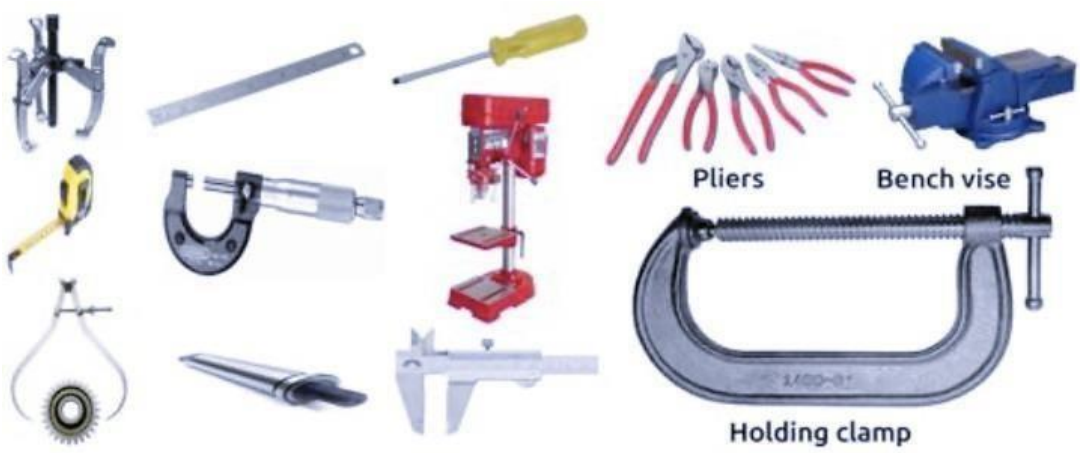
Sreenivasa Institute of Technology and Management Studies (Autonomous)
Department of Mechanical Engineering

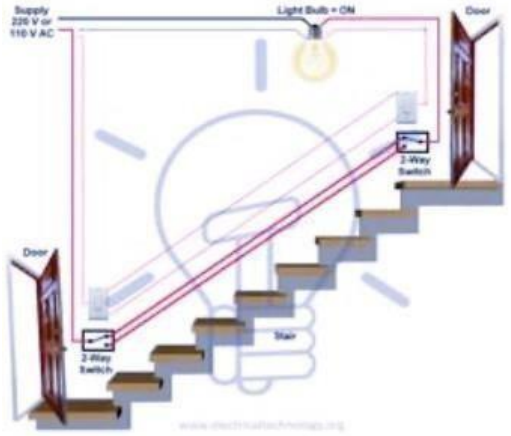
ENGINEERING WORKSHOP

LABORATORY MANUAL

I B.TECH I/II SEMESTER REGULATION: R23

ACADEMIC YEAR 2025-2026





Name of Student:

Roll Number:

Subject Code:

Faculty Name:

INSTITUTE VISION

To emerge as a Center of Excellence for Learning and Research in the domains of engineering, computing and management.

INSTITUTE MISSION

IM1: Provide congenial academic ambience with state-of-art of resources for learning and research.

IM2: Ignite the students to acquire self-reliance in the latest technologies.

IM3: Unleash and encourage the innate potential and creativity of students.

IM4: Inculcate confidence to face and experience new challenges.

IM5: Foster enterprising spirit among students.

IM6: Work collaboratively with technical Institutes / Universities / Industries of National and International repute.

DEPARTMENT VISION

To become a Centre of Excellence in Mechanical Engineering Studies and Research.

DEPARTMENT MISSION

DM1: Provide congenial academic ambience with necessary infrastructure and learning resources.

DM2: Inculcate confidence to face and experience new challenges from industry and society.

DM3: Ignite the students to acquire self-reliance in the latest technologies.

DM4: Foster Enterprising spirit among students.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After a few years of graduation, the graduate of the program will,

PEO1: Have Professional competency through the application of knowledge gained from subjects like Mathematics, Physics, Chemistry, Inter-Disciplinary and core subjects like Manufacturing Engineering, Thermal Sciences, CAD/CAM and Design & Development. (**Professional Competency**).

PEO2: Excel in one's career by critical thinking towards successful services and growth of the organization or as an entrepreneur or through higher studies. **(Successful Career Goals)**.

PEO3: Enhance knowledge by updating advanced technological concepts for facing the rapidly changing world and contribute to society through innovation and creativity. **(Continuing Education and Contribution to Society)**.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Apply the knowledge obtained in core areas for the design, analysis and manufacturing of mechanical systems and processes.

PSO2: Exhibit novel concepts on product development with the help of modern CAD/CAM integration, while ensuring best manufacturing practices.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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.

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.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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.

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.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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.

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.

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.

	I B.Tech I/II Semester				
23ESC117	**ENGINEERING WORKSHOP**	L	T	P/D	C
	(Common to all branches)	-	-	3	1.5

Course Educational Objectives:

CEO1: To provide exposure to the students with hands on experience on various basic engineering practices in civil, mechanical and electrical engineering.

A. ENGINEERING WORKSHOP

TRADES FOR EXERCISES:

1. **Demonstration:** Safety practices and precautions to be observed in workshop.
2. **Carpentry:** Familiarity with different types of woods and tools used in woodworking and make following joints.
   a. Middle T lap joint or Half lap joint
   b. Mortise and tenon joint
   c. Dove tail joint or bridle joint
3. **Sheet Metal:** Familiarity with different types of tools used in sheet metalworking, Developments of following sheet metal job from GI sheets.
   d. Tapered tray
   e. Conical funnel
   f. Elbow pipe
   g. Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do thefollowing fitting exercises.
   h. V fit
   i. Dove tail joint
   j. Semi-circular fit / Square fit
   k. Bicycle tyre puncture
5. **House Wiring:** Familiarity with different types of basic electrical circuits and makes the following connections.
   l. Parallel and series
   m. Two-way switch
   n. Go down lighting
   o. Tube light
   p. Three phase motor
   q. Soldering of wires
6. **Basic Machining:** Familiarity with different types of tools used in metal parts and practicing basic machining operation.
   r. Simple plain turning / simple step turning.
   s. Drilling and tapping
7. **Plumbing:** Familiarity with plumbing tools, Preparation of pipe joints withcoupling for same diameter and with reducer for different diameters and make the following tap connections
   t. Single tap connections
   u. Multi tap connections.

TRADES FOR DEMONSTRATION:

1. **Foundry Trade:** Demonstration and practice on moulding tools and processes, preparation of green sand moulds for single and split patterns.
2. **Welding:** Demonstration and practice on Arc Welding and Gas welding Preparation of Lap joint and Butt joint.

TEXT BOOKS:

1. Serope Kalpak jian and Steven R. Schmid, "Manufacturing Processing forEngineering Materials (SI Edition)", Pearson Education, New Delhi, 6/e, 2018.
2. P.N. Rao, "Manufacturing Technology - Foundry, Farming and Welding, Volume-I",Tata McGraw-Hill Education Pvt. Ltd., Noida, 5/e, 2018.

REFERENCE BOOKS:

1. Hajra Choudhury S.K and Nirjhar Roy, "Elements of Workshop Technology, Volume-I", Media Promoters and Publishers Pvt.Ltd, 15/e, 2010.
2. Roy A Lindberg, "Process and Materials of Manufacturing", Pearson Education, NewDelhi, 4/e, 2015.
3. R.K. Jain, "Production Technology", Khanna publishers, New Delhi, 17/e, 2011.
4. R.K. Rajput, "A Textbook of Manufacturing Technology: Manufacturing Processes", Laxmi Publications (P) Ltd., New Delhi, 2/e, 2017.
5. "A Text book of Manufacturing Technology-I", P.C.Sharma, S.Chand& Company Pvt.Ltd., New Delhi, 1/e, 2011.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104301/
2. https://nptel.ac.in/courses/112/107/112107219/

Course Outcomes

On successful completion of the course, students will be able to		POs related to COs
CO1	Demonstrate the knowledge on different tools used in carpentry, sheet metal, fitting, house wiring, plumbing and machining sections.	PO1
CO2	Analyze the basic pipe line connections using different joining components.	P02
CO3	Design small components using different materials includes wood, G.I Sheet and M.S. Plates.	P03
CO4	Apply basic electrical engineering tools on the house wiring practice.	P05
CO5	Follow the ethical principles in while doing the exercises.	PO8
CO6	Do the exercises effectively as an individual and as a team member in a group.	PO9
CO7	Communicate verbally among team members and in written form, the understanding about the exercises.	PO10
CO8	Continue updating their skill related to trades.	PO12

Subject Name: Engineering Workshop **Subject Code: 23ESC117**

CONTENT

Signature of the Faculty

Sreenivasa Institute of Technology and Management Studies (Autonomous)

Department of Mechanical Engineering

INDEX SHEET

Name of the student: **Roll No.:**

S.No	Experiment Name	Knowledge Gained	Analysis, Design and Use of ModernTool / Technique	Ability to do experiment and following of ethical principles	Result & Conclusion	VIVA VOCE (Communication,Life Long learning	TOTAL	Signature ofthe Faculty
		5		**5**		**5**	**15M**	
1	Fabrication of middle T lap joint from the wooden pieces							
2	Fabrication of Mortise and Tenon joint from the wooden pieces							
3	Preparation of a Tapered tray from GI sheet							
4	Preparation of a Conical funnel from GI sheet							
5	Make V- fitting from mild steel flat pieces							
6	Make Semi-circular fitting from the mild steel flat pieces							
7	Connection of two lights controlled by one switch in series and parallel							
8	Connection of one light controlled by two two-way switches							
9	Make Connection of Tube light							
10	Preparation of Soldering of wires							
11	Simple plain turning by using M.S. Rod							
12	Performance of Drilling and tapping operations in M.S Plate							
13	Construction of One-Tap water distribution system							
14	Construction of Four- Tap water distribution system							

ATTAINMENT LEVELS

Name of the student: **Roll No.:**

S.No	Experiment Name	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8
		Knowledge	Analysis	Design/Develop/ Fabrication	Use of tools /modern tools	Ethics	Individual / Team work	Communication ability	Life Long Learning
1	Fabrication of middle T lap joint from the wooden pieces								
2	Fabrication of Mortise and tenon joint from the wooden pieces								
3	Preparation of a Tapered tray from GI sheet								
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12	Performance of Drilling and tapping operations in M.S Plate								
13	Construction of One-Tap water distribution system								
14	Construction of Four- Tap water distribution system								
Total Attainment (B1)									

RUBRICS FOR ENGINEERING WORKSHOP LAB

	Excellent(3)	Good(2)	Fair(1)
Conduct Experiments (CO1)	Student successfully completes the experiment and explains the experiment concisely and well.	Student successfully completes the experiment and explains the experiment moderately.	Student successfully completes the experiment and explains the experiment satisfactorily.
Analysis (CO2)	Student understands the drawing of the models thoroughly.	Student understands the drawing of the models reasonably.	Student not able to visualize the drawings properly.
Design/Make/ Fabricate (CO3)	Student construct/ make the physical model excellently.	Student construct/ make the physical model moderately.	Student construct/ make the physical model fairly.
Use of tools/ modern tools in engineering practice (CO4)	Student understands the functioning of each tool and use the appropriate tools to make the models.	Student understands the functioning of some tools and uses correctly.	Student understands the functioning of few tools and uses correctly.
Ethics and Lab Safety (CO5)	Student will demonstrate good understanding and follow lab safety	Student will demonstrate good understanding of lab safety	Students demonstrate a little knowledge of lab safety.
Ability to work in teams (CO6)	Performance on teams is excellent with clear evidence of equal distribution of tasks and effort	Performance on teams is good with equal distribution of tasks and effort	Performance on teams is acceptable with one or more members carrying a larger amount of the effort
Report Writing (CO7)	Generate the report with clear procedure of the experiment using excellent language.	Generate the report with clear procedure of the experiment using understandable language	Generate the report with improper organized.
Continuous learning (CO8)	Highly enthusiastic towards continuous learning	Interested in continuous learning	Inadequate interest in continuous learning

CARPENTRY

➢ Introduction:

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

➢ Timber:

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

➢ Timber sizes:

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

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

➢ Classification of Timber:

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

➢ Seasoning of Wood:

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

➢ Characteristics of Good Timber:

The good timber must possess the following characteristics

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

h. During driving the nails and screw, it should not split easily.

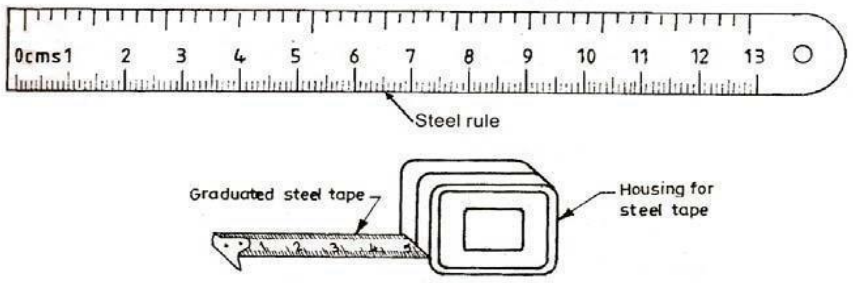
Carpentry Tools:

- **Marking and Measuring Tools:**

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

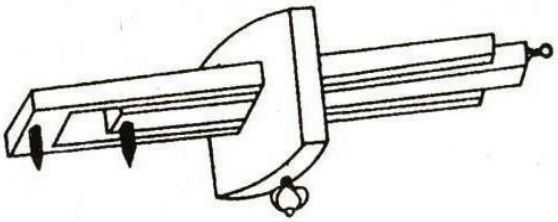
- **Steel rule and Steel tape**

Steel rule is a simple measuring instrument consisting of a long, thin metal strip with a marked scale of unit divisions. It is an important tool for linear measurement. Steel tape is used for large measurements, such as marking on boards and checking the overall dimensions of the work.



- **Marking gauge**

It is a tool used to mark lines parallel to the edge of a wooden piece. It consists of a square wooden stem with a sliding wooden stock (head) on it. On the stem is fitted a marking pin, made of steel. The stock is set at any desired distance from the marking point and fixed in position by a screw. It must be ensured that the marking pin projects through the stem, about 3 mm and the end are sharp enough to make a very fine line. A mortise gauge consists of two pins. In this, it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.



- **Try- square**

It is used for marking and testing the squareness and straightness of planed surfaces. It consists of a steel blade, fitted in a cast iron stock. It is also used for checking the planed surfaces for flatness. Its size varies from 150 to 300 mm, according to the length of the blade. It is less accurate when compared to the try square used in the fitting shop.

- **Compass and divider**

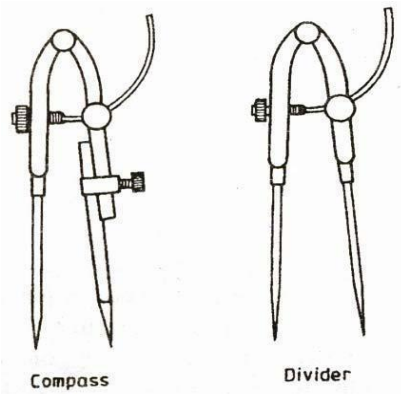
Compass and divider, are used for marking arcs and circles on the planed surfaces of the wood.

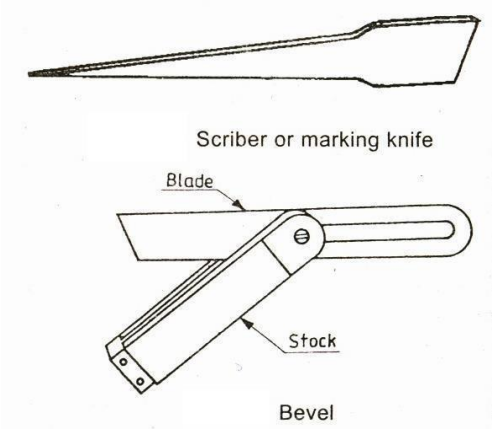
➢ **Scriber or marking knife**

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

➢ **Bevel**

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





Holding Tools:

Carpenter's vice

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

Carpenters vice

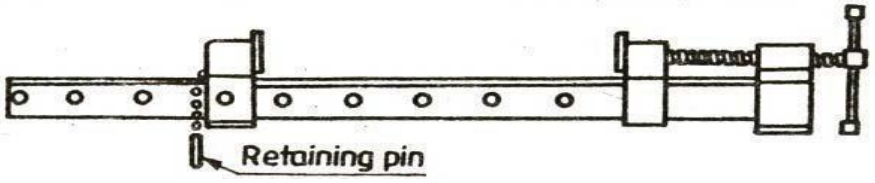
C- clamp

C- clamp

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

Bar cramp

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



Planning Tools:

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

Jack plane

It is the most commonly used general purpose plane. It is about 35 cm long. The cutting iron

(blade) should have a cutting edge of slight curvature. It is used for quick removal of material on rough work and is also used in oblique planning.

Smoothing plane

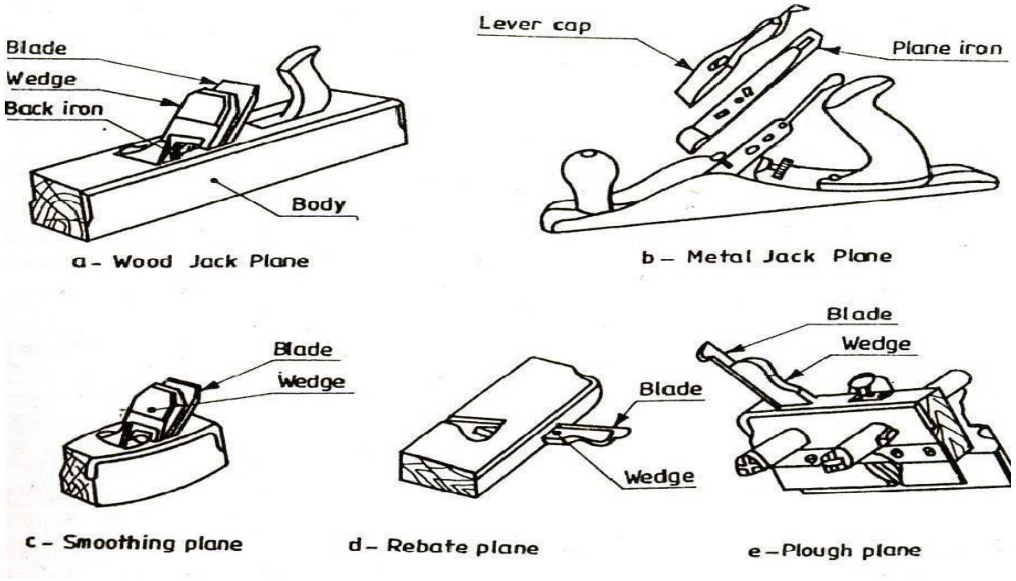
It is used for finishing work and hence, the blade should have a straight cutting edge. It is about 20 to 25 cm long. Being short, it can follow even the slight depressions in the stock, better than the jack plane. It is used after using the jack plane.

Rebate plane

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

Plough plane

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



Cutting Tools:

Saws

A saw is used to cut wood into pieces. There are different types of saws, designed to suit different purposes. A saw is specified by the length of its toothed edge.

Cross- cut or hand saw

It is used to cut across the grains of the stock. The teeth are so set that the saw kerfs will be wider than the blade thickness. This allows the blade to move freely in the cut, without sticking.

Rip saw

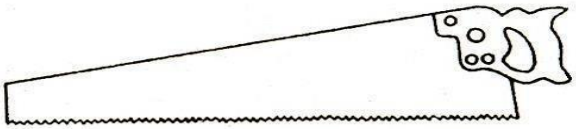
It is used for cutting the stock along the grains. The cutting edge of this saw makes a steeper angle, i.e., about 60° whereas that of crosscut saw makes an angle of 45° with the surface of the stock.

Tenon saw

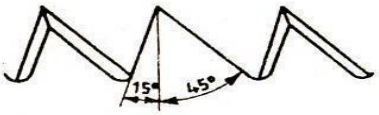
It is used for cutting the stock either along or across the grains. It is used for cutting tenons and in fine cabinet work. However, it is used for small and thin cuts. The blade of this saw is very thin and so it is stiffened with a thick back steel strip. Hence, this is sometimes called as back- saw.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

Compass saw

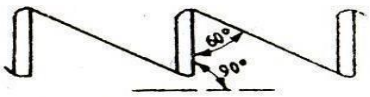
It has a narrow, longer and stronger tapering blade, which is used for heavy works (Fig.). It is mostly used in radius cutting. The blade of this saw is fitted with an open type wooden handle.



a – Cross cut saw

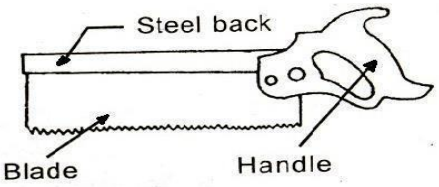


b – Cross cut saw teeth

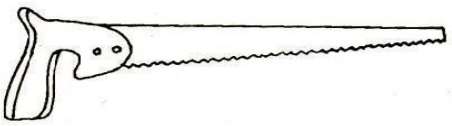


c – Rip saw teeth

Cross-cut and rip saw



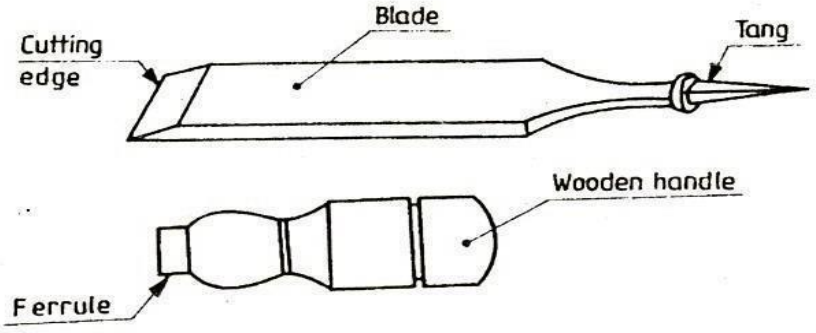
Tenon saw



Compass saw

Chisels

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



Firmer chisel

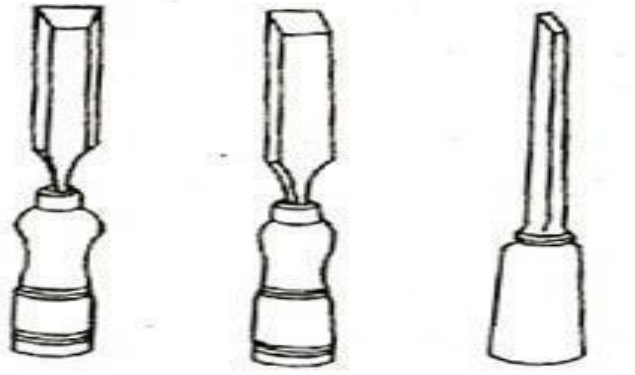
The word 'firmer' means 'stronger' and hence firmer chisel is stronger than other chisels. It is a general purpose chisel and is used either by hand pressure or by a mallet. The blade of a firmer chisel is flat, as shown in Figure.

Dovetail chisel

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

Mortise chisel

It is used for cutting mortises and chipping inside holes, etc. The cross section of the mortise chisel is proportioned to withstand heavy blows during mortising. Further, the cross section is made stronger near the shank.



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

Drilling and Boring Tools:

Carpenter's brace

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

Auger bit

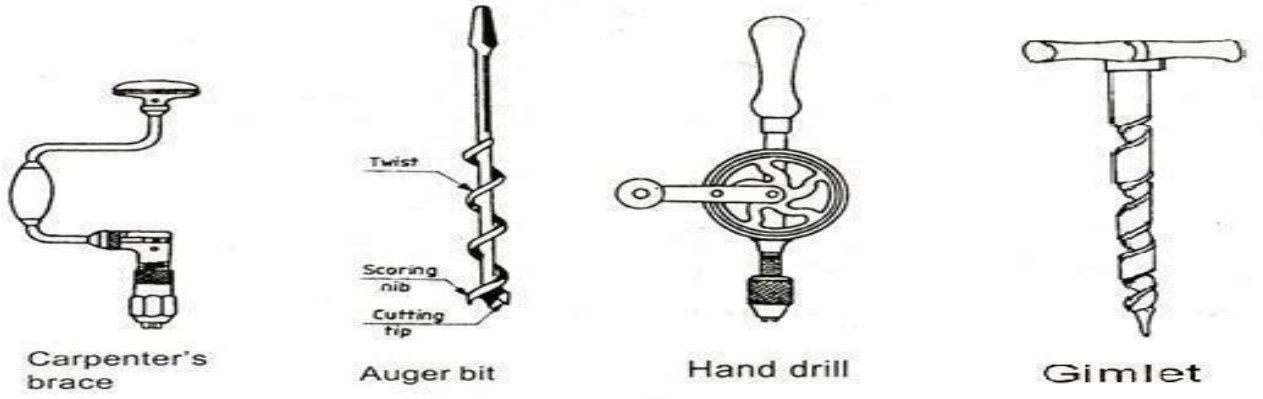
It is the most common tool used for making holes in wood. During drilling, the lead screw of the bit guides into the wood, necessitating only moderate pressure on the brace. The helical flutes on the surface carry the chips to the outer surface.

Hand drill

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

Gimlet

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



Miscellaneous Tools:

Mallet

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

Pincer

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

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

Claw hammer

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

Screw driver

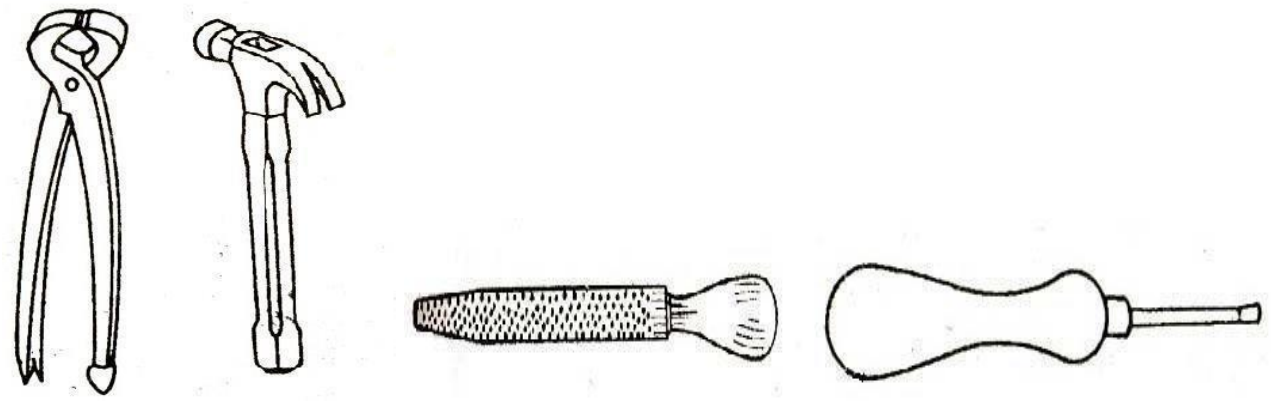
It is used for driving screws into wood or unscrewing them. The screw driver of a carpenter is different from the other common types, as shown in figure. The length of a screw driver is determined by the length of the blade. As the length of the blade increases, the width and thickness of the tip also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

Wood rasp file

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

Bradawl

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



Pincer **Claw hammer** **Wood rasp file** **Bradawl**

MIDDLE T- LAP JOINT

Ex. No: **Ex. Date:**

Aim:

To make a middle T lap joint from the given wooden piece for the desired dimensions.

Material Supplied:

A wooden piece of size 300 x 50 x 35 mm

Tools Required:

Jack plane, try square, marking gauge, tenon saw, rip saw, steel rule, firmer chisel, mallet, wood rasp file and carpentry vice.

Sequence of Operations:

1. Rough planning, 2.Marking, 3.Cutting or sawing, 4.Chiselling, 5.Finish planning.

Working Steps:

1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the work piece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut by using rip saw then proper marking is done for middle T lap joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using tenon saw and firmer chisel, the unwanted portions are removed as per the drawing.
7. The above procedure is repeated for the other half of the work piece.
8. A fine finishing is given to the parts, if required so that, proper fitting is obtained.
9. The parts are fitted to obtain a slightly tight joint.

Precaution:

- Care should be taken while marking,
- Care should be taken while cutting the wooden piece with chisel.

Drawing:

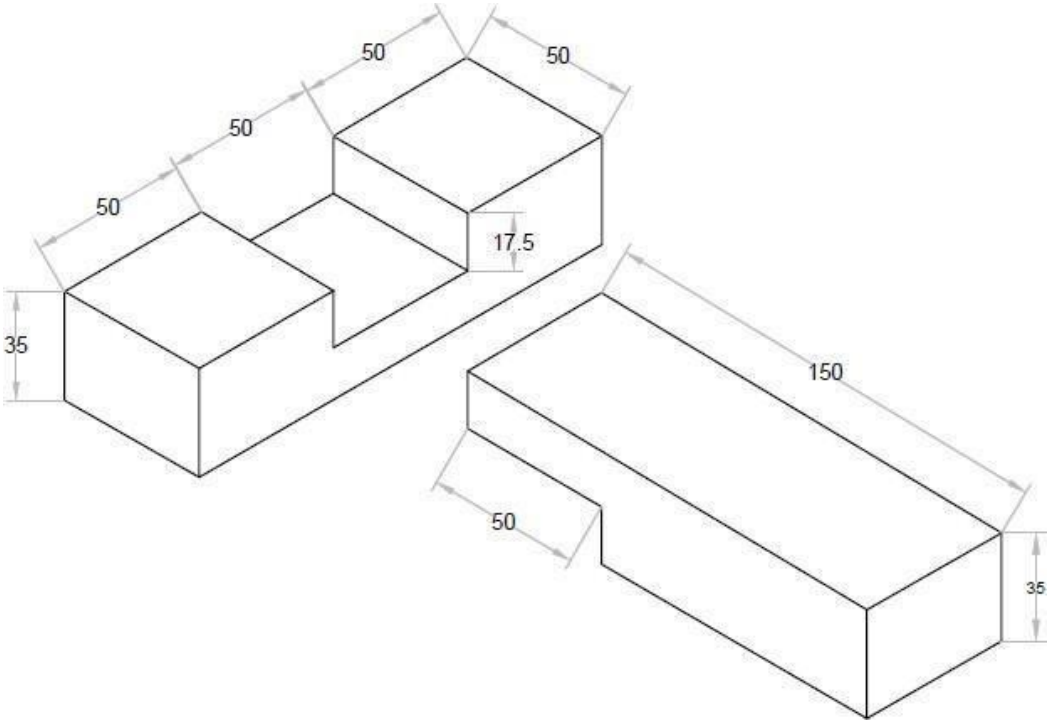


Fig: Middle T- Lap joint

Result:

Hence the middle T lap joint from the given wooden piece for the desired dimensions has been made.

Staff Signature

Mortise and tenon joint

Ex. No: **Ex. Date:**

Aim:

To make a Mortise and tenon joint from the given wooden piece for the desired dimensions.

Material Supplied:

A wooden piece of size 300 x 50 x 35 mm

Tools Required:

Jack plane, try square, marking gauge, tenon saw, rip saw, steel rule, firmer chisel, mallet, wood rasp file and carpentry vice.

Sequence of Operations:

1. Rough planning, 2.Marking, 3.Cutting or sawing, 4.Chiselling, 5.Finish planning.

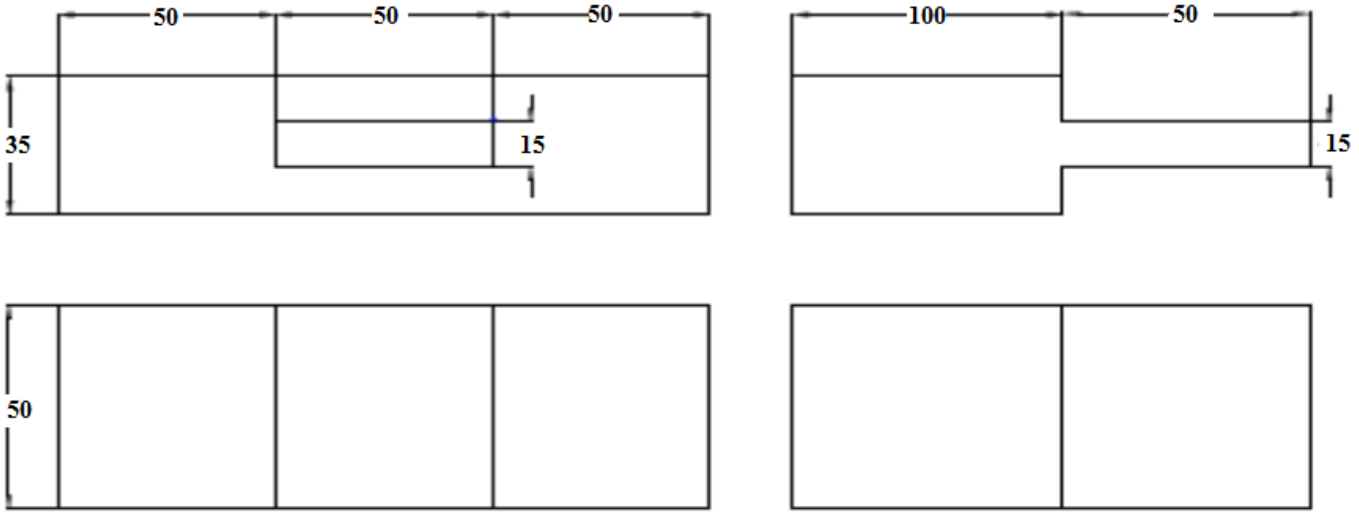
Working Steps:

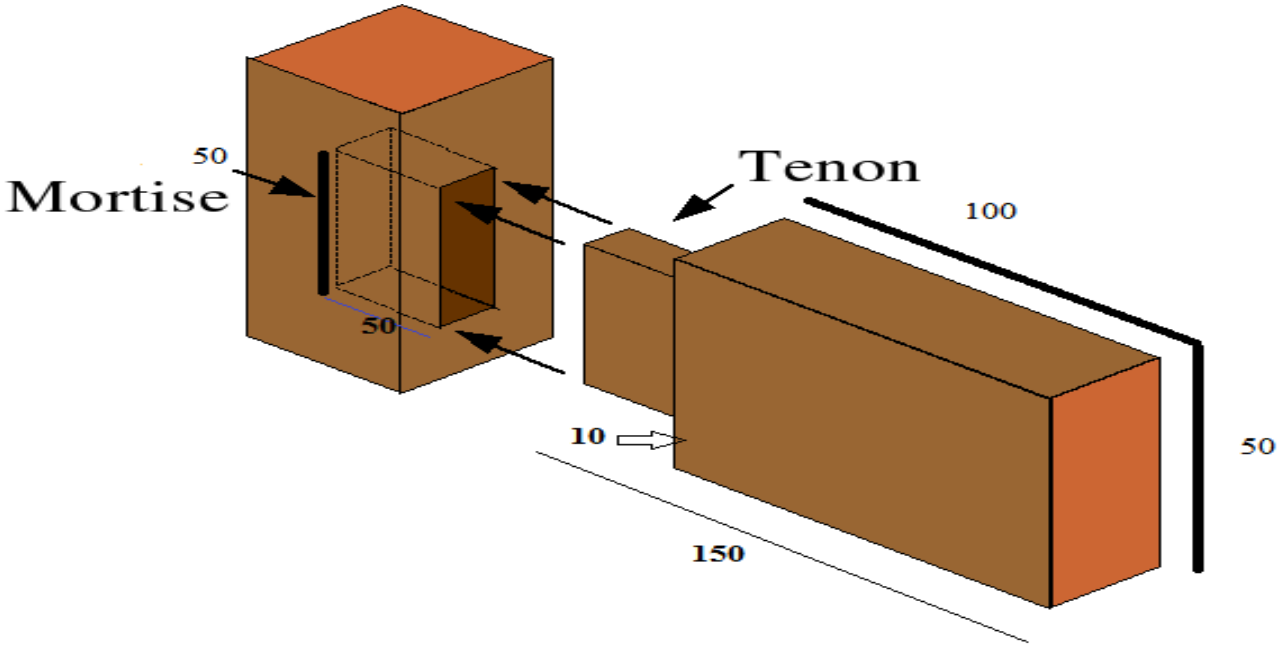
1. The given job is checked to ensure it correct size.
2. The job is firmly clamped in the carpentry vice and any two surfaces are planed by jack plane to get right angle.
3. Using try square, the right angle of the work piece is checked.
4. All the four sides of the wooden pieces are planed to get the smoother and finished surface.
5. The job is cut by using rip saw then proper marking is done for middle T lap joint on the two pieces using steel rule and marking gauge.
6. One half is taken. Using tenon saw and firmer chisel, the unwanted portions are removed as per the drawing.
7. The above procedure is repeated for the other half of the work piece.
8. A fine finishing is given to the parts, if required so that, proper fitting is obtained.
9. The parts are fitted to obtain a slightly tight joint.

Precaution:

- Care should be taken while marking,
- Care should be taken while cutting the wooden piece with chisel.

Drawing:





All Dimensions are in mm

Fig: Mortise and tenon join

Result:

Hence the Mortise and tenon joint from the given wooden piece for the desired dimensions has been made.

Staff Signature

VIVA QUESTIONS- CARPENTRY

1. What are the various types of wood material used in carpentry?
2. What is the sequence of operations in carpentry?
3. Classify the tools used in carpentry.
4. Name some measuring tools.
5. Name some marking tools.
6. Name some cutting tools.
7. Name some finishing tools.
8. Name some work holding devices.
9. What is the use of mortise gauge?
10. What is the use of wooden jackplane?
11. What are various types of saws?
12. What are various types of chisels?
13. What is the difference between saw and chisels?
14. What is the use of try square?
15. What is the use of C-Clamp?
16. Differentiate between bench vice and C-clamp.
17. What is the use of adze?
18. What are the various types of joints?
19. Justify your answer - Which joint is strongest?
20. What is the difference between marking gauge and mortise gauge?
21. What is the use of claw hammer?
22. Why saw setting is required?
23. What are the safety precautions should be taken in carpentry?
24. Why butt joint is not performed in carpentry?
25. Identify the parts of wood jackplane.
26. Define carpentry.
27. What is the use of pincer?
28. Which chisel is convenient for making?
29. What is the maximum length you can measure with steel rule?
30. Identify the given joint.

SHEET METAL (TIN SMITHY)

Introduction:

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

(i) Sheet metal materials:

- **Black Iron:**

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

- **Galvanized Iron:**

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

- **Copper Sheets:**

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

- **Aluminum Sheets:**

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

(ii) Tools used in Sheet metal shop:

- **Steel Rule:**

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

- **Scriber:**

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

- **Dividers:**

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

- **Punches:**

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

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

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

- **Mallet:**

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

- **Snips of Shears:**

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

- **Stakes:**

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

TAPERED TRAY

Ex. No: **Ex. Date:**

Aim:

To make a Tapered tray from the given sheet metal.

Material Supplied:

Galvanized Iron (G.I) sheet.

Tools required:

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

Sequence of Operations:

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

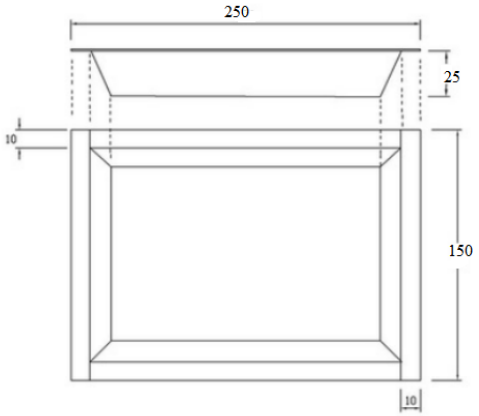
Working Steps:

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

Precautions:

- Should pay attention while marking.
- Bending and finishing should be done neatly and straight.
- Cutting should be done carefully along the marked lines, and while cutting care should be taken to cut it at the further end. Otherwise the metal sheet might bend giving wrong shape.

Drawing:



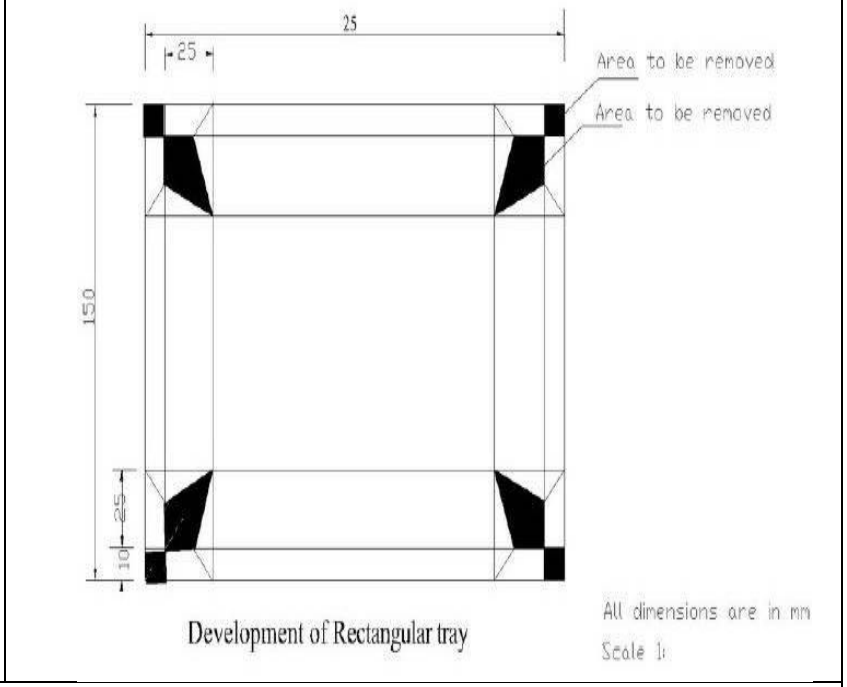


Fig: TAPERED TRAY

All Dimensions are in mm

Result:

Hence the Tapered tray from the given sheet metal has been made.

Staff Signature

Conical Funnel

Ex. No: **Ex. Date:**

Aim:

To make a Conical Funnel from the given sheet metal.

Material Supplied:

Galvanized Iron (G.I) sheet 160 x 80mm size.

Tools required:

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

Sequence of Operations:

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

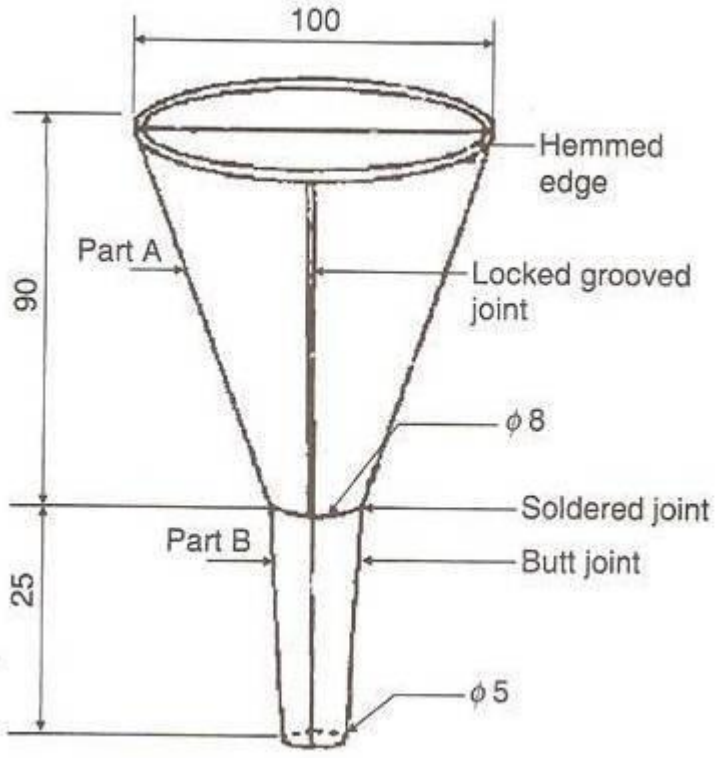
Working Steps:

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

Precautions:

- Should pay attention while marking.
- Bending and finishing should be done neatly and straight.
- Cutting should be done carefully along the marked lines, and while cutting care should be taken to cut it at the further end. Otherwise the metal sheet might bend giving wrong shape.

Drawing:



FUNNEL DEVELOPEMENT

Result:

Hence the Conical Funnel from the given sheet metal has been made.

Staff Signature

VIVA QUESTIONS- SHEET METAL

1. What is the raw material used in tin smithy for doing experiments?
2. Classify the tools used in tin smithy.
3. Name some measuring tools?
4. Name some marking tools?
5. Name some cutting tools?
6. Name some finishing tools?
7. What is the use of nylon mallet?
8. What is the purpose of given tool?
9. Differentiate between mallet and hammer?
10. Differentiate between straight snip and curved snip?
11. What is the purpose of snip?
12. What is the use of anvil?
13. What is the purpose of stake?
14. What is the use of scriber?
15. What is use of cutting plier?
16. What is the supporting tool used to obtain the final shape of the model?
17. What type of development is applied for plain pipe?
18. What type of development is applied for square or rectangular tray?
19. What type of development is applied for funnel?
20. What is the full form of SWG?
21. Tell some precautions should be taken in tin smithy trade?
22. What are the various types of hammer?
23. What do you mean by galvanization?
24. Draw any sheet metal joint symbols.
25. Name different parts of anvil?
26. What is the difference between cross peen hammer and straight peen hammer?
27. What are the different types of metal sheets available?
28. What is the use of divider?
29. What is the sequence of operations in tin smithy?
30. How did you join metal sheets?

FITTING

Introduction:

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

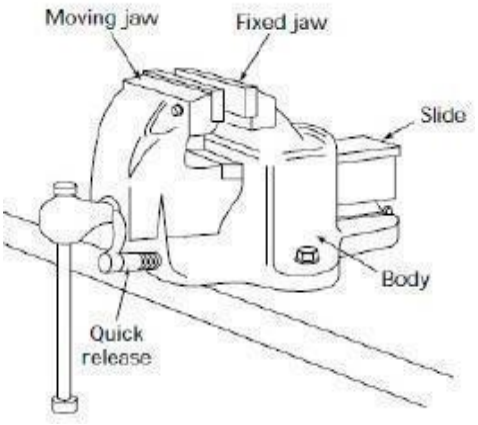
(i) Safety precautions in fitting shop:

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

(ii) Tools used in Fitting Shop

➢ **Bench vice:**

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

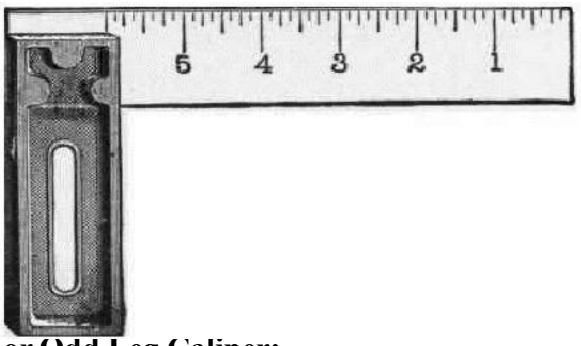


➢ **Hacksaw:**

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

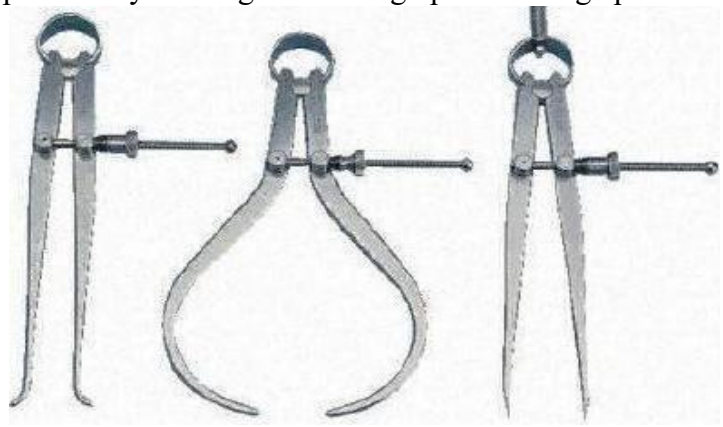
- **Try square**:

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



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

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



- **Scriber:**

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

- **Centre punch:**

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

- **Chisels:**

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

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

- **Steel rule:**

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

- **Hammer:**

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

- **Files:**

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

- **Types of files:**

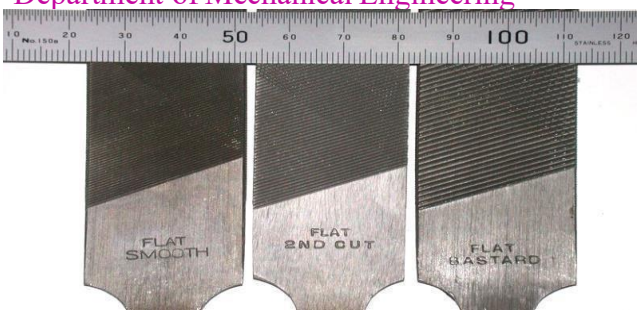
Files are classified according to their shape, cutting teeth and pitch or grade of the teeth.

- **Flat File:**

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

- **Square file:**

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



- **Triangular file:**

Its section is triangular and faces are double cut and edges are single cut. It's each side on 60^0. It is used for filing internal angles, shoulders or corners and for sharpening wood working saws.

- **Round file:**

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

- **Half round file:**

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

Different Types of Files used for different profiles:

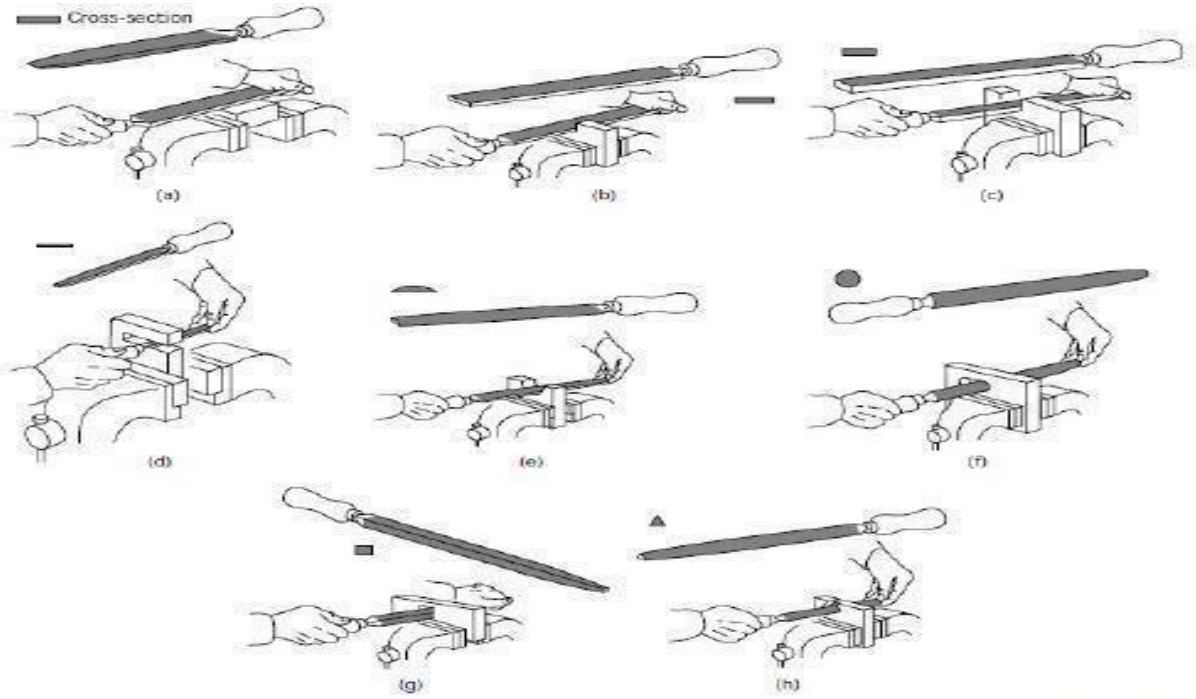


Figure *Types of file and their applications: (a) flat file; (b) hand file; (c) pillar file; (d) ward file; (e) half-round file; (f) round file; (g) square file; (h) three-square file*

V-FITTING

Ex. No: **Ex. Date:**

Aim:

To make a V- fitting from the given mild steel flat piece.

Material Supplied:

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

Tools Required:

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

Sequence of Operations:

1. Checking, 2. Rough filling, 3.Marking, 4.Punching, 5.Sawing, 6.Rough filling,
7. Smooth (Finish) filling.

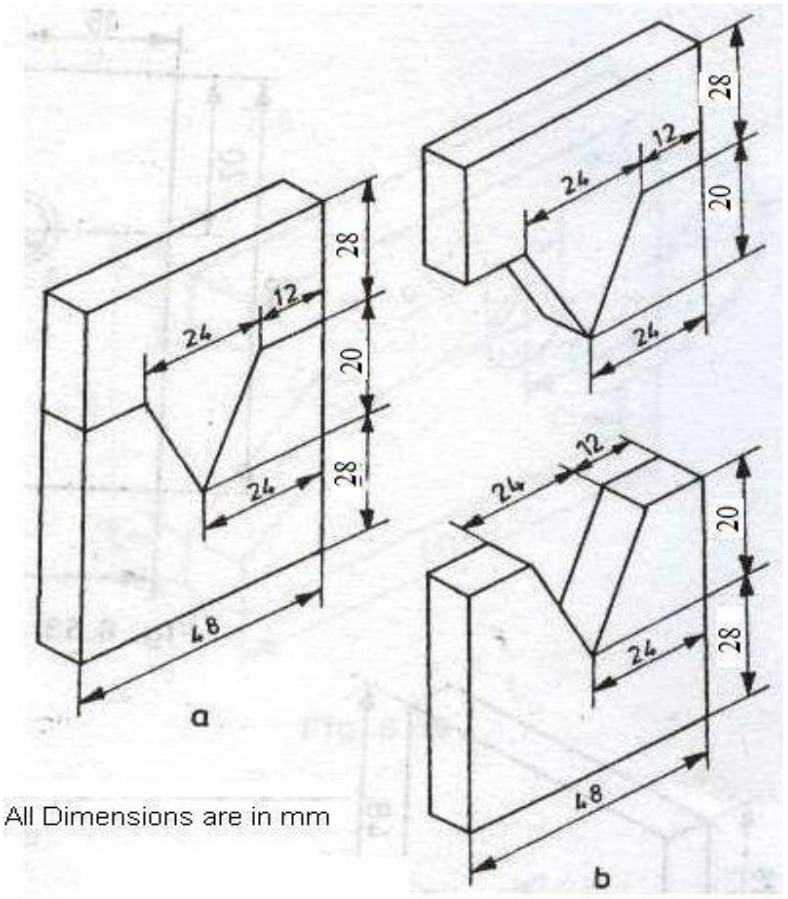
Working Steps:

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

Precautions:

- Care should be taken while marking,
- Care should be taken while hack sawing,
- Use cleaning brush while removing chips.

Drawing:



V - FITTING

Result:

Hence the V- fitting from the given mild steel flat piece has been made according to the dimensions.

Staff Signature

SEMI- CIRCULAR FITTING

Ex. No: **Ex. Date:**

AIM: - To make a Semi-Circular fit from the given two M.S pieces.

TOOLS REQUIRED: -
1. Bench vice
2. Steel rule
3. Try square
4. Ball peen hammer
5. Scriber
6. Hack saw with blade
7. Dot punch and Centre punch
8. Surface plate
9. Rough and smooth flat files
10. Flat chisel and triangular file

MATERIAL REQUIRED: -
Mild steel (M.S) plate of size 50 x 50–2 Nos.

SEQUECE OF OPERATIONS:-
1. Filing
2. Checking flatness and squareness
3. Marking and measuring
4. Punching
5. Sawing
6. Chipping
7. Finishing

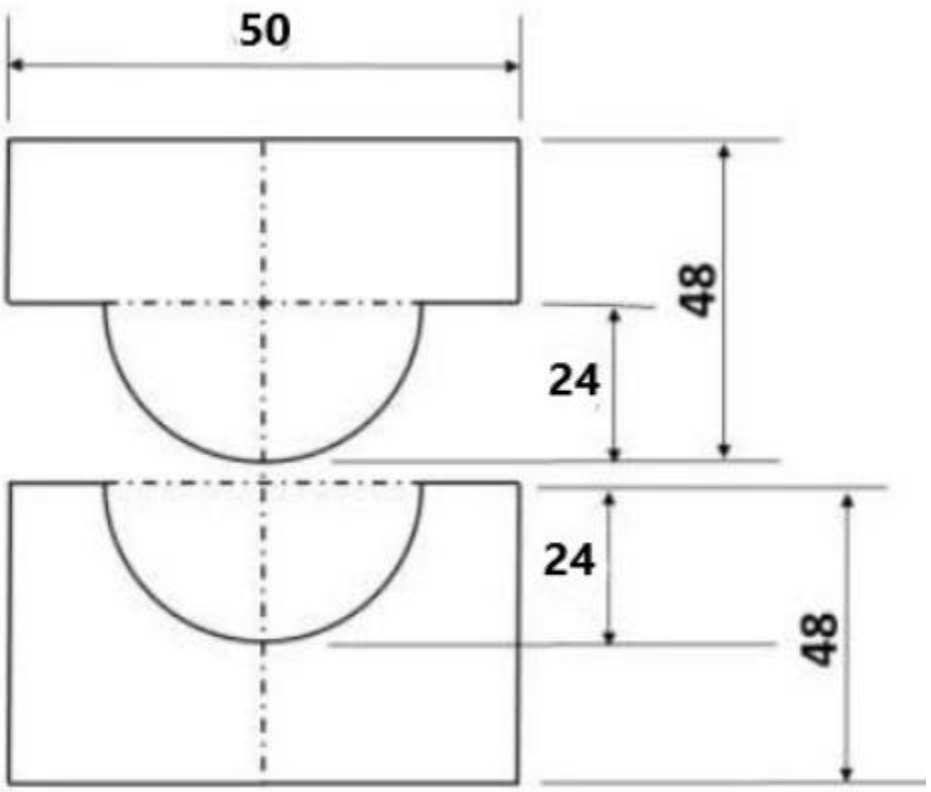
PROCEDURE:-
1. The burrs in the pieces are removed and the dimensions are checked with the steel rule.
2. The pieces are clamped one after the other and the outer mating edges are filed by using rough and smooth files.
3. The flatness, straightness and squareness i.e. right angle between adjacent sides are checked with help of Try-square.
4. Chalk is then applied on the surfaces of the two pieces.
5. The given dimensions of the V-fitting are marked carefully.
6. Using the dot punch, dots are punched along the above scribed lines.
7. Using the hack saw, the unwanted portions are removed.
8. Using the flat chisel, the unwanted material in the piece Y is removed.
9. The cut edges are filed by the half round file.
10. The corners of the stepped surfaces are filed by using a square or triangular file to get the sharp corners.
11. The pieces (X and Y) are fitted together and the mating is checked for the correctness of the fit.

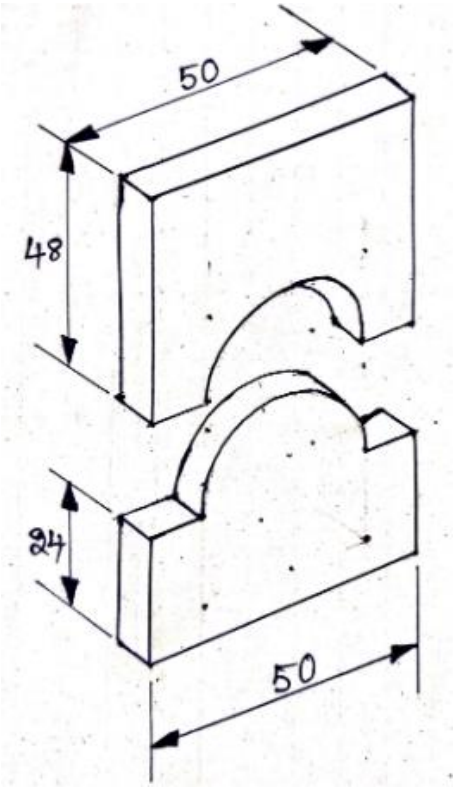
SAFETY PRECAUTIONS

1. Care is taken to see that the marking dots are not crossed, which is indicated by the half of the punch dots left on the pieces.
2. Apply pressure in forward direction during hack sawing.
3. Don’t rub steel rule on the job.
4. Fix blade in hack saw frame with correct tension.

5. During hack sawing the coolant like water or lubricating oil is to be used.
6. Files are to be cleaned properly after using.

DRAWING:-





RESULT

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

VIVA QUESTIONS- FITTING

1. What is meant by fitting?
2. What is the use of vice and give the various types of vice?
3. State the different types of hammers used in fitting work?
4. What is the use of V-block?
5. What is the material used for files?
6. What are the methods of filing?
7. What is the composition of high speed steel?
8. What is meant by peening or swaging?
9. What are the different types of punches?
10. What is the use of pilers?
11. What is a wrench?
12. What are the types of wrenches?
13. What is a torque wrench?
14. What are the materials used for making hacksaw blades?
15. When should a blade with 32 teeth per inch be used?
16. What are the causes of breaking of hacksaw blades?
17. How to specify a vice?
18. Name the material out of which the vice is made?
19. Name the different types of drills used in fitting shop?
20. How can a tap drill step be determined?
21. What is meant by reaming?
22. What are the lengths of the available steel rule?
23. What is the use of tap?
24. What are the materials used in making taps?
25. Name the files which are classified based on longitudinal shape and cross section.
26. What is meant by scraping?
27. What is meant by chipping?
28. What is meant by scriber?
29. What is meant by angle plate?
30. What is meant by surface plate?

ELECTRICAL WIRING

INTRODUCTION:-

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

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

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

ELEMENTS OF HOUSE WIRING:-

Fuses & circuit Breakers:

These are the devices to provide protection to a circuit against excess current.

Open link

fuses are not in safe in operations, even though they are cheaper and reliable. Itconsists of a thin strip of metal (or) wire.

Electric switch:

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

Plug:

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

Socket outlet:

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

Lamp holder:-

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

Ceiling rose:-

A ceiling rose consists of a circular base & cover made of Bakelite. The base has2 or 3 terminal plates. One end of the plate is connected to supply wire connected to pendent lamp, ceiling fan, exhaust fan, etc.

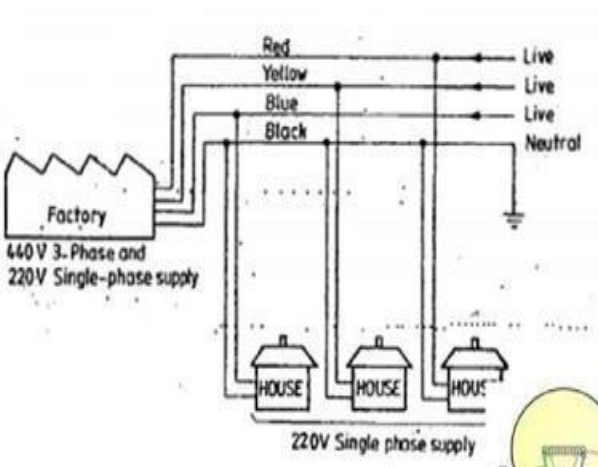
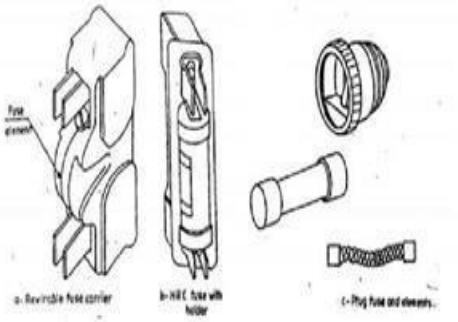


Fig. 3.1 3 phase-4 wire supply



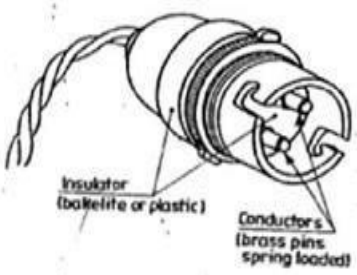
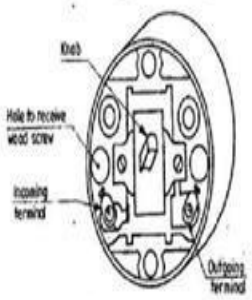
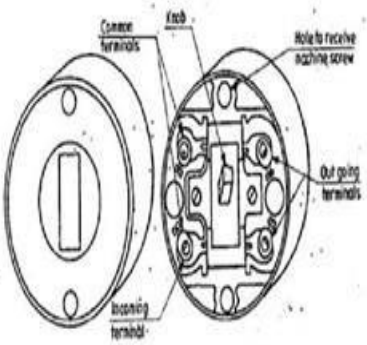


Fig. 3.6 Pendant lamp holder



One-way switch



Cap ..... Two-way switch

Fig. 3.4 Electric switches

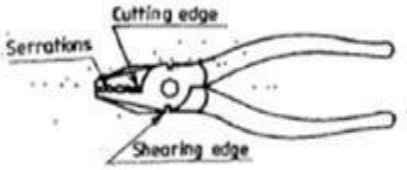


Fig. 8.22 Combination plier

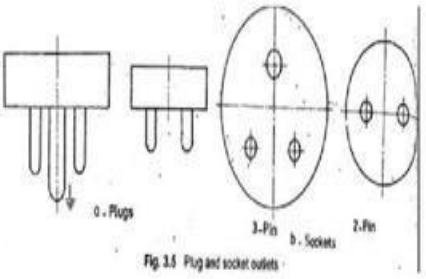


Fig. 3.5 Plug and socket outlets

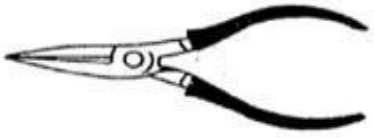


Fig. 8.23 Nose plier

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

Main switch:-

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

Incandescent light:-

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

Interior wiring:-

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

PARALLEL AND SERIES

(WIRING FOR TWO LAMPS CONTROL BY ONE SWITCH)

Ex. No: **Ex. Date:**

Aim:

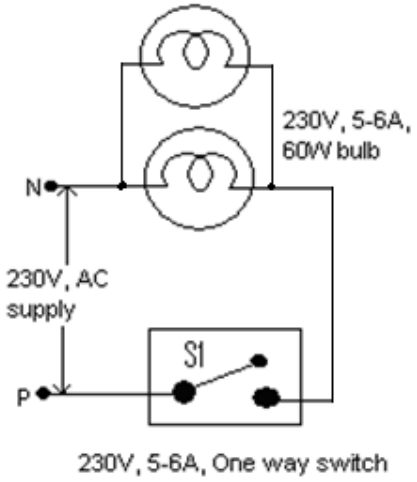
To give connection to two lamps, controlled With Independent Switch Control s with or Without Looping.

Tools Required:

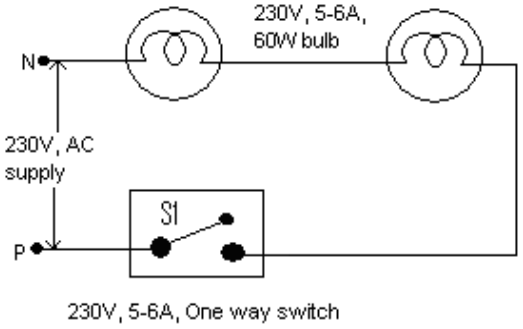
1. Screw driver
2. Cutting pliers
3. Ball peen hammer
4. Insulation remover
5. Tester

MATERIAL REQUIRED: -

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



Parallel Connections



Series Connections

Sequence of Operations:

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

Safety Precautions:

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

Result:

Hence the connection to two lamps, controlled With Independent Switch Control swith or Without Looping was completed.

Staff Signature

TWO-WAY SWITCH

Ex. No: **Ex. Date:**

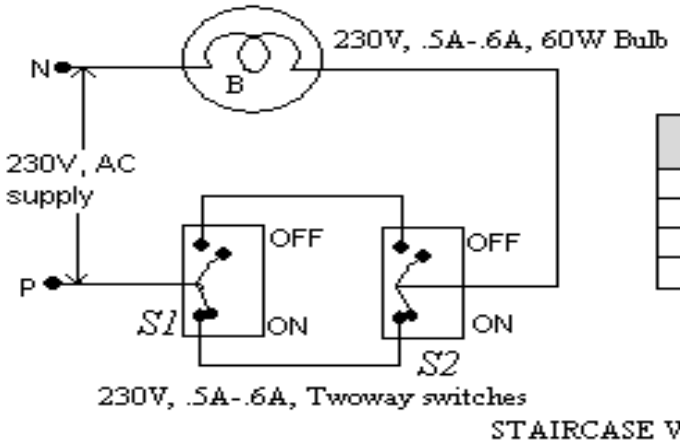
Aim: To give connections to one light controlled by 2 two-way switches.

TOOLS REQUIRED: -

1. **Screw driver**
2. **Cutting pliers**
3. **Ball peen hammer**
4. **Insulation Remover**
5. **Tester**
6. **2 two-way switches**

MATERIALREQUIRED:

1. **Wooden wiring board**
2. **Silk wire**
3. **Electrical bulb - 1 No**
4. **Two -way switches - 2Nos**
5. **Wooden round block - 3 Nos**
6. **Batten lamp holder - 1 No**
7. **Wire clips**
8. **Nails**
9. **Screws**
10. **Starter**
11. **Ballast**



Truth Table

Position of Switch -S1	Position of Switch –S2	Condition of Bulb
ON	ON	ON
ON	OFF	OFF
OFF	ON	OFF
OFF	OFF	ON

Fig: One lamp controlled by 2 two – way switches

PROCEDURE: -

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

SAFETY PRECAUTIONS: -

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

Result:

Hence connections to one light controlled by 2 two-way switches was completed.

Staff Signature

TUBE LIGHT

Ex. No: **Ex. Date:**

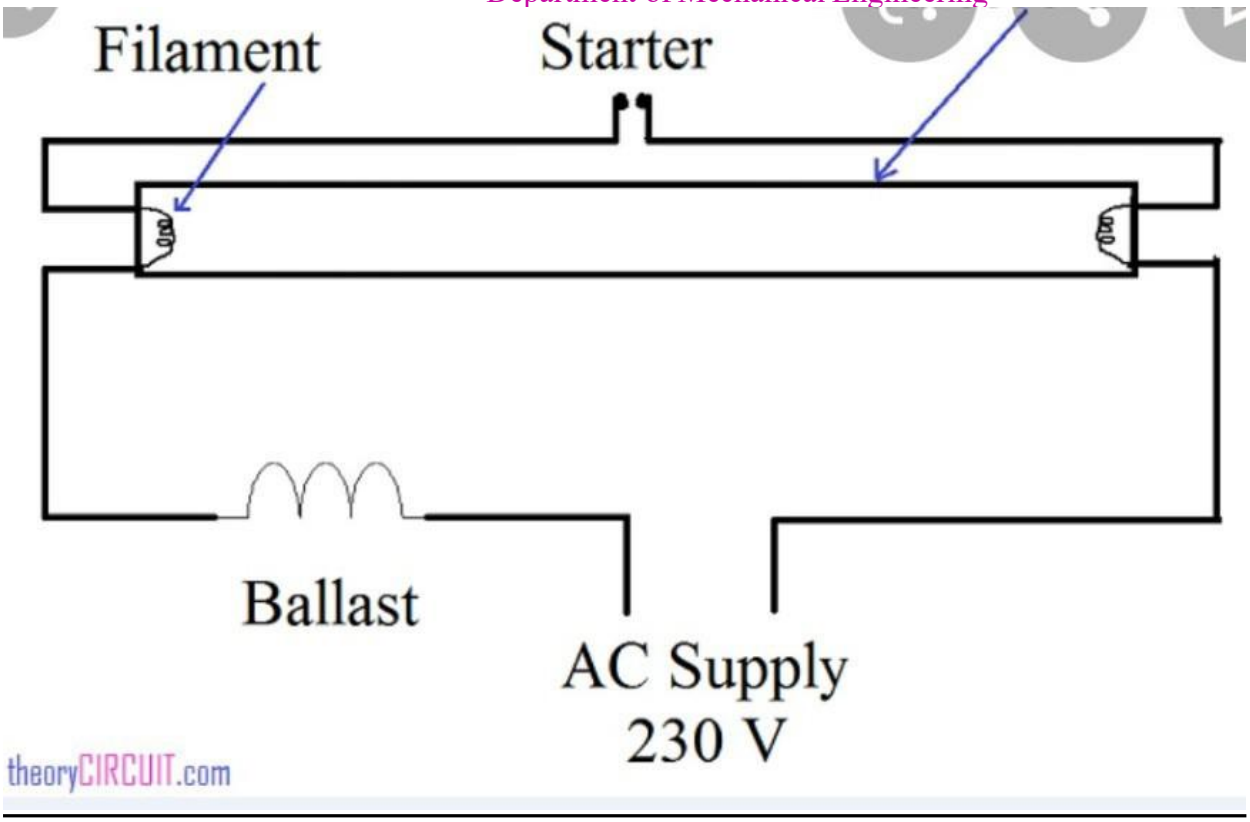
AIM: - To give connections to tube light.

TOOLS REQUIRED: -

1. Screw driver
2. Cutting pliers
3. Ball peen hammer
4. Insulation remover
5. Tester
6. 2 two-way switches

MATERIAL REQUIRED: -

1. Wooden wiring board
2. Silk wire
3. Electrical bulb - 1 No
4. Two -way switches - 2Nos
5. Wooden round block - 3 Nos
6. Batten lamp holder - 1 No
7. Wire clips
8. Nails
9. Screws
10. Starter
11. Ballast



PROCEDURE: -

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

SAFETY PRECAUTIONS: -

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

Result:

Hence the connections to tube light was completed.

Staff Signature

SOLDERING OF WIRES

Ex. No: **Ex. Date:**

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

Method of soldering:

The following are the stages involved in soldering work.

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

strength.Advantages:

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

Result:

Staff Signature

VIVA QUESTIONS- HOUSE WIRING

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

MACHINING

Introduction to Lathe Machine:

Lathe is a machine, which removes the metal from a piece of work to the required shape and size. It is one of the most important machine tools in the metal working industry. A lathe operates on the principle of a rotating work piece and a fixed cutting tool.

In a machine shop, metals are cut to shape on different machine tools. A lathe is used to cut and shape the metal by revolving the work against a cutting tool. The work is clamped either in a chuck, fitted on to the lathe spindle or in-between the centers. The cutting tool is fixed in a tool post, mounted on a movable carriage that is positioned on the lathe bed. The cutting tool can be fed on to the work, either lengthwise or cross-wise. While turning, the chuck rotates in counter-clockwise direction, when viewed from the tail stock end.

Principal parts of a Lathe

Figure 1 shows a center lathe, indicating the main parts. The name is due to the fact that work pieces are held by the centers.

Bed

It is an essential part of a lathe, which must be strong and rigid. It carries all parts of the machine and resists the cutting forces. The carriage and the tail stock move along the guide ways provided on the bed. It is usually made of cast iron.

Head stock

It contains either a cone pulley or gearings to provide the necessary range of speeds and feeds. It contains the main spindle, to which the work is held and rotated.

Tail stock

It is used to support the right hand end of a long work piece. It may be clamped in any position along the lathe bed. The tail stock spindle has an internal Morse taper to receive the dead center that supports the work. Drills, reamers, taps may also be fitted into the spindle, for performing operations such as drilling, reaming and tapping.

Carriage or Saddle

It is used to control the movement of the cutting tool. The carriage assembly consists of the longitudinal slide, cross slide and the compound slide and apron. The cross slide moves across the length of the bed and perpendicular to the axis of the spindle. This movement is used for facing and to provide

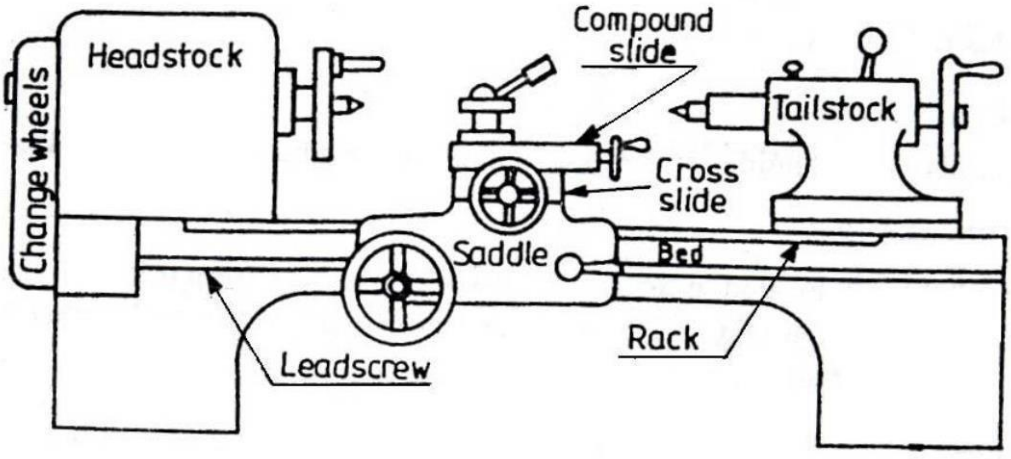


Fig :1Parts of a center Lathe

the necessary depth of cut while turning. The apron, which is bolted to the saddle, is on the front of the lathe and contains the longitudinal and cross slide controls.

Compound Rest

It supports the tool post. By swiveling the compound rest on the cross slide, short tapers may be turned to any desired angles.

Tool Post

The tool post, holds the tool holder or the tool, which may be adjusted to any working position.

Lead Screw

It is a long threaded shaft, located in front of the carriage, running from the head-stock to the tail stock. It is geared to the spindle and controls the movement of the tool, either for automatic feeding or for cutting threads.

Centers

There are two centers known as dead center and live center. The dead center is positioned in the tail stock spindle and the live center, in the head-stock spindle. While turning between centers, the dead center does not revolve with the work while the live center revolves with the work.

WORK- HOLDING DEVICES

1. Three jaw chuck

It is a work holding device having three jaws (self-centering) which will close or open with respect to the chuck center or the spindle center, as shown in figure. It is used for holding regular objects like round bars, hexagonal rods, etc.

Face plate

It is a plate of large diameter, used for turning operations. Certain types of work that cannot be held in chucks are held on the face plate with the help of various accessories.

Lathe dogs and driving plate

These are used to drive a work piece that is held between centers. These are provided with an opening to receive and clamp the work piece and dog tail, the tail of the dog is carried by the pin provided in the driving plate for driving the work piece.

LATHE OPERATIONS

1. Turning

Cylindrical shapes, both external and internal, are produced by turning operation. Turning is the process in which the material is removed by a traversing cutting tool, from the surface of a rotating workpiece. The operation used for machining internal surfaces is often called the boring operation in which a hole previously drilled is enlarged. For turning long work, first it should be faced and center drilled at one end and then supported by means of the tail-stock centre.

2.Boring

Boring is enlarging a hole and is used when correct size drill is not available. However, it should be noted that boring cannot make a hole.

3.Facing

Facing is a machining operation, performed to make the end surface of the work piece, flat and perpendicular to the axis of rotation. For this, the work piece may be held in a chuck and rotated about the lathe axis. A facing tool is fed perpendicular to the axis of the lathe. The tool is slightly inclined towards the end of the work piece.

4.Taper Turning

A taper is defined as the uniform change in the diameter of a work piece, measured along its length. It is expressed as a ratio of the difference in diameters to the length. It is also expressed in degrees of half the included (taper) angle. Taper turning refers to the production of a conical surface, on the work piece on a lathe. Short steep tapers may be cut on a lathe by swiveling the *compound rest* to the required angle. Here, the cutting tool is fed by means of the compound slide feed handle. The work piece is rotated in a chuck or face plate or between centers.

5.Drilling

Holes that are axially located in cylindrical parts are produced by drilling operation, using a twist drill. For this, the work piece is rotated in a chuck or face plate. The tail stock spindle has a standard taper. The drill bit is fitted into the tail stock spindle directly or through drill chuck. The tail stock is then moved over the bed and clamped on it near the work. When the job rotates, the drill bit is fed into the work by turning the tail stock hand wheel.

6.Knurling

It is the process of embossing a diamond shaped regular pattern on the surface of a work piece using a special knurling tool. This tool consists of a set of hardened steel rollers in a holder with the teeth cut on their surface in a definite pattern. The tool is held rigidly on the tool post and the rollers are pressed against the revolving work piece to squeeze the metal against the multiple cutting edges. The purpose of knurling is to provide an effective gripping surface on a work piece to prevent it from slipping when operated by hand.

7.Chamfering

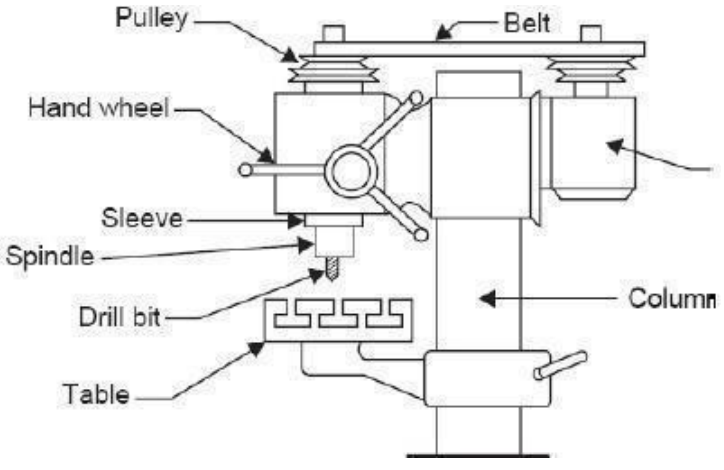
It is the operation of beveling the extreme end of a work piece. Chamfer is provided for better look, to enable nut to pass freely on threaded work piece, to remove burrs and protect the end of the work piece from being damaged.

8.Threading

Threading is nothing but cutting helical groove on a work piece. Threads may be cut either on the internal or external cylindrical surfaces. A specially shaped cutting tool, known as thread cutting tool, is used for this purpose. Thread cutting in a lathe is performed by traversing the cutting tool at a definite rate, in proportion to the rate at which the work revolves.

Introduction to Drilling Machine:

A drilling machine also called a drill press is used to cut holes into or through metal, wood, or other materials.



Constructional Features of the Drilling Machine:

Drilling is a process of making holes of different sizes. A special tool called drill bit is used for drilling. The machine tool used for this is known as drilling machine. The main disadvantage of drilling is that it is not possible to make holes of any odd size. Drill bits are available in standard sizes. The size that is close to the required size of the hole is to be selected for making the hole. In addition, the surface quality is not very good in drilling. However, drilling is a simple process. The drilling machine also is not very complex. It can be readily used to make holes of different sizes on different jobs. The operator need not be skilled.

Principal Cutting Motions in Drilling

The principal cutting motions involved in the drilling process. The drill hit is made out of a cylinder, with two grooves spiraling around it. Two cutting edges are formed at the end of the drill bit. The two edges are twisted and joined in an end cutting edge called chisel edge. Therefore, drill bits are multi-point cutting tools. The main cutting motion in drilling is rotation of the drill bit about its own axis. When it is rotated, the two cutting edges remove small layers of the work material. The cut material comes out in the form of chips. These chips ravel along the groves and finally come out of the hole being drilled.

The other motion required for drilling is the ability to move the rotating drill bit into and out of the work piece. This is called the feed motion. This will help in controlling the depth of the drilled hole.

Drilling Machine:

The construction of the drilling machine can be understood from Fig. It can be seen that the drilling machine is made of a base, supporting a column and a drilling head mounted on the column. A motor is mounted at the top of the column. This motor is connected through some driving mechanisms to the main spindle of the machine. This vertical spindle rotates when the motor is switched on. The drill bit can be fixed into the spindle. When the spindle rotates, the drill bit also rotates. This is how the basic cutting motion in drilling is achieved. A special mechanism is used to provide the feed motion to the rotating drill bit. By using the handle fixed to the drill head, the spindle and along with it, the drill bit can be moved up and down. Further description of the different parts of the drilling machine is given below.

Base: This is a solid block mounted on the floor. This gives support for the machine.

Column: This is usually a round column erected vertically on the base. This supports the drill worktable, head and other driving mechanisms.

Work Table: This is mounted on the column. This can be raised or lowered on the column. This will help in working with jobs of different sizes. The worktable can also be rotated about the column. This will help in properly locating the drill bit at the place where the required hole is to be made. A vice is fixed on the worktable. The work piece can be fixed in the vice.

Drill Head: This contains the main spindle of the machine. The main spindle is connected through some mechanisms to the driving motor. The control switches are also fixed on the drill head.

Spindle: This is a shaft mounted in the drill head. This rotates about its own axis when the machine is switched on. It can be rotated at different speeds by using the gearbox provided in the drill head. It has a tapered hole at the bottom. This tapered hole can be used to fix the drill bit into the spindle.

Drill Bit: This is the cutting tool used for drilling. It is fixed in the tapered hole of the spindle. Sometimes, a special chuck, called drill chuck is fixed in the spindle. The drill chuck can be used to fix drill bits of different sizes.

Feed handle: This handle can be used to raise or lower the drill bit when it is cutting a hole. This helps in controlling the depth of the hole being machined.

Operations that can be performed on a drilling machine:

Drilling: This is the process of making holes.

Core drilling: This is the process of enlarging an existing hole. The drill bit used in this case is flat at the bottom. It does not have any chisel edge.

Step drilling: This is the process of making a stepped hole with different diameters. Special stepped drill bit is used for this purpose.

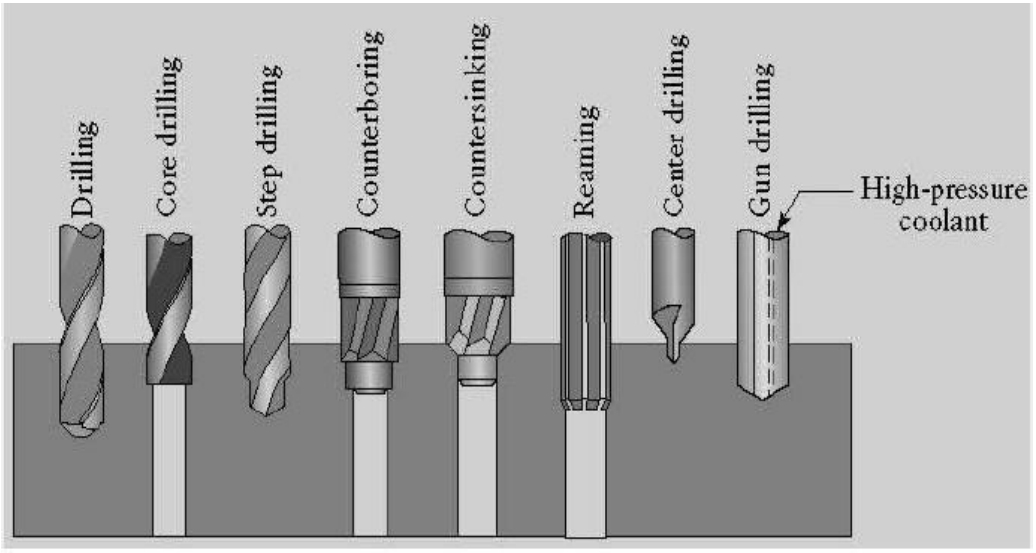
Counter boring: This is the process of enlarging the top portion of an already drilled hole. Special counter boring tools are used for this purpose. The front portion of the tool goes into the existing hole and guides the counter boring tool.

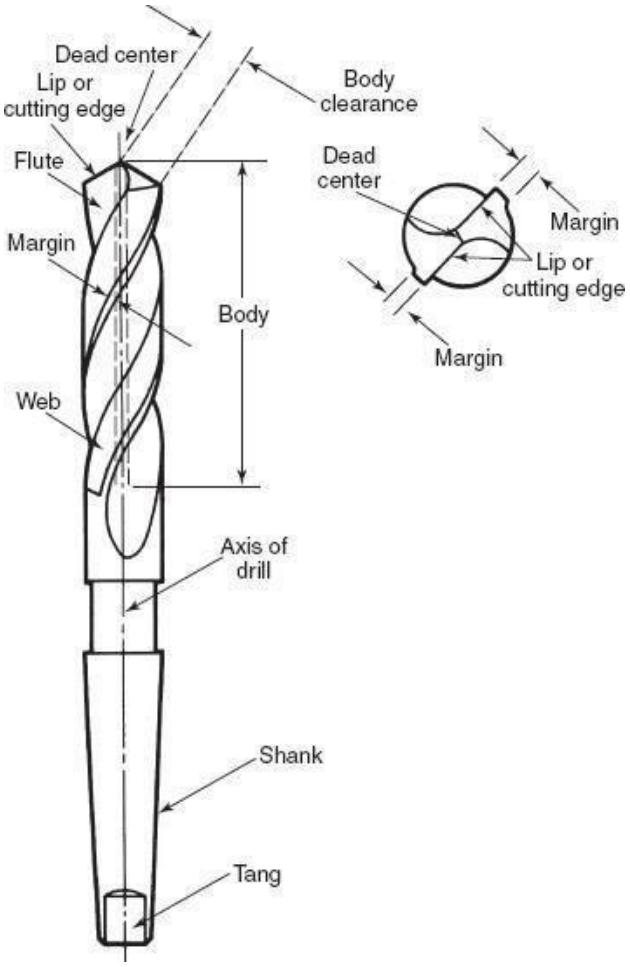
Counter sinking: This is the process of enlarging the top of. hole a tapered shape. This tapered enlargement takes the tapered screw head.

Reaming: Reaming is the process of correcting the hole produced by drilling. It is mentioned that drilling produces bad surfaces. The surface quality of the drilled hole is improved by reaming. It will also correct the size of the hole. Special tools called reamers are used for this purpose.

Center drilling: This is the process of marking the center for further operations. Special tools are used for this purpose.

Gun drilling: This is the process of making very deep holes. Special hallow drill bits are used for this purpose.





Staff Signature

TURNING OPERATION

Ex.no: **Ex. Date:**

AIM

To perform plain turning operation on the given M.S work piece.

APPARATUS

Single point cutting tool

Chuck key

Tool post key

Vernier caliper

Lathe machine

MATERIALS REQUIRED:

Mild Steel rod 50 mm diameter

PROCEDURE:

Facing is done on both sides of the work piece.

The plain turning operations are done and the work piece is marked as per the given dimensions.

The step turning is done.

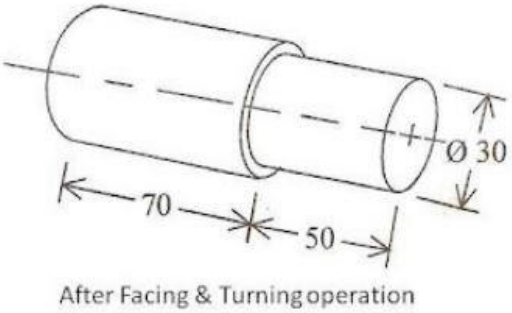
Hence the model is completed

PRECAUTIONS:

Care should be taken while cutting.

While performing turning operations lubricant should be used to minimize friction.

DIAGRAM



After Facing & Turning operation

RESULT:

Staff Signature

DRILLING OPERATION

Ex.no: **Ex. Date:**

AIM

To perform drilling operation on the given M.S Flat work piece.

APPARATUS

1. Drilling Machine with standard accessories
2. Work piece

MATERIAL

Mild Steel flat plate 50 × 50 ×5 mm

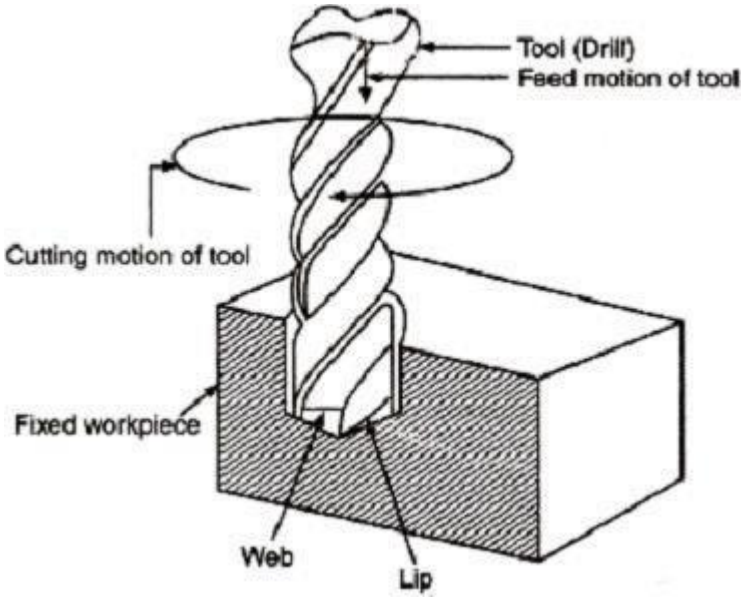
PROCEDURE

1. The given work piece is first filed to get required length, breadth and thickness wet Chalk is applied on four sides and with the scriber lines are drawn to get center hole at required location.
1. The centers are punched with a Punch and hammer.
2. The work piece is fixed firmly in the vice of the Drilling Machine.
3. 3/8" drill bit is fixed firmly in the chuck and drilling is performed giving uniform depths.
5. The drill bit is removed and repeat the experiment.

PRECAUTIONS

1. Care should be taken while cutting and drilling.
2. While performing the operation use lubricant and it should be used to minimize the friction.

DIAGRAM



RESULT:

Staff Signature

TAPPING OPERATION

Ex.no: **Ex. Date:**

AIM

To perform tapping operation on the given M.S Flat work piece.

APPARATUS

1. Taps with required sizes
2. Work piece

MATERIALS REQUIRED:

Mild Steel flat plate 50 mm × 50 mm ×5 mm

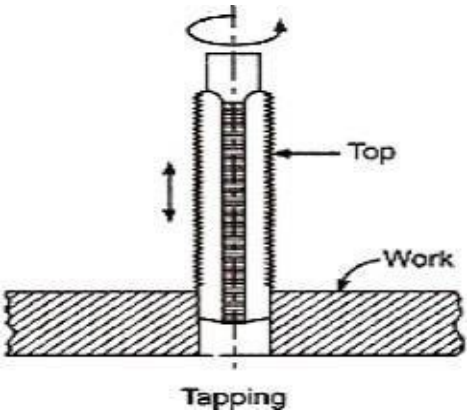
PROCEDURE:

1. The reaming operation is performed on the hole which has been previously drilled.
2. The work is removed from the vice for performing tapping operation.
3. The job is fixed firmly in a bench vice.
4. Tap is fixed in the tap handle and pressure applied on the taps to obtain internal threads.

PRECAUTIONS:

1. While performing reaming and tapping operations lubricant should be used to minimize friction.

DIAGRAM



Tapping

RESULT:

Thus the required tapping operation is performed as per dimensions from the given work piece.

Staff Signature

VIVA QUESTIONS- MACHINING

1. What do you mean by cutting tool?
2. What do you meant by coolant and what is the necessity of using coolant?
3. What is turning?
4. What is Facing?
5. What is taper turning?
6. What is meant by single point cutting tool?
7. What is threading?
8. What are the parts in the centre drill?
9. What is drilling?
10. What is the difference between drilling and reaming?
11. What is least count of vernier caliper?
12. What are the different parts of lathe machine?
13. What are the different parts of drilling machine?
14. A single point cutting tool have ____ rake angle?
15. What are the main parts of drilling machine?
16. Name the single point cutting tool matrial?

PLUMBING

Introduction

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

Plumbing tools

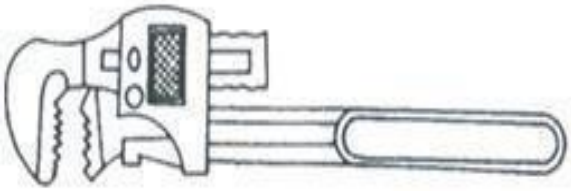
The tools used by a plumber can be classified as follows

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

Pipe wrench

A pipe wrench is used for holding and turning the pipes, rods and machine parts.

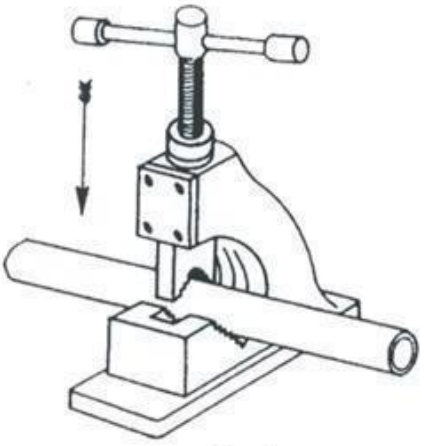
Wrenches are classified as follows.1.Fixed wrenches 2. Adjustable wrenches.



Pipe wrench.

Pipe vice

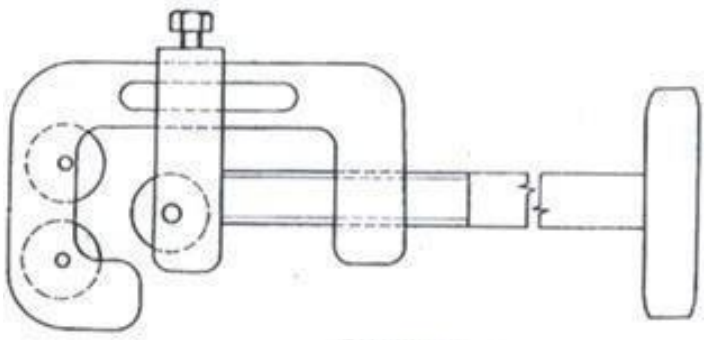
A pipe vice is fitted on the work bench. This has a set of jaws to grip the pipe and prevent it from turning while cutting, threading and fitting of bends, couplings etc. The yoke vice is commonlyused in plumbing used in plumbing practice.



Pipe vice.

Pipe cutter

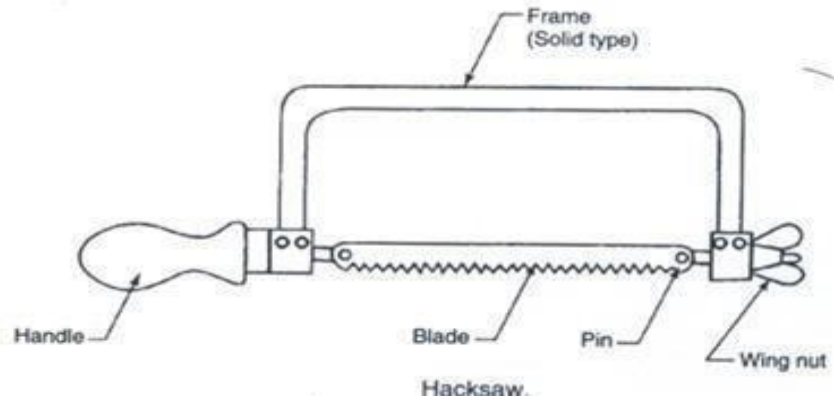
The pipe cutter mainly consists of three wheels which are hardened with sharp cutting edges along their periphery. Of these three wheels, one can be adjusted to any desired distance to accommodate different size of pipes. After adjusting the cutter on a pipe, it is around the pipe, so that the cutter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



Pipe cutter.

Hack saw

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



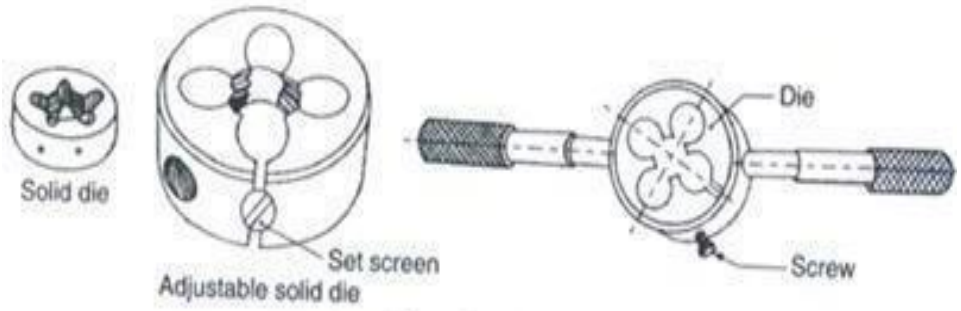
Hacksaw.

Threading dies and taps

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

Files and rasps

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



Threading dies and taps.

File and rasp

Plumb bob

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

Plumb bob.

Pipe fittings

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

Coupling

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

Union

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

Nipple

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

Elbow

An elbow is to make an angle between adjacent pipes.

Tee

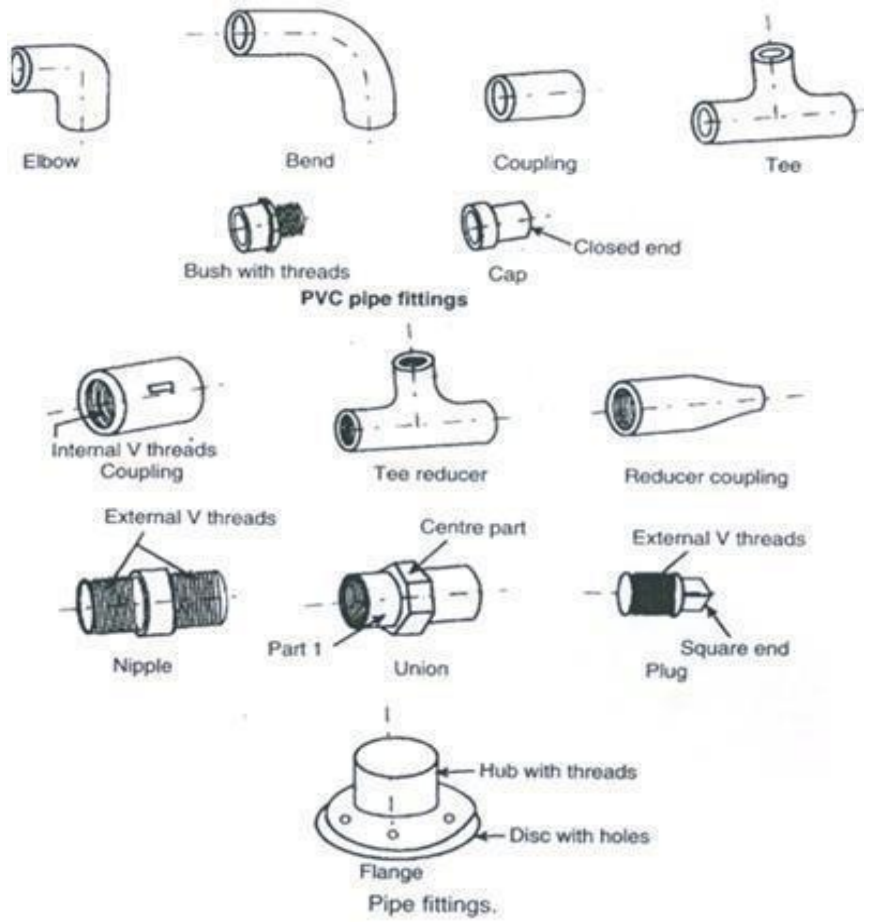
A tee is a fitting that has one side outlet at a right angle to the run. It is used for a single outlet branch pipe.

Reducer

It is used to connect two different sized of pipes

Plug

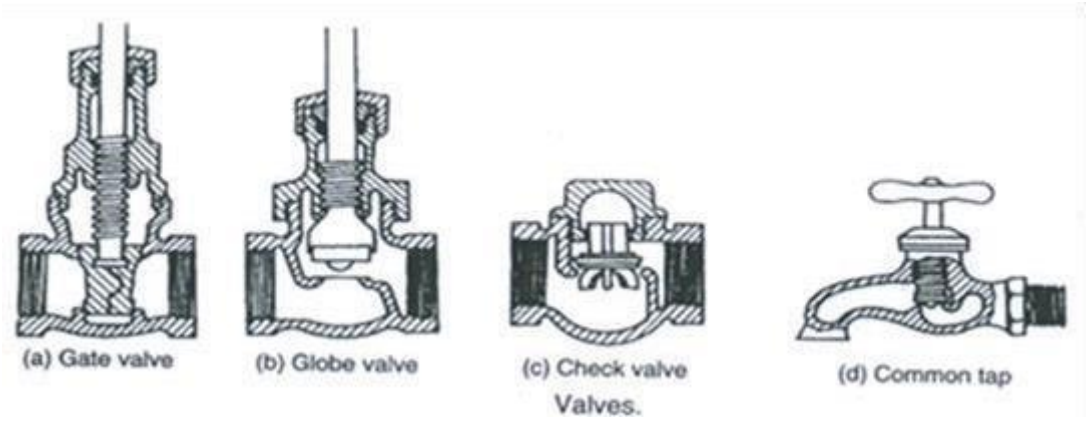
It is used to screw on to a threaded opening, for closing it temporarily.



Valves

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

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

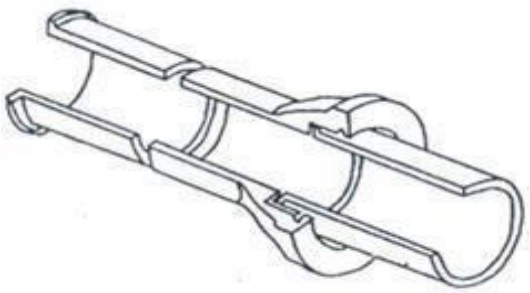


Valves.

TYPES OF PIPE JOINTS

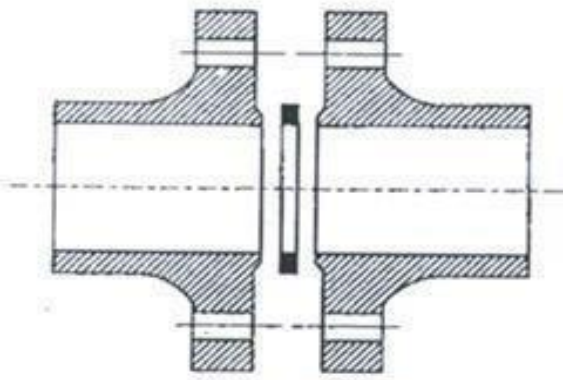
Bell and spigot joints

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


Bell and spigot joints.

Flanged joints

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

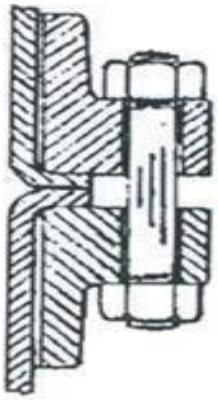


Flange joint.

Bolted joints

The use of bolted joint is advantageous in the following circumstances

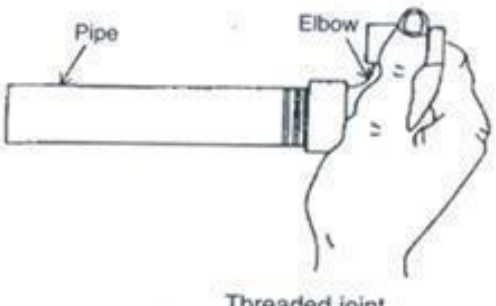
1. The component that cannot be serviced in line.
2. The components being joined that are not capable of being welded.
3. Quick field assembly is required.
4. The component or pipe section that needs to be frequently removed for surface.



Bolted joint.

Threaded joints

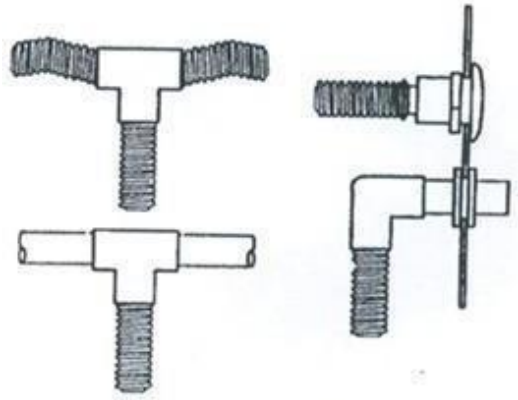
Threads are cut in a pipe, flange coupling to connect them with each other and these joints are called threaded joints.



Threaded joint.

Flexible joints

The flexible joints are generally used to connect between a washbasin and an angle valve.



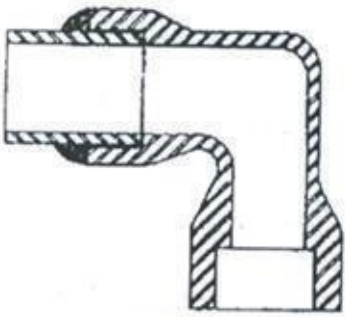
Flexible joints.

Swing joints

Swing joints are special purpose joints mainly used for industrial oriented purposes where a long bend is required.

Welded and brazed joints

Welded and brazed joints are the most commonly used joints for joining pipe components.



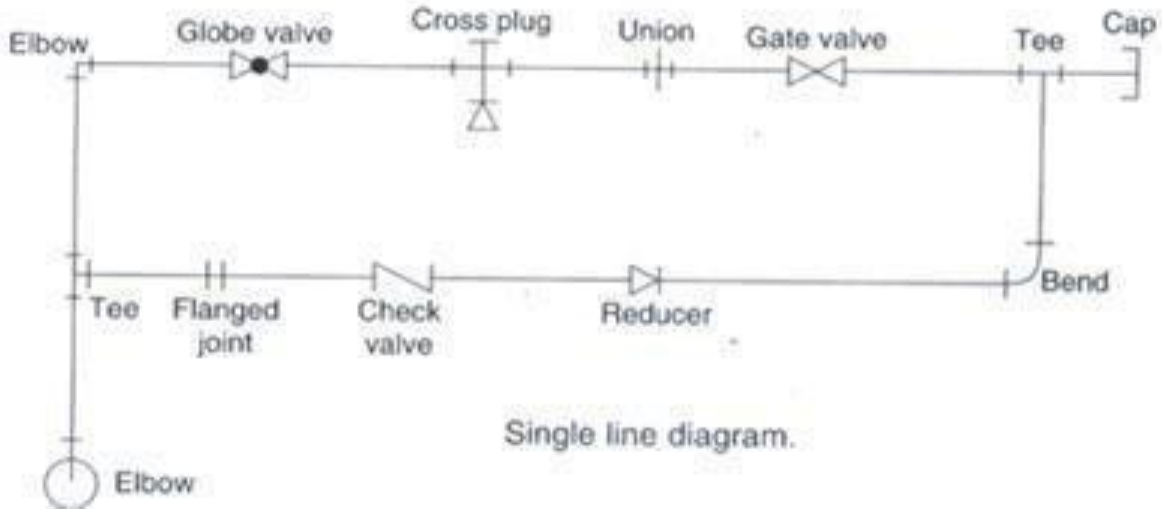
Welded and brazed joints.

Expansion joints

Expansions joints are specially designed in pipeline where a small extension of pipe is required.

Single line diagram

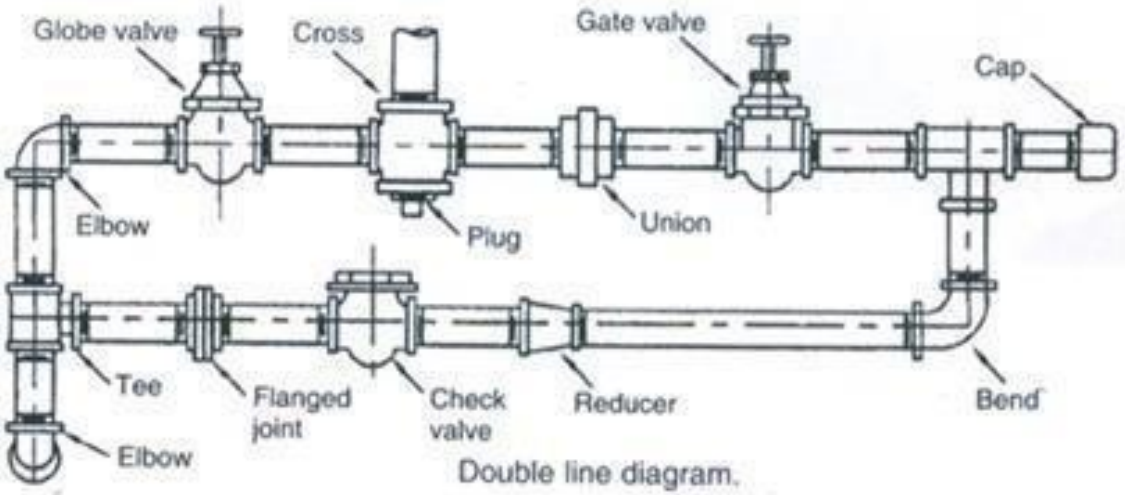
Single line diagram are most commonly used in plumbing diagram. All power plants and bottling plant pipes are made by the single line piping diagram.



Single line diagram.

Double line diagram

It is used for catalogs and other applications where the visual appearance is more important.



Double line diagram.

PLUMBING OF ONE TAP WATER DISTRIBUTION SYSTEM

Ex.no: **Ex. Date:**

Aim

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

Fittings required

1. PVC pipes
2. Tank fitting (GI)
3. Union (GI)
4. MTA (PVC)
5. Gate valve
6. Elbow
7. Reducer (GI)
8. Bend (PVC)
9. FTA (PVC)
10. TAP (PVC)

Procedure

1. The given PVC pipes are measured out to the required size.
2. The suitable die is selected.
3. Gate valve is connected between the two MTA.

4.1" x ¾" reducer connected between 1" pipe and ¾" pipe.

5.1" (GI) bend is connected between the two pipes.

6.¾"x1/2" reducer connected between ¾" pipe and ½".

7.½" bend connected between ¾" and ½" pipe.

8. At the end of the pipe ½" MTA tap is connected.

Result

Staff signature

PLUMPING OF FOUR TAP WATE DISTRIBUTION SYSTEM

Ex.no: **Ex. Date:**

Aim

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

Fittings required

1. PVC pipes
2. Tank fitting (GI)
3. Union (GI)
4. MTA (PVC)
5. Gate valve
6. Elbow
7. Reducer (GI)
8. Bend (PVC)
9. FTA (PVC)
10. TAP (PVC)

Procedure

1. The given PVC pipes are measured out to the required size.
2. The suitable die is selected.
3. Gate valve is connected between the two MTA.

4.1" x ¾" reducer connected between 1" pipe and ¾" pipe.
5.1" (GI) bend is connected between the two pipes.
6.¾"x1/2" reducer connected between ¾" pipe and ½".
7.½" bend connected between ¾" and ½" pipe.
8. Finally FTA ½" connected at four ends and then ½" tap fixed to the four ends.

Result:

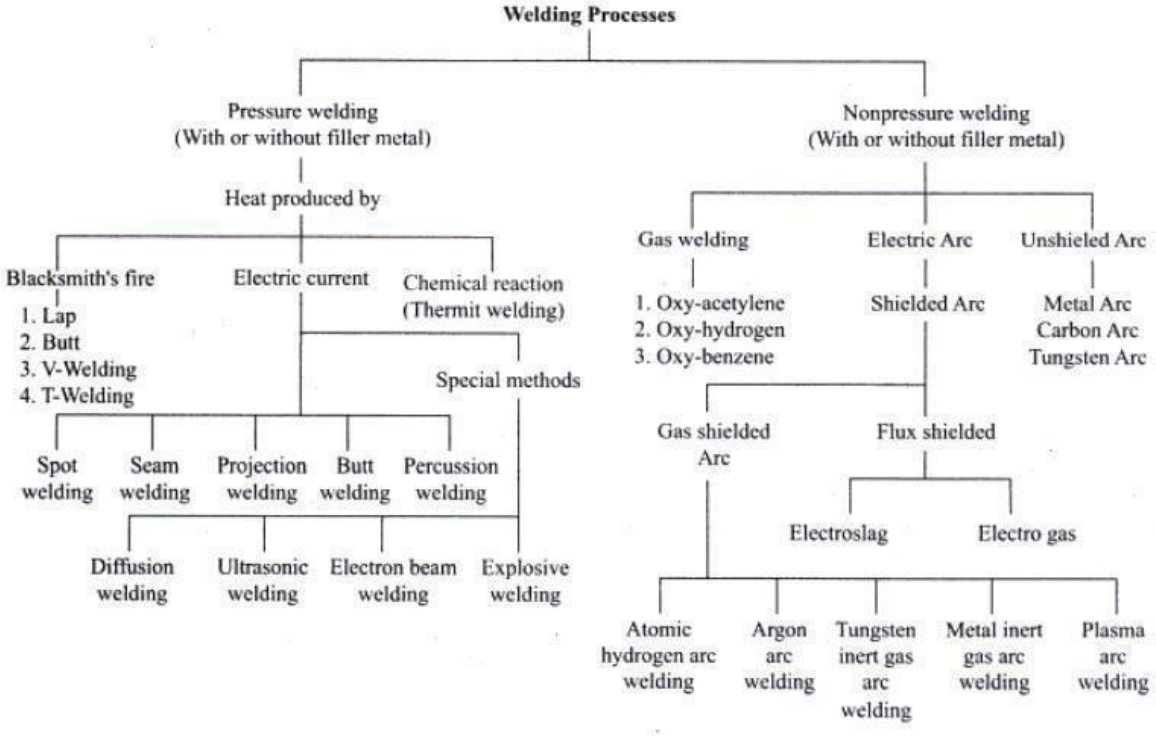
Staff signature

TRADES FOR DEMONSTRATION

Welding

Welding is a process for joining two similar or dissimilar metals by fusion. It joins different metals/alloys, with or without the application of pressure and with or without the use of filler metal. The fusion of metal takes place by means of heat. The heat may be generated either from combustion of gases, electric arc, electric resistance or by chemical reaction.

Welding provides a permanent joint but it normally affects the metallurgy of the components. It is therefore usually accompanied by post weld heat treatment for most of the critical components. The welding is widely used as a fabrication and repairing process in industries. Some of the typical applications of welding include the fabrication of ships, pressure vessels, automobile bodies, off-shore platform, bridges, welded pipes, sealing of nuclear fuel and explosives, etc.



Most of the metals and alloys can be welded by one type of welding process or the other. However, some are easier to weld than others. To compare this ease in welding term 'weldability' is often used. The weldability may be defined as property of a metal which indicates the ease with which it can be welded with other similar or dissimilar metals.

Elements of welding process used with common welding joints such as base metal, fusion zone, weld face, root face, root opening toe and root are depicted in the below Figure.

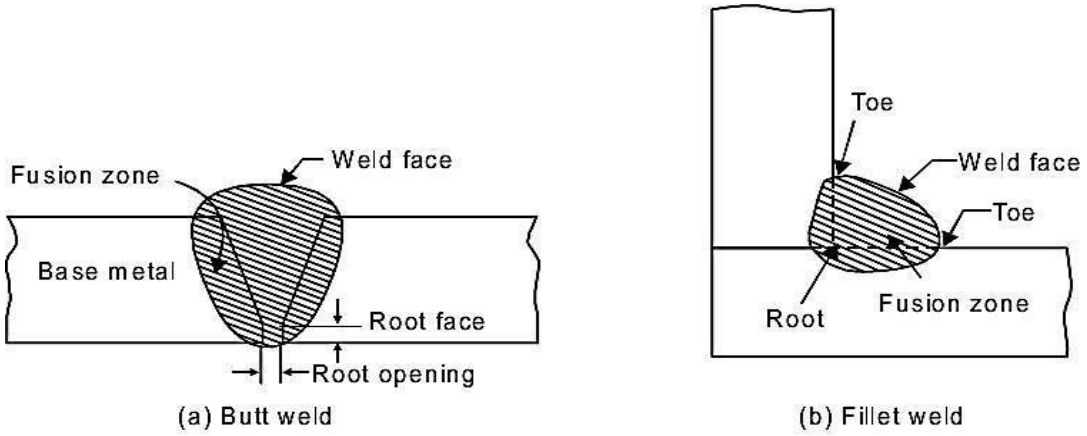


Fig. 17.1 Terminological elements of welding process

Edge preparations

For welding the edges of joining surfaces of metals are prepared first. Different edge preparations may be used for welding butt joints, which are given in Figure.

Welding joints

Some common welding joints are shown in Figure. Welding joints are of generally of two major kinds namely lap joint and butt joint. The main types are described as under.

1. Lap weld joint

Single-Lap Joint

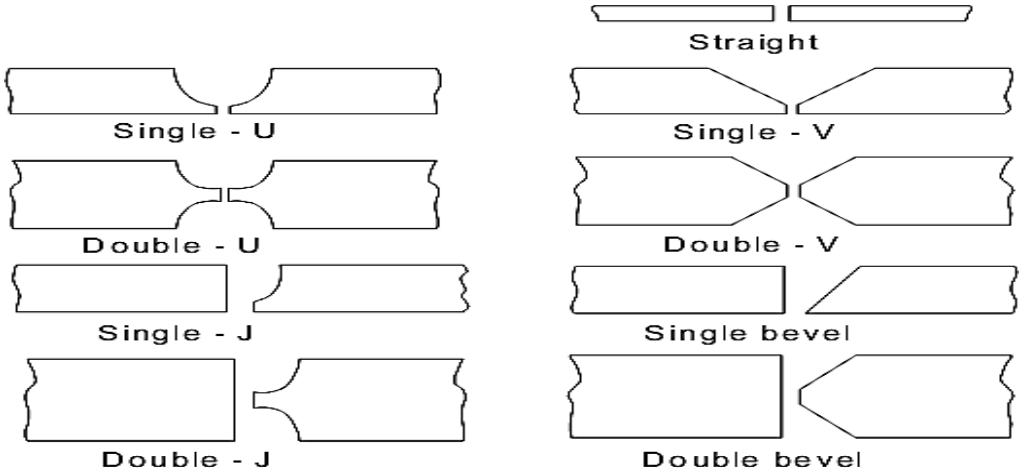
This joint, made by overlapping the edges of the plate, is not recommended for most work. The single lap has very little resistance to bending. It can be used satisfactorily for joining two cylinders that fit inside one another.

Double-Lap Joint

This is stronger than the single-lap joint but has the disadvantage that it requires twice as much welding.

Tee Fillet Weld

This type of joint, although widely used, should not be employed if an alternative design is possible.



2. Butt weld joint

a. Single-Vee Butt Weld

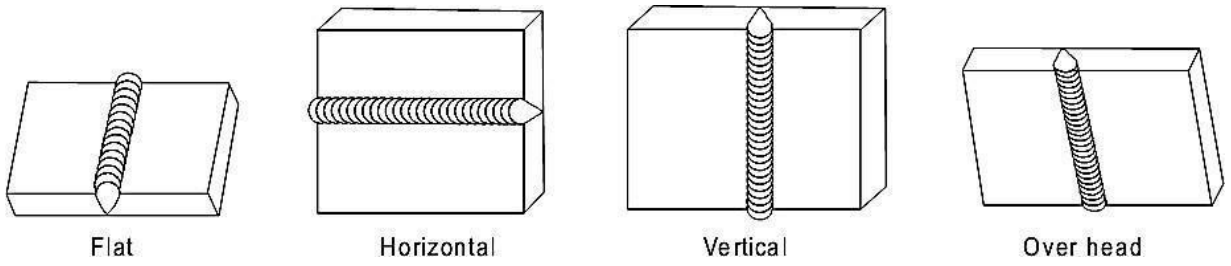
It is used for plates up to 15.8 mm thick. The angle of the vee depends upon the technique being used, the plates being spaced approximately 3.2 mm.

b. Double-Vee Butt Weld

It is used for plates over 13 mm thick when the welding can be performed on both sides of the plate. The top vee angle is either 60° or 80°, while the bottom angle is 80°, depending on the technique being used.

Welding Positions

As shown in Fig. 17.4, there are four types of welding positions, which are given as:
a. Flat or down hand position b. Horizontal position c. Vertical position d.Overhead position



Flat or Down-hand Welding Position

The flat position or down hand position is one in which the welding is performed from the upper side of the joint and the face of the weld is approximately horizontal.

Horizontal Welding Position

In horizontal position, the plane of the workpiece is vertical and the deposited weld head is horizontal. This position of welding is most commonly used in welding vessels and reservoirs.

Vertical Welding Position

In vertical position, the plane of the work-piece is vertical and the weld is deposited upon a vertical surface. It is difficult to produce satisfactory welds in this position due to the effect of the force of gravity on the molten metal.

Overhead Welding Position

The overhead position is probably even more difficult to weld than the vertical position. Here the pull of gravity against the molten metal is much greater.

ARC WELDING PROCESSES

The process, in which an electric arc between an electrode and a work-piece or between two electrodes is utilized to weld base metals, is called an arc welding process. The basic principle of arc welding is shown in Figure1. However the basic elements involved in arc welding process are shown in Figure2. Most of these processes use some shielding gas while others employ coatings or fluxes to prevent the weld pool from the surrounding atmosphere.

1) Switch box.
2) Secondary terminals
3) Welding machine.
4) Current reading scale.
5) Current regulating hand wheel.
6) Leather apron.
7) Asbestos hand gloves.
8) Protective glasses strap
11) Channel for cable protection.
12) Welding cable.
13) Chipping hammer.
14) Wire brush.
15) Earth clamp.
16) Welding table (metallic).
17) Job.

9) Electrode holder.
10) Hand shield

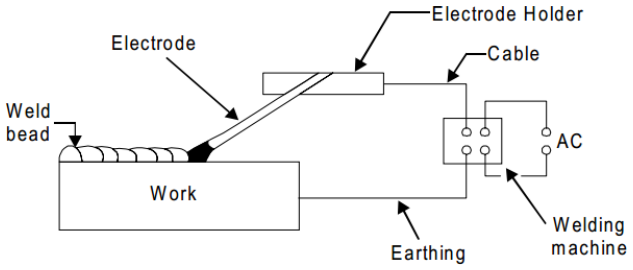


Fig1.The basic principle of arc welding

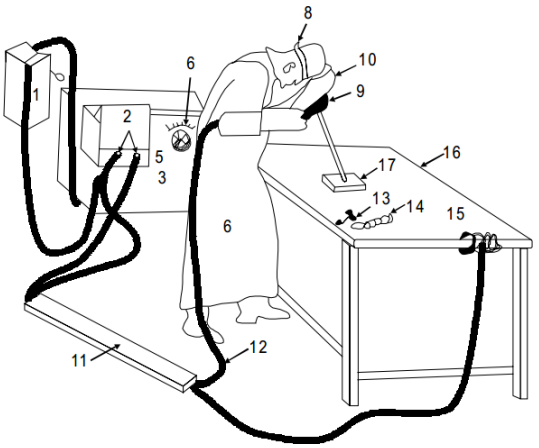


Fig2.The basic elements of arc welding

Arc Welding Equipment

Arc welding equipment, setup and related tools and accessories are shown in Figure. However some common tools of arc welding are shown separately through Figure. Few of the important components of arc welding setup are described as under.

1. Arc welding power source

Both direct current (DC) and alternating current (AC) are used for electric arc welding, each having its particular applications. DC welding supply is usually obtained from generators driven by electric motor or if no electricity is available by internal combustion engines. For AC welding supply, transformers are predominantly used for almost all Arc-welding where mains electricity supply is available. They have to step down the usual supply voltage (200-400 volts) to the normal open circuit welding voltage (50-90 volts). The following factors influence the selection of a power source:

a. Type of electrodes to be used and metals to be welded
b. Available power source (AC or DC)
c. Required output
d. Duty cycle
e. Efficiency
f. Initial costs and running costs
g. Available floor space
h. Versatility of equipment

2. Welding cables

Welding cables are required for conduction of current from the power source through the electrode holder, the arc, the work piece and back to the welding power source. These are insulated copper or aluminum cables.

3. Electrode holder

Electrode holder is used for holding the electrode manually and conducting current to it. These are usually matched to the size of the lead, which in turn matched to the amperage output of the arc welder. Electrode holders are available in sizes that range from 150 to 500 Amps.

4. Welding Electrodes

An electrode is a piece of wire or a rod of a metal or alloy, with or without coatings. An arc is set up between electrode and workpiece. Welding electrodes are classified into following types-

(i) Consumable Electrodes
(a) Bare Electrodes
(b) Coated Electrodes
(ii) Non-consumable Electrodes
(a) Carbon or Graphite electrodes
(b) Tungsten Electrodes

Consumable electrode is made of different metals and their alloys. The end of this electrode starts melting when arc is struck between the electrode and workpiece. Thus consumable electrode itself acts as a filler metal. Bare electrodes consist of a metal or alloy wire without any flux coating on them. Coated electrodes have flux coating which starts melting as soon as an electric arc is struck. This coating on melting performs many functions like prevention of joint from atmospheric contamination, arc stabilizers etc.

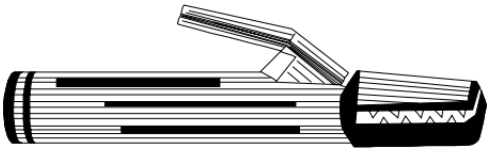
Non-consumable electrodes are made up of high melting point materials like carbon, pure tungsten or alloy tungsten etc. These electrodes do not melt away during welding. But practically, the electrode length goes on decreasing with the passage of time, because of oxidation and vaporization of the electrode material during welding. The materials of non-consumable electrodes are usually copper coated carbon or graphite, pure tungsten, thoriated or zirconiated tungsten.

5. Hand Screen
Hand screen used for protection of eyes and supervision of weld bead.

6. Chipping hammer
Chipping Hammer is used to remove the slag by striking.

7. Wire brush
Wire brush is used to clean the surface to be weld.

8. Protective clothing
Operator wears the protective clothing such as apron to keep away the exposure of direct heat to the body.



Electrode holder

Electrode (Welding Rod)

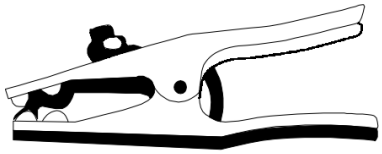


Fig. 17.11 Earth clamp

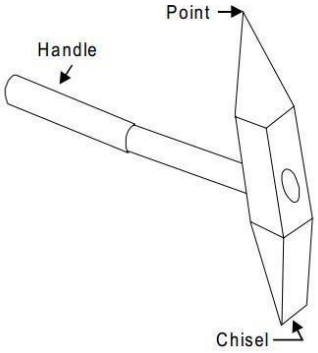


Fig. 17.13 Chipping and hammer

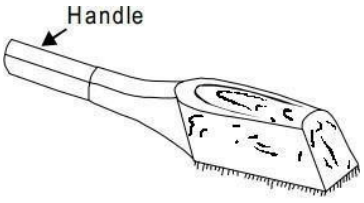


Fig. 17.14 Wire brush

Safety Recommendations for ARC Welding

The beginner in the field of arc welding must go through and become familiar with these general safety recommendations which are given as under.

1. The body or the frame of the welding machine shall be efficiently earthed. Pipe lines containing gases or inflammable liquids or conduits carrying electrical conductors shall not be used for a ground return circuit All earth connections shall be mechanically strong and electrically adequate for the required current.
2. Welding arc in addition to being very is a source of infra-red and ultra-violet light also; consequently the operator must use either helmet or a hand-shield fitted with a special filter glass to protect eyes.
3. Excess ultra-violet light can cause an effect similar to sunburn on the skin of the welder.
4. The welder's body and clothing are protected from radiation and burns caused by sparks and flying globules of molten metal with the help of the following:
5. Gloves protect the hands of a welder.
6. Leather or asbestos apron is very useful to protect welder's clothes and his trunk and thighs while seated he is doing welding.
7. For overhead welding, some form of protection for the head is required.
8. Leather skull cap or peaked cap will do the needful.
9. Leather jackets and 1ather leggings are also available as clothes for body protection.
10. Welding equipment shall be inspected periodically and maintained in safe working order at all times.
11. Arc welding machines should be of suitable quality.
12. All parts of welding set shall be suitably enclosed and protected to meet the usual service conditions.

FOUNDRY

Introduction:

Foundry is a process of shaping the metal components in their molten stage. It is the also called as metal casting the shape and size of the metal casting is obtained depends on the shape and size of the cavity produced in sand mould by using wooden/ metal pattern.

Practical application

1. Casting is the cheapest and most direct way of producing the shape of the component
2. Casting is best suited to work where components required is in low quantity.
3. Complicated shapes having internal openings and complex section variation can be produced quickly and cheaply by casting since liquid metal can flow into any form/ shape. Example: 1. Outer casing of all automobile engines.

   2. Electric motor housing

   3. Bench vice, Irrigation pump set.

4. Heavy equipment such as machine beds of lathe, milling machine, shaping, drilling plaining machine etc. can be cast/easily

5. Casting is best suited for composite

   components Example.1: steel screw threads in

   zinc die casting

   All conductors into slot in iron armature for electric motor.

Steps in foundry process

The Foundry process involves three steps.

(a) Making the required pattern
(b) Moulding process to produce the cavity in sand using pattern.
(c) Pouring the molten metal into the cavity to get casting.

Classification of foundries;

- Steel foundry
- C.I foundry
- Light alloy foundry
- Brass foundry
- Shell moulding foundry
- Die casting foundry (using permanent metal or dies for high volume of low and pressure die)

Pattern:

A pattern is normally a wooden/ metal model or thermosetting plastic which is facsimile of the cast product to be made, there are many types of pattern and are either one piece, two piece or three piece, split pattern, loose piece pattern, Gated and match plate pattern etc.

Pattern size: Actual casting size +shrinkage allowance +shake allowance +finish allowance

1. Shrinkage allowance: The liquid metal shrinks during solidification and it contraction to its room temperature, so that the pattern must be made larger then the casting to provide for total contraction.
2. Finishing allowance: The casting is to be machined at some points then the casting should be provided with excess metal for machining.

Types of foundry sand:

1. **Natural sand**: Sand containing the silica grains and clay bond as found. It varies in grain size and clay content. Collected from natural recourses.
2. **Synthetic sand**: It is an artificial sand obtained by mixing relatively clay free sand, binder (water and bentonite). It is better moulding sand as its properties can be easily controlled.
3. **Facing sand**: It is the fine grade sand used against the face of the pattern and finally governs the surface finish of the casting.

4. **Parting sand**: It is fine dry sand + brick dust used to preserve the joint face between the cope and the drag.
5. **Dry sand mould:** Dry sand mould refer to a mould which is artificially dried before the molten metal is poured into it. Dry sand moulds are costly, stronger, used for complicated castings, i.e. avoid casting defects, casting gets smoother surface.
6. **Green sand**: It is the most common moulding process

Moulding methods:

1. **Bench moulding:** In this method the moulding is carried out on convenient bench and moulds are relatively small.
2. **Floor moulding:** In this method the moulding is carried out in medium and large moulds are carried out on the floor.
3. **Plate moulding:** For large quantity production and for very heavy casting two plates may be used with pattern.
4. **Pit moulding:** In this method the moulding is carried out in the pits and generally very large moulds are made.
5. **Machine moulding:** A machine is used to prepare moulds of small and medium. This method is faster and gives uniform moulding.

CORE AND CORE MAKING

CORES: Cores are sand blocks they are used to make hollow portion in a casting. It is placed in a mould so that when molten metal is poured into the mould. This apart of mould will remain vacant
i.e. the molten metal will not fill this part of the mould. So, when the mould is broken and the castings removed a hollow portion will result in the casting.

Core sand= Moulding sand+ binders (ABC core oil) or sodium silicate

Core making: Cores are made separately in a core box made of wood or metal.

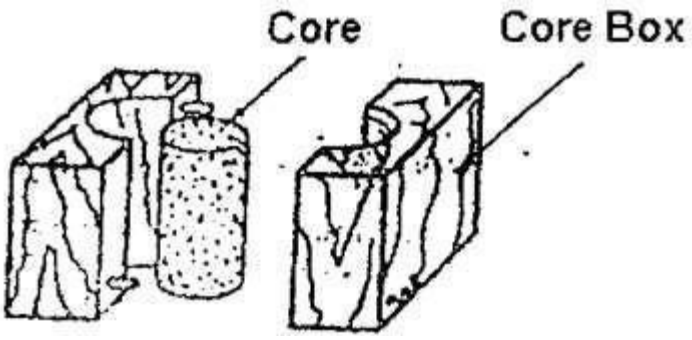


Fig. Core making

Core binders

1. Water soluble binders (2 to 4% by weight)

2. Oil binders (1-3% by weight)

3. Pitch and resin binders (1-35 by weight)

The sand is treated with binder to achieve cohesion

Core Baking

The core is baked (hardened) by heating at 150C depends on core size in oven.

This hardening of the core helps to handle and to place the core in the mould.

The core is supported in the mould by projection known as core prints.

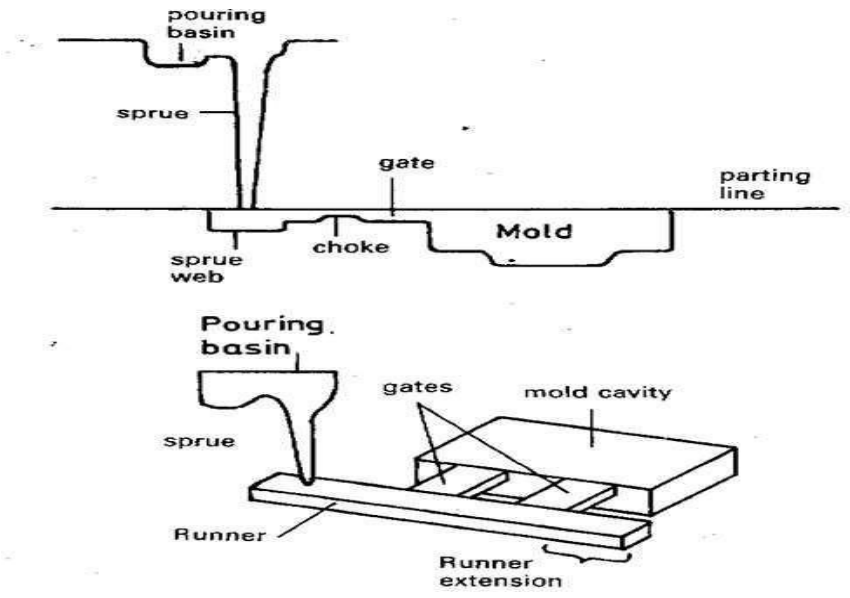
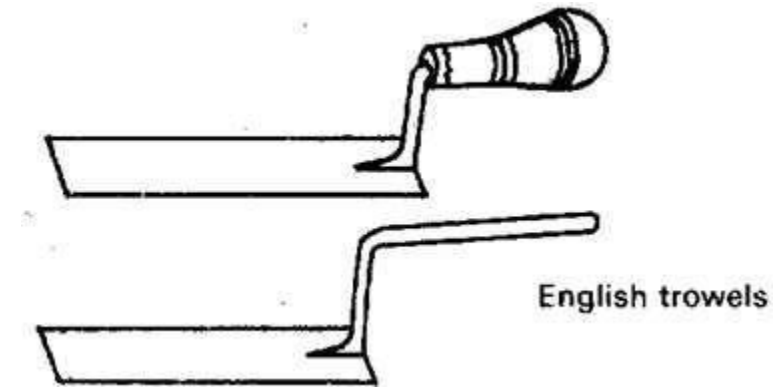
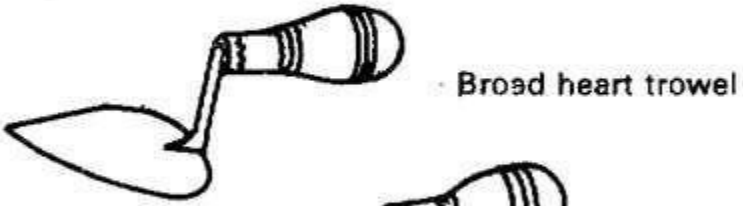
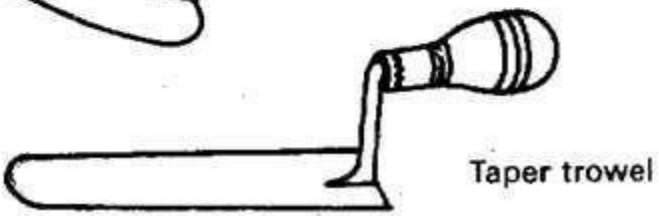


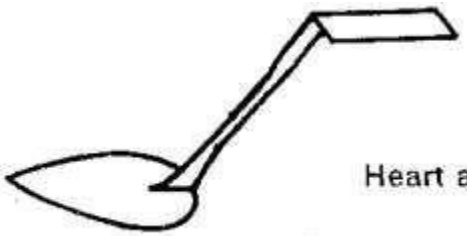
Fig. Nomenclature of a Mould

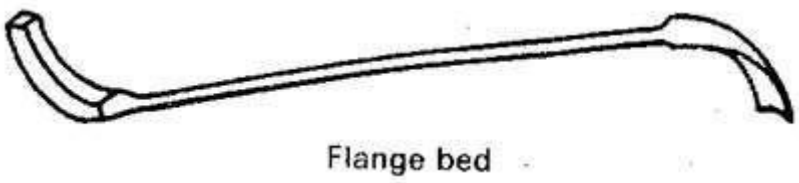
MOULDING TOOLS & EQUIPMENTS











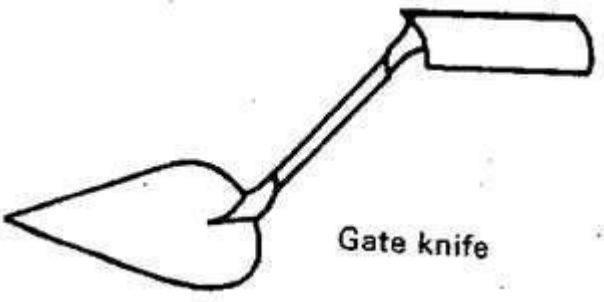
Boss tool

scoth cleaner

girdar tool

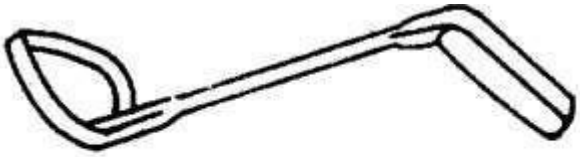
English cleaner

fluted bead

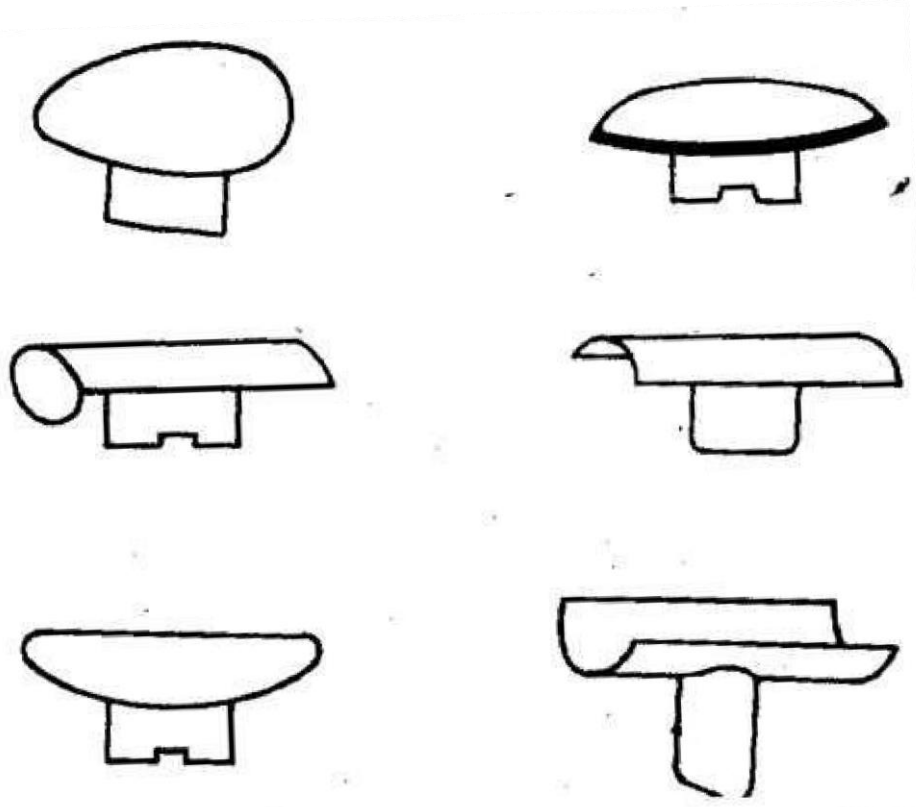


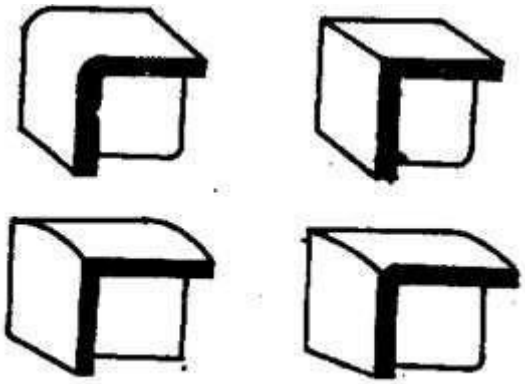
Gate knife

. Spoon tool



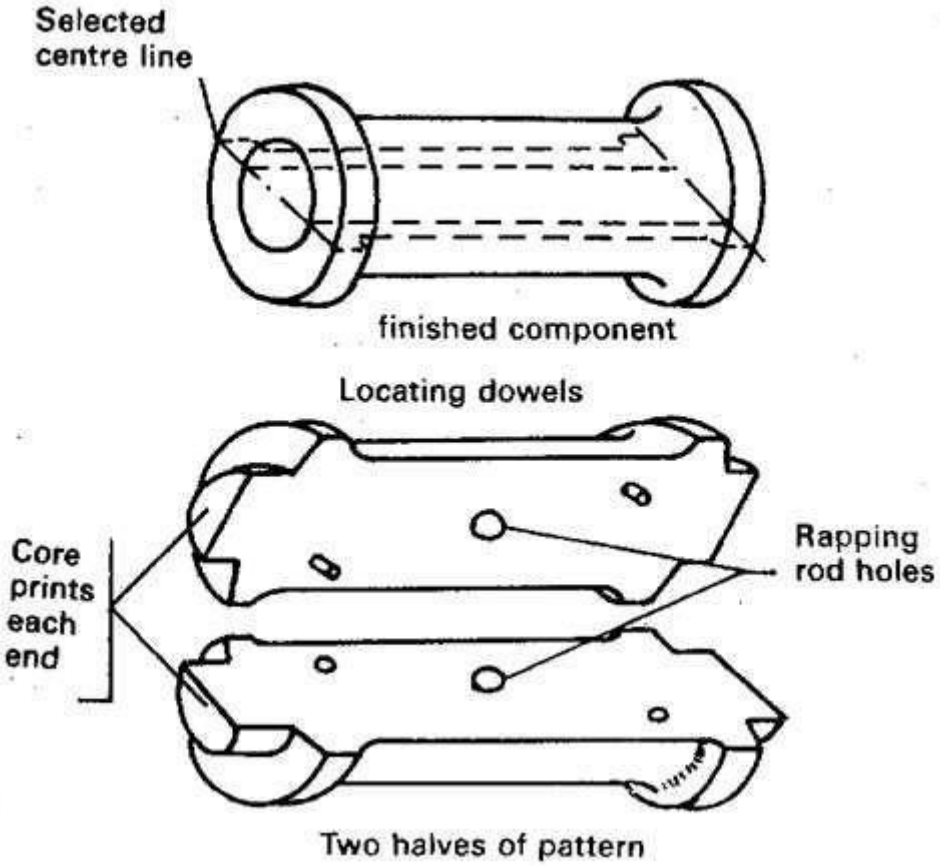
Safe edge heart and upset

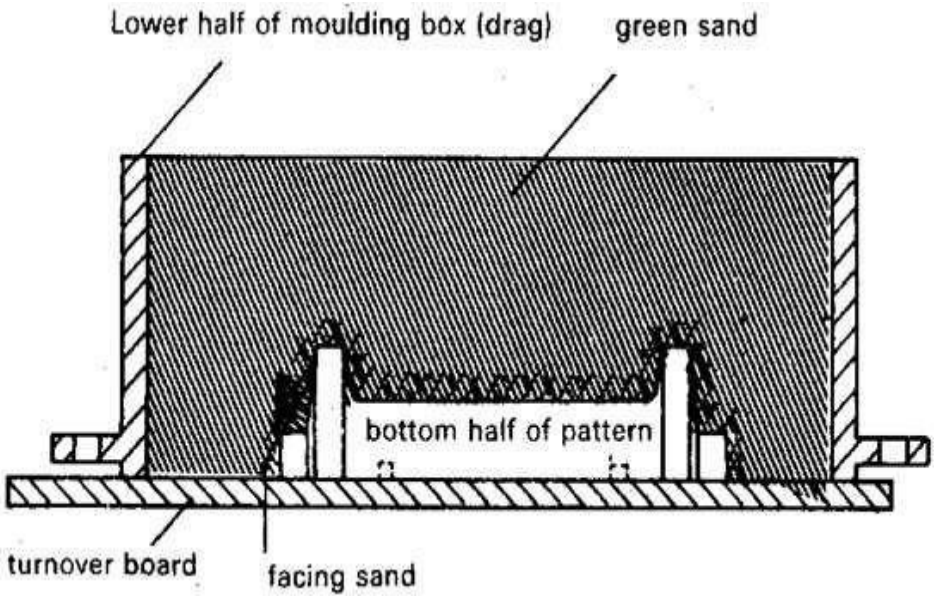


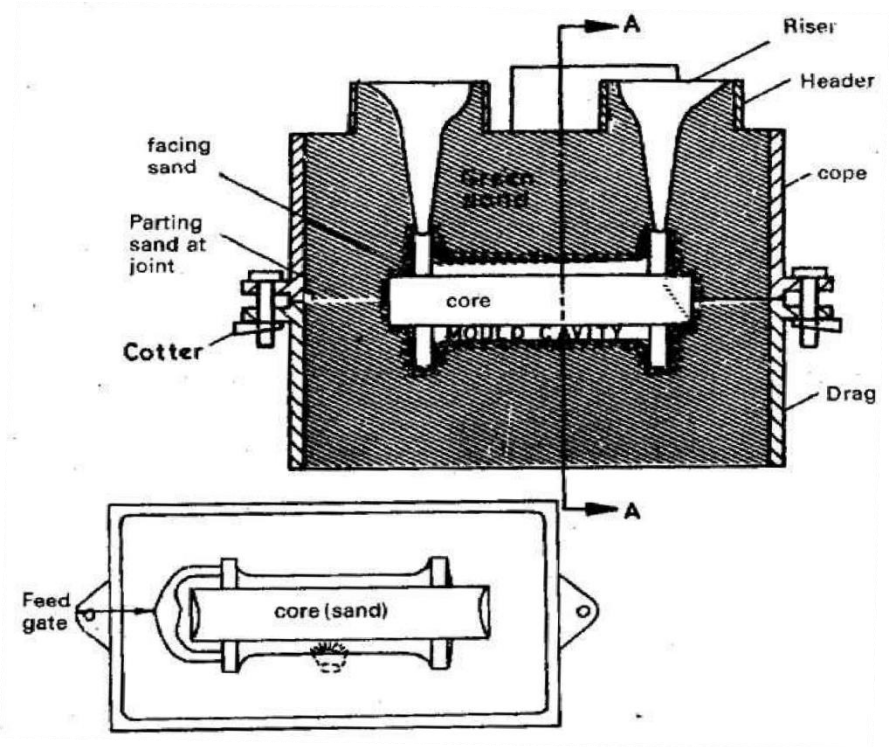


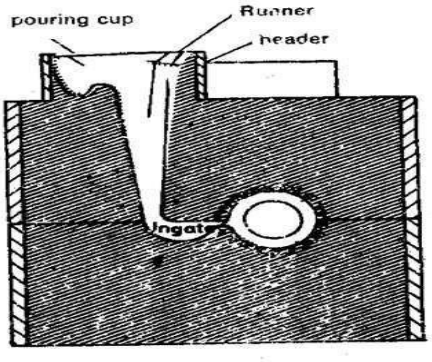
Smoothers

Bellows

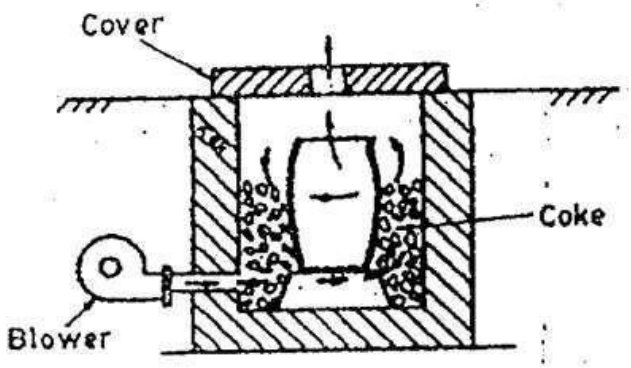



Lower half of moulding box (drag)
green sand
bottom half of pattern
turnover board
facing sand

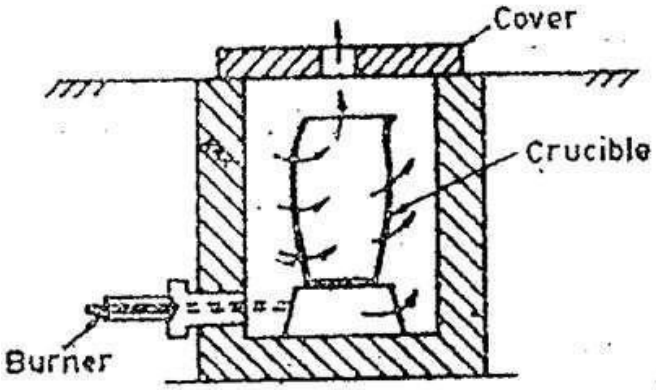

A
Riser
Header
facing sand
cope
Green sand
Parting sand at joint
core
MOULD CAVITY
Cotter
Drag
A
Feed gate
core (sand)


pouring cup
Runner
header
Ingate

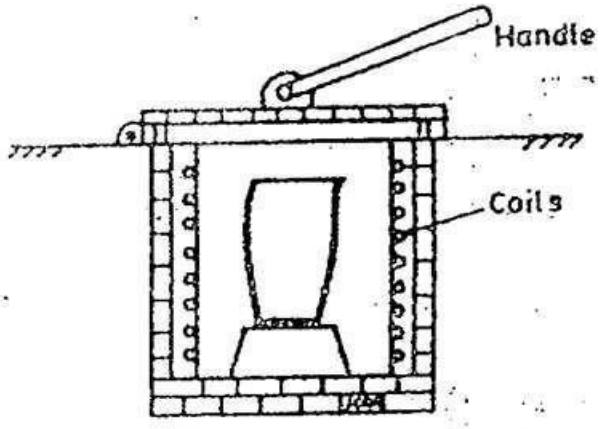
SECTION A - A



(a) Coke fired



(b) Oil/Gas fired



(c) Resistance type

Pin Type Furnaces

Trowels: These are used for working up into a square corner.

Taper trowel: It is more useful for working along the curved edges of a pattern. trowels are measured by the length and width of the blade.

Slicks: Used for repairing and slicking small surfaces. They are named according to the shape of the blade and measured at the widest part of the blade.

Lifters and Cleaners: They are used to clean & finish the bottom and sides of deep narrow openings.

Gate Knife: is for cutting the channel from the mould to the bottom of the runner or riser.

Spoon tool: is convenient for cutting the pouring basin.

Corner Slicks: are, as the shape implies, for finishing off fillets and corners of moulds.

Draw Spike: is a spike for knocking into the wooden pattern in order to withdraw it.

Draw Screw: is for the same purpose as the draw spike; the end is threaded to screw into the rapping plate.

Swap: is a soft – pointed brush for moistening the edges of the mould before lifting the pattern. The angle at which it is held will decide the area to be covered. Care must be taken not to get the sand too damp.

Bellows: are used for blowing out loose sand from the completed mould; they must be used gently; too vigorous use will damage the mould.

Working steps in making the sand casting:

1. Place the pattern on the turn overboard.
2. Place the drag around the pattern with upside and sprinkle the parting sand at thebottom.
3. Fill the Moulding sand over the pattern pack, Ram, Jolt &squeeze.
4. Level the bottom drag surface by leveler& turn over thedrag.
5. Sprinkle the parting sand, place the cope on the drag to suit the dragslot.
6. Select the in and out gate in the drag, Place the spruepins.
7. Fill the moulding sand around the sprue pins pack, Ram, Jolt and Squeeze & level the surface.
8. Make vent holes on both the boxes with the help of vent wire.
9. Remove the sprue pin & Separate cope from drag.

10. Remove the pattern carefully with the help of draw pin, Cut gate ways to flow the molten metal.
11. From the funnel shape on runner & riser, Hole to pour the molten metal on the top of the cope box.
12. Join the two boxes with clamps, Now the mould is ready to pour the molten metal.