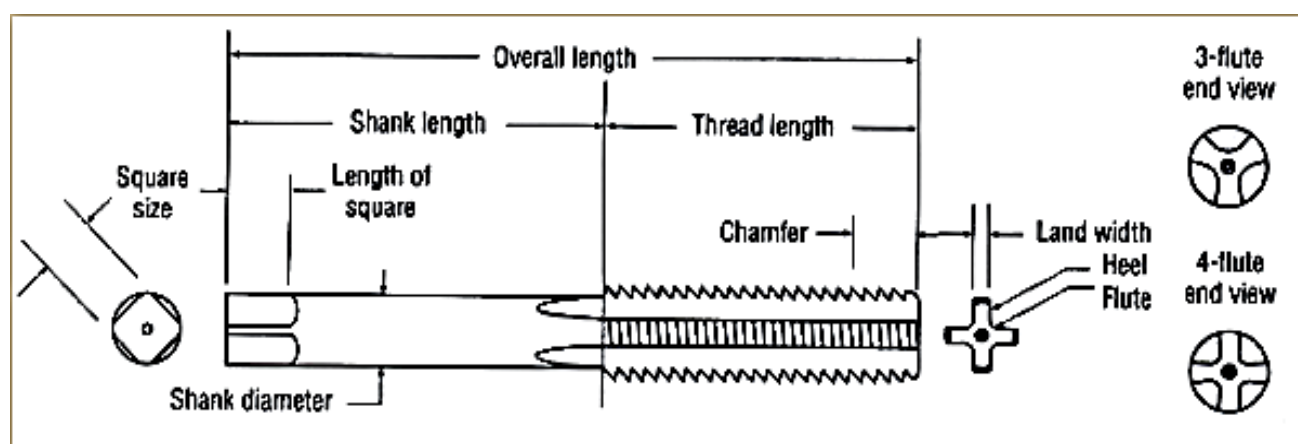
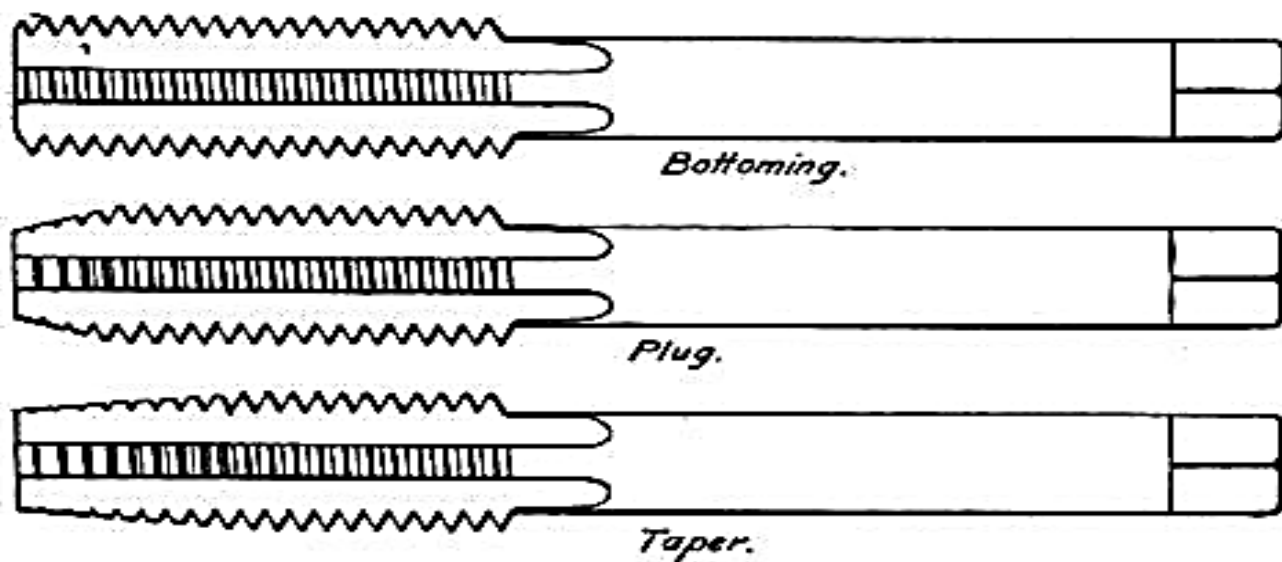
Types of Drilling Machines:

1. **Bench Drill:** Small and compact, ideal for light-duty drilling and mounted on a workbench.
2. **Radial Drill:** Features an adjustable arm, making it suitable for large workpieces and various hole locations.
3. **Pillar Drill:** Larger, floor-standing machines for heavy-duty operations requiring stability and depth control.
4. **CNC Drill:** Computer-controlled, providing automation and high precision for complex drilling tasks.

**Tapping machine:**

A tapping machine is a device used to test the impact sound insulation of floors, for measurements of impact noise (noise of footsteps) in the field of building acoustics.

The standard tapping machine^[1] has five hammers placed in a line. Each hammer is lifted and dropped in turn, creating 20 impacts per second on the floor. In the room below or adjacent, a sound level meter is used to measure the sound level created by the impacts. Because the force and frequency of the impacts is known, the impact insulation provided by the floor can be determined from the sound level.



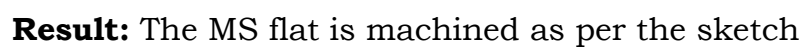
PROCEDURE:

- The given work piece is first filed to get required length, breadth and thickness wet chalk is applied on four sides and with the scribe lines are drawn to get Center hole at required location.
- The centres are punched with a Punch and hammer.
- The work piece is fixed firmly in the vice of the Drilling Machine
- 3/8" drill bit is fixed firmly in the chuck and drilling is performed giving uniform depths.
- The drill bit is removed from the drill chuck and is replaced by a reamer.
- The reaming operation is performed on the hole which has been previously drilled.
- The work is removed from the vice for performing tapping operation.
- The job is fixed firmly in a bench vice.
- Tap is fixed in the tap handle and pressure applied on the taps to obtain internal thread.

PRECAUTIONS:

- Reamer should be free from moisture.
- Marking is done without parallax error.
- Care should be taken while cutting and drilling.
- While performing drilling and tapping operations lubricant should be used to minimize the friction.

Specifications:



Exp No:**THREAD CUTTING****Date:**

AIM: V-thread cutting on a lathe forming right hand and left-hand threads as shown in fig.

MATERIAL REQUIRED: Mild steel bar of 24 mm diameter and 100 mm length.

TOOLS AND EQUIPMENT:

- H.S.S. single point cutting tool,
- Grooving tool,
- Threading tool thread gauge,
- Outside caliper,
- Chuck key,
- Tool post key,
- Steel rule.

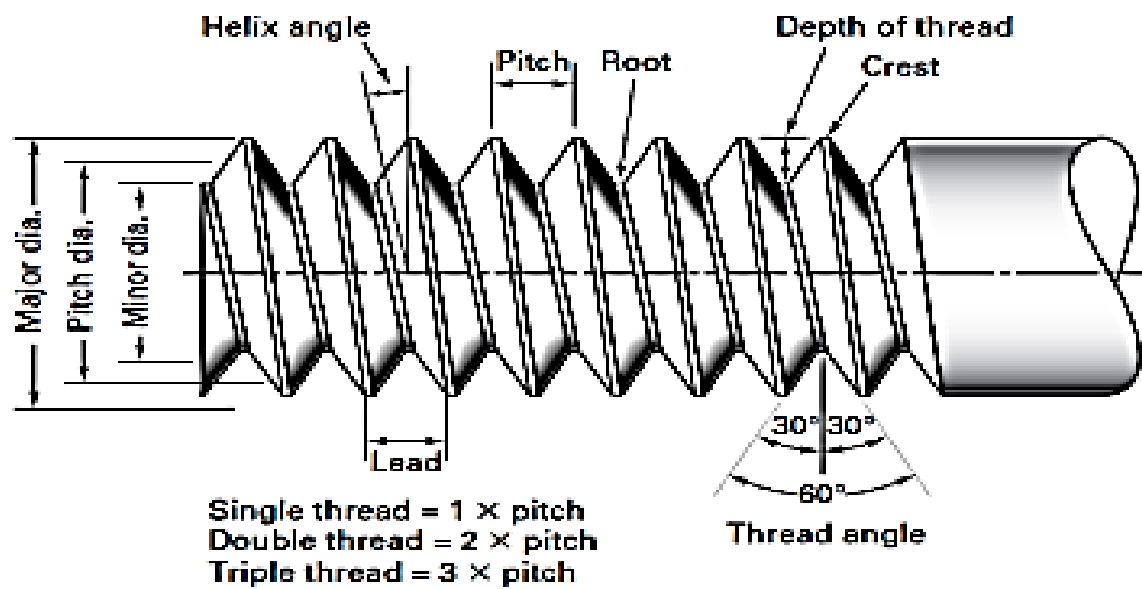
Calculation of change-wheels, metric thread on English lead screw:

To calculate the wheels required for cutting a screw of certain pitch, it is necessary to know how the ratio is obtained and exactly where the driving and driven wheels are to be placed. Suppose the pitch of a lead screw is 12 mm and it is required to cut a screw of 3 mm pitch, then the lathe spindle must rotate 4 times the speed of the lead screw that is

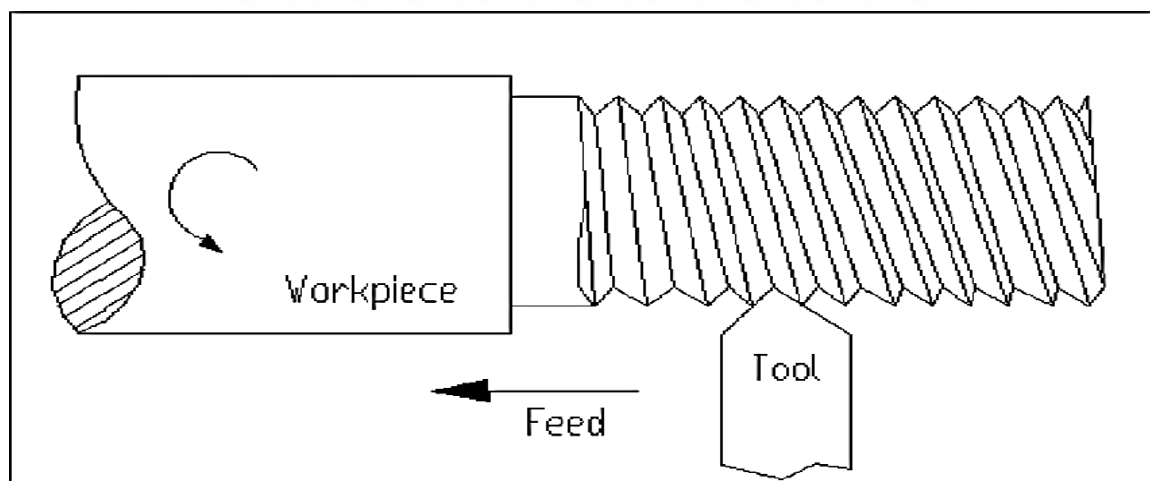
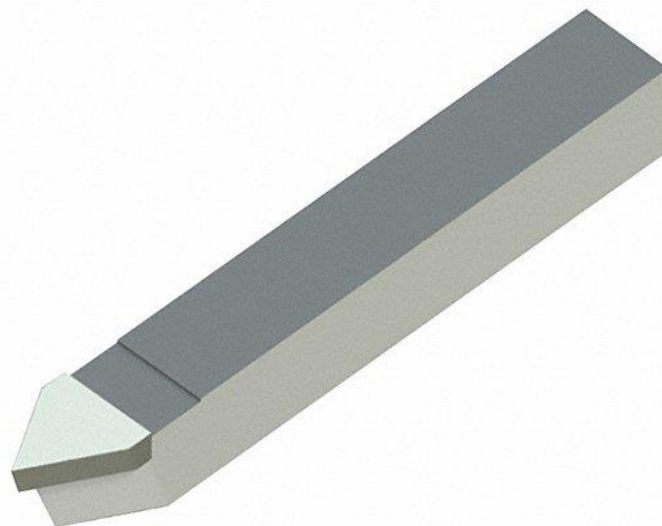
$$\frac{\text{Spindle turn}}{\text{Lead screw turn}} = \frac{\text{Driven teeth}}{\text{Driver teeth}}$$

Hence, we may say,

$$\frac{\text{Driven teeth}}{\text{Driver teeth}} = \frac{\text{Lead screw turn pitch of the screw to be cut}}{\text{spindle turn pitch of the lead screw}}$$



Single point cutting tool bit:



PROCEDURE:

1. The work piece and HSS single point cutting tool are fixed in chuck and tool post respectively.
2. Operations such as facing, rough turning finish turning and step turning are performed on the given mild steel bar one after the other in sequence up to the dimensions shown.
3. Single point cutting tool is replaced by a grooving tool and grooving operation is performed at half of the normal spindle speed.
4. The grooving tool is replaced by a threading tool. Right hand and left-hand metric threads are cut on the work piece up to the required length at $1/4^{\text{th}}$ of the normal speed of the spindle.
5. Threading tool replaced by a single point cutting tool again and finally chamfering is done at right end of the work piece at normal spindle speed.

PRECAUTIONS:

- Select appropriate tools designed for the specific material and thread size to ensure proper cutting and avoid breakage.
- Firmly clamp the workpiece in place to prevent any movement during threading, which could lead to misaligned or damaged threads.
- Inspect the threading tool for wear or damage before use, as a dull or damaged tool can lead to poor thread quality and increased risk of tool failure.
- Set the cutting speed and feed rate according to the material being threaded to optimize performance and prevent overheating or tool wear.
- Apply cutting fluid to reduce friction, improve chip removal, and enhance surface finish, prolonging tool life during the operation.
- Ensure the threading tool is properly aligned with the workpiece to produce accurate and uniform threads.

Result: The MS circular shaft is machined as per the sketch

Exp No:**BORING****Date:**

Aim: To perform boring on a cylindrical work piece.

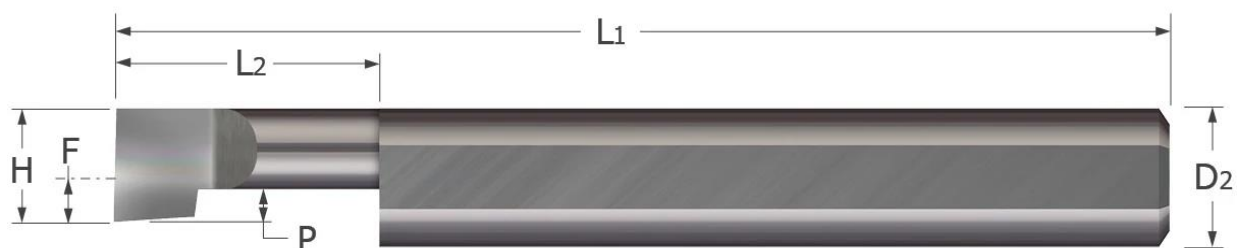
MATERIAL REQUIRED: Mild steel bar of 24 mm diameter and 100 mm length.

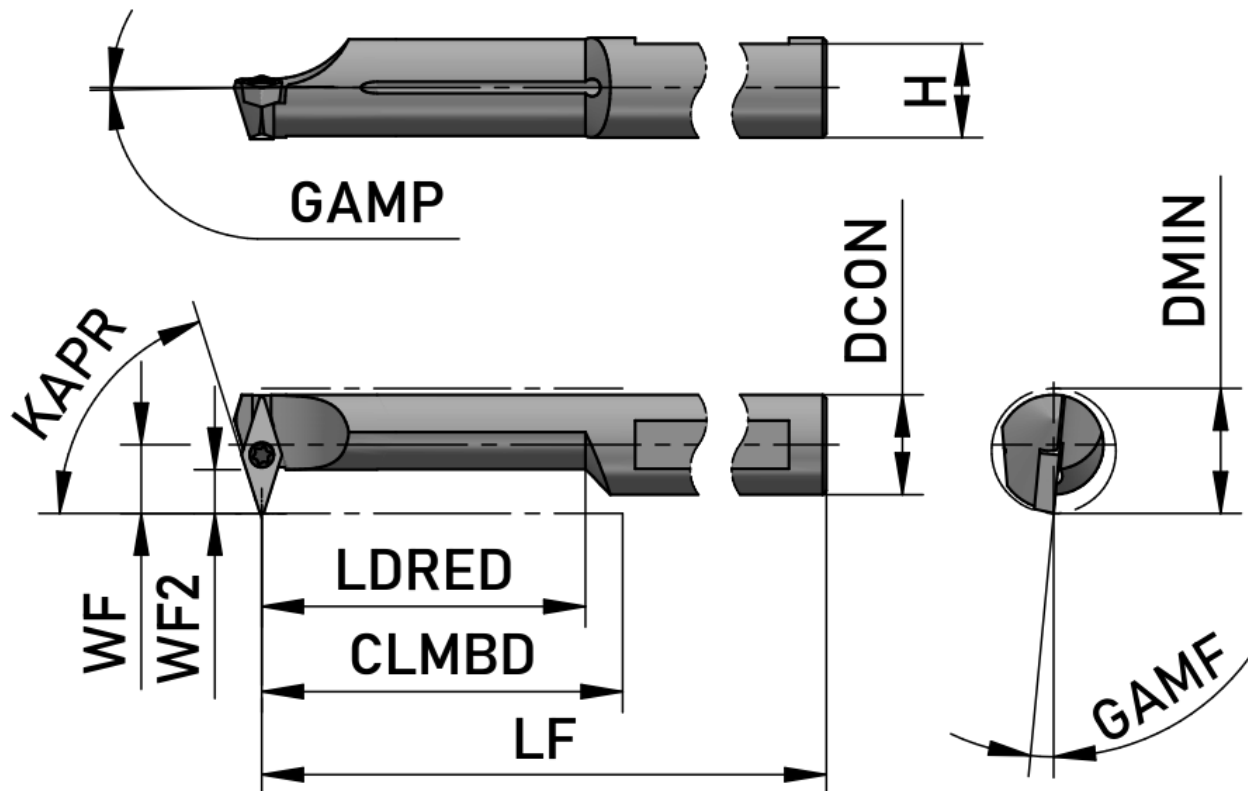
TOOLS AND EQUIPMENT:

- H.S.S. single point cutting tool,
- Grooving tool,
- Threading tool thread gauge,
- Outside caliper,
- Chuck key,
- Tool post key,
- Steel rule.
- Lathe
- Three-jaw chuck
- Vernier caliper
- Cutting tools

Procedure:

1. First loosen the jaw in the chuck key to position the work piece, and then tighten the jaws.
2. Fix the cutting tool in the tool post.
3. Switch on the lathe and move the carriage near to the work piece. Give it a small cross feed, and then move carriage longitudinally to the required length slowly.
4. Bring the carriage to the original position, give a small cross feed, and move carriage longitudinally. Repeat this step until required diameter is obtained.
5. To get smooth surface give a very small feed when the diameter is nearing the required value.
6. The drill bit is fixed in the tail stock.
7. The hole is made by moving the tailstock through over the bed.
8. By rotating the hand wheel, which is in the tailstock, the tailstock is move.
9. The drill bit is removed. Then the boring bar is fixed in the tailstock. The boring operation is done in the drilled work piece.
10. Finally, the dimensions of work piece are again checked.

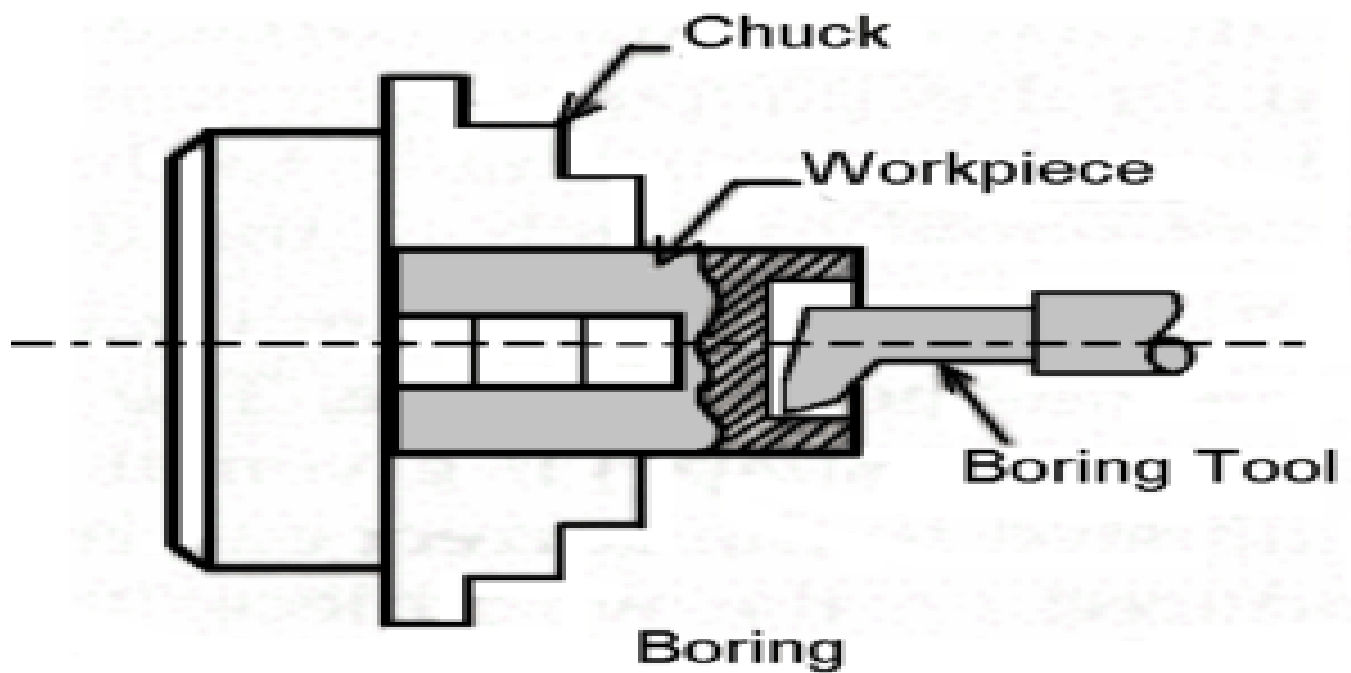




PRECAUTIONS:

- Ensure the workpiece is securely clamped to prevent movement during the boring operation.
- Select the correct boring tool for the specific material and desired hole size to avoid tool breakage or poor finish.
- Inspect the boring tool for any wear or damage before use, replacing it if necessary to maintain accuracy.
- Adjust the spindle speed according to the material being bored to optimize cutting efficiency and reduce heat buildup.
- Use cutting fluid to lubricate the boring tool, reduce friction, and improve surface finish.

Diagram:



Result:

Thus, the required size and shape of the given work piece is obtained.