

FITTING

INTRODUCTION: Machine tools are capable of producing work at a faster rate, but there are occasions when components are processed at the bench. The term bench work refers to the production of components by hand on the bench, whereas fitting deals with the assembly of mating parts, through removal of metal to obtain the required fit. Both the bench work and fitting operations consist of filing, chipping, sawing, drilling, tapping etc.

CLASSIFICATION OF TOOLS: The tools commonly used in fitting may be classified as

Work holding tools

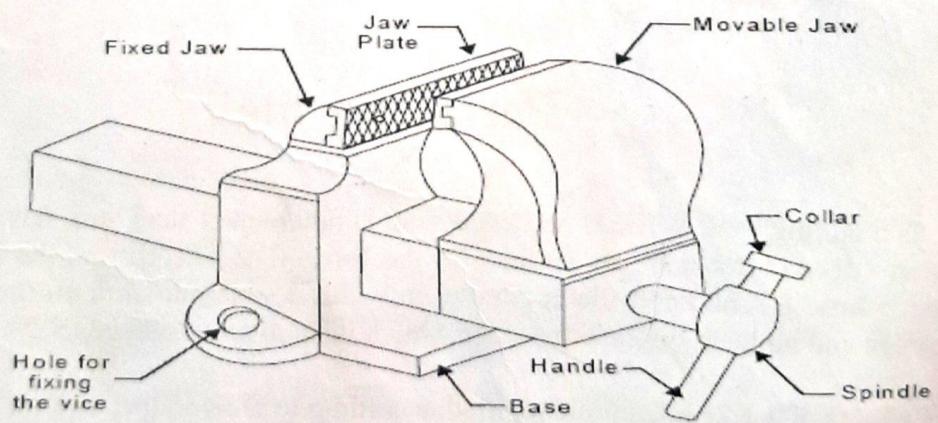
Cutting tools

Striking tools

Marking and checking tools

WORK HOLDING TOOLS:

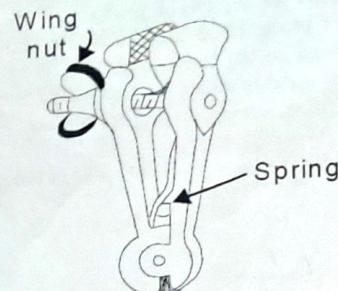
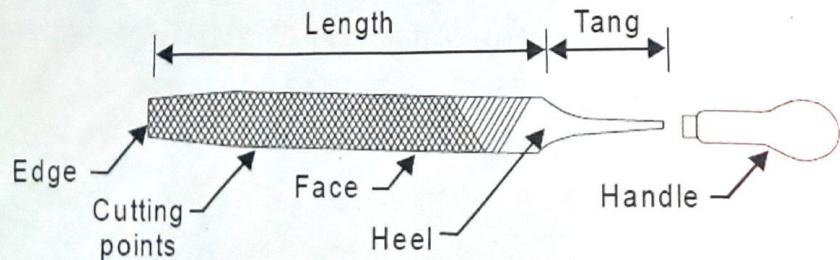
Bench vice b) Hand vice c) Pipe vice d) Pin vice e) Tool makers vice f) Leg-vice g) C-clamp



BENCH VICE:

A bench vice

The bench vice is a work-holding device. It has two jaws, one of which is fixed to the bench and the other slides with the aid of a square screw and a box nut arrangement. The outer end of the screw carries a handle. The jaws are made of hardened steel and the body is cast iron or cast steel. The working faces of the jaws are serrated to give additional grip for holding.

HAND WISE:**Hand vice****FILE:****Parts of a file**

File is a cutting tool. A file is hardened steel is a hardened steel tool, having slant parallel rows of cutting edges or teeth on its surface on the faces. The one end of the file is shaped to fit into wooden handle. The hand file is parallel in width double cut teeth on the faces, single cut on the 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 grades of teeth.

Hand file -----It is used for filing a surface, at a right angle to an already finished surface.

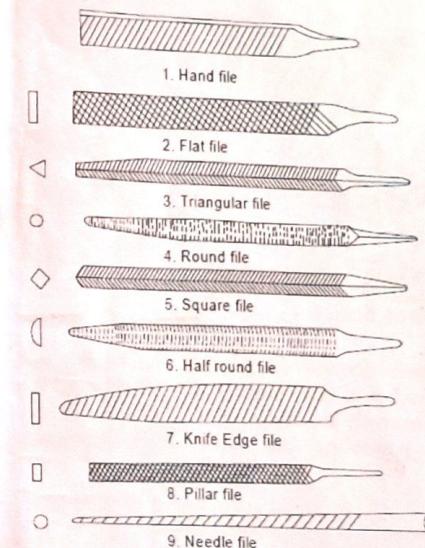
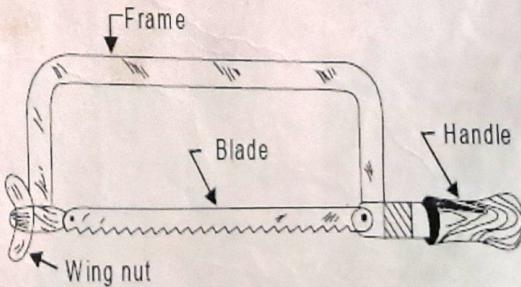
Flat file -----Used for general filing

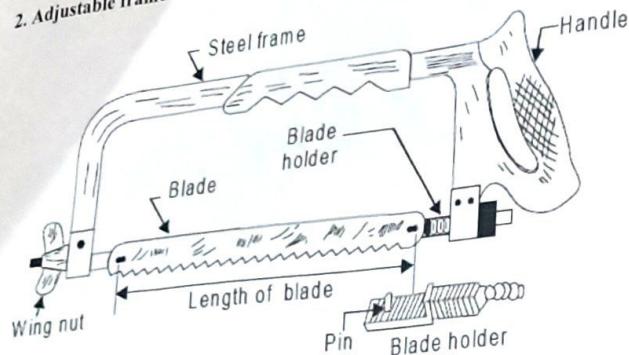
Square file -----Used for slots and key ways.

Triangular file ----- Used for sharp corners

Half round file ----- Used for filing concave surfaces and internal corners.

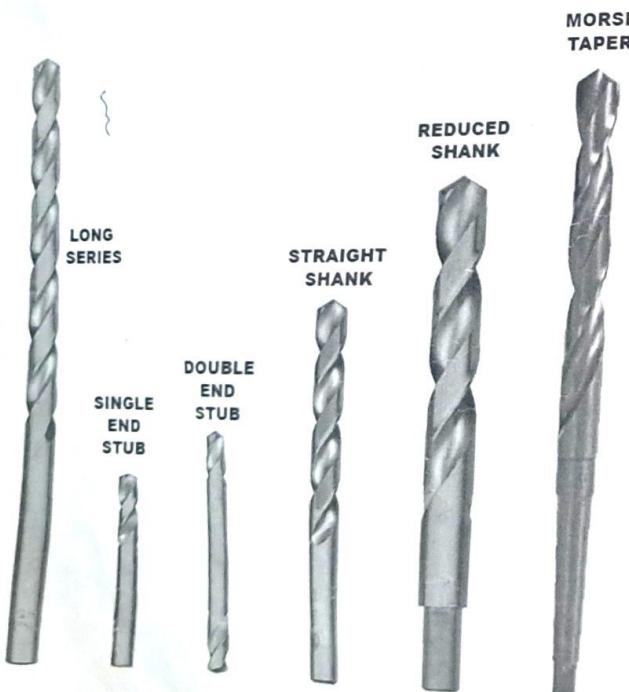
Round file ----- Used for deep hole filing

**CUTTING TOOLS:****HACK SAW:****1. Solid frame**

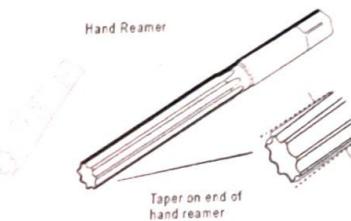
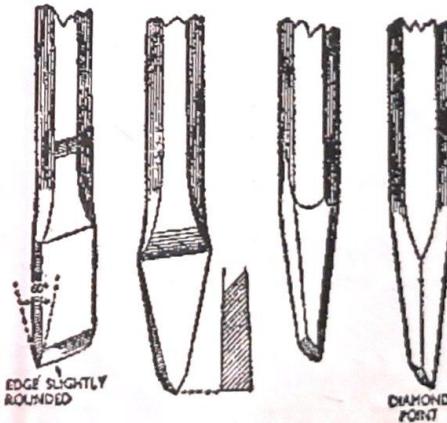
2. Adjustable frame

The hack saw is used for cutting metal by hand. It consists of a frame. This holds a blade, firmly in position. Hack saw blades have a number of teeth ranging 5 to 15 per cm. A reamer is used to finishing a drilled hole to accurate size and to produce a good surface finishing. The teeth of Hack saw blade are staggered or bended alternatively known as a set of teeth. It is made of HSS. They are two types of reamers.

DRILLS:



Drills are cutting tools used for making holes. These are usually made of high speed steel tools. Drills are two cutting edges and two helical grooves. The flute (grooves) admits coolants and allows the chips in. The shank of twist drill may either straight or taper.

REAMER:**1. Hand Reamer****2. Machine reamers****CHISELS:**

Chisel are used for removing extra material from the surface and cutting the sheets . these tools are made up of from 0.9% to 1.0% carbon steel of octagonal or hexagonal. The cutting angle for the chisel for general purpose is about 60 degree. The recommended angles for cutting different materials at cold state. Alluminium-35 degrees, Mild steel-55 degrees, Copper and brass-40-50 degrees, Cast iron 60 degrees cast steel 70 degrees.

The chisels are specified by width of the cutting edge. The most common used chisels are.

- 1) Flat chisel
- 2) Half round Chisel
- 3) Side chisel
- 4) Diamond point chisel
- 5) Cross cut chisel

SCRAPPERS:

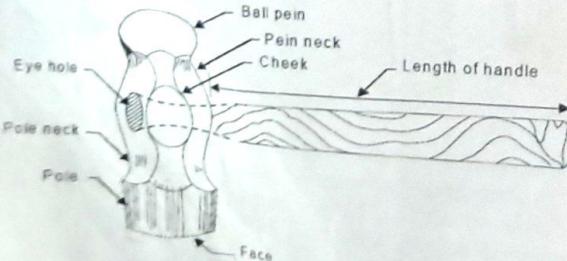
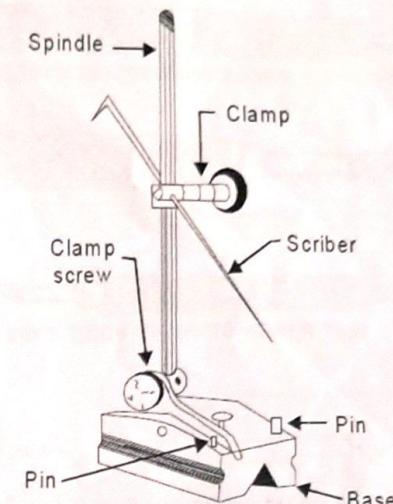
Scrapers are used for producing finished surface. It removes the surface irregularities at selected spots on a surface hardened.

The scrapers are made of tool steel. The cutting edge is usually not tempered. The most commonly used scrapers are.

1. Flat scraper
2. Triangular scraper
3. Half round scraper.

STRIKING TOOLS:

Hand hammers are striking tools. They are made of medium carbon steel. The various types of hand hammers in common use are ball peen hammer, cross peen hammer, and straight peen hammer.

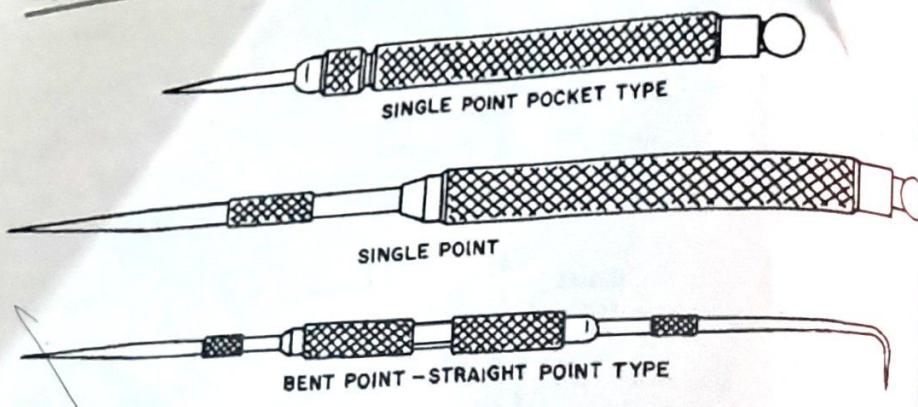
**MARKING TOOLS:**

A universal surface gauge

Marking is a process of layout of sizes on work piece. The following tools are used in marking out operations.

1. Scriber
2. Dividers
3. Jenny calipers
4. Scribing book
5. Angle plate
6. V-block
7. Punch
8. Try square
9. Surface plate.

SCRIBERS: A scribe is slender tool used to scribe or marking lines on metal work piece.

**TAP AND TAP WRENCHES:**

A Tap is hardened steel tool. Used for cutting internal threads in a drilled hole. Hand taps are available in sets containing three taps. Taper tap, second tap and plug or bottom tap.



Taper tap



Plug tap



Bottoming tap

Types of hand taps

PUNCH: Punch is made of tool steel. The various types of punches prick punch, center punch, number punch and letter punch.

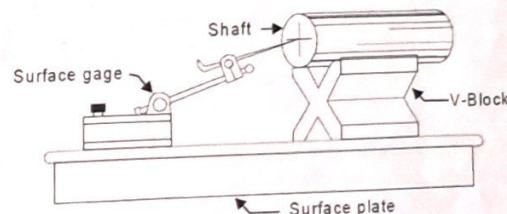
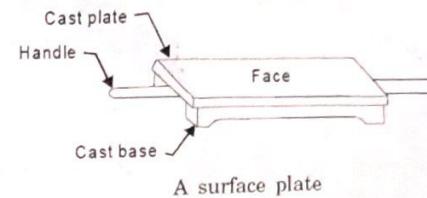
PRICK PUNCH: It is also called as dot punch. Used for marking small dots along the layout lines.

CENTER PUNCH: This is similar to dot punch, except that its point is ground to an angle 90° . It is used for marking the location of holes to be drilled.

V-BLOCK: V-blocks are made of cast iron or hardened steel. They are provided with grooves on the top and bottom, and rectangular slots on two sides for location of clamps.

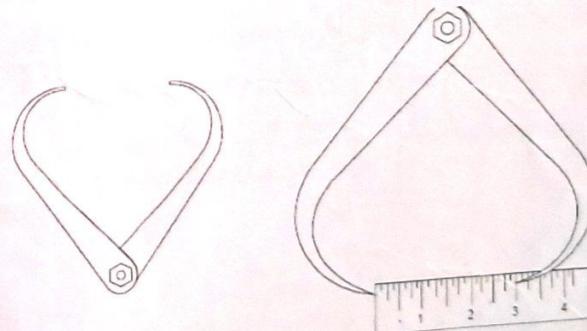
TRY SQUARE: It is used for checking the squareness of small works. The size of try square is specified by the length of the blade.

SURFACE PLATE: It is used for providing true surface support to the work during marking. It is made of cast iron, hardened steel or granite. It is specified by length x width x height x grade.

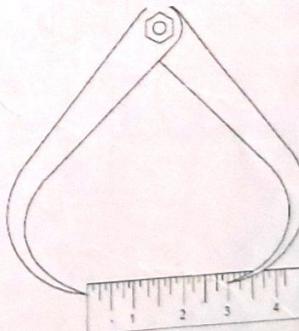
**DIVIDER:**

This is used for making circles, arcs, laying out perpendicular lines, bisecting lines etc

CLENNY CALIPER: This is also called as odd leg or hermaphrodite caliper used for marking parallel lines from a finished edge and also for locating the center of round bars.



A simple outside caliper

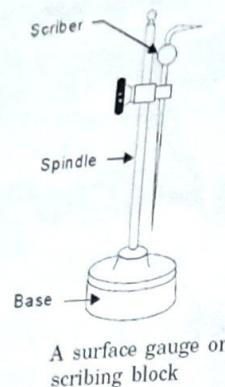


A caliper held in rule



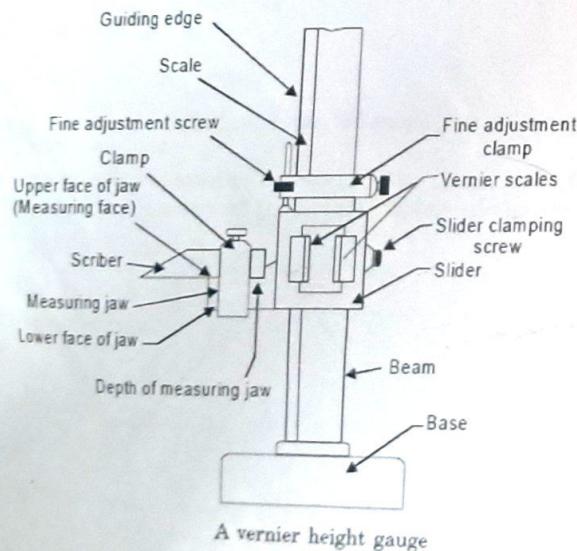
A standard spring joint outside caliper

SCRIBING BLOCK: It is also known as universal scribbing block. This is used for scribing lines for layout work and checking parallel surfaces.

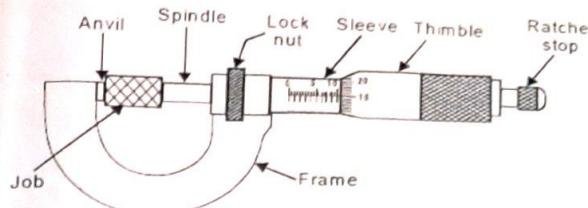


ANGLE PLANE: The angle plate is made of cast iron or hardened steel. They are provided with V-grooves on the top and bottom, and rectangle slots on two sides for location of clamps.

VERNIER HEIGHT GUAGE: It is clamped with scriber it is used when it is required to take measurements from the surface on which the guage is standing. The accuracy and working principles of this guage are the same as those of the vernier caliper



OUTSIDE MICROMETER: It is used for measuring external dimensions accurately of 0.01mm



INSIDE MICROMETER: This is used to measure inside dimensions accuracy of 0.01 mm. It consists of measuring unit, a number of interchangeable extension rods, and a handle.

MEASURING AND CHECKING INSTRUMENT: Measuring tools may be classified:

1	LINEAR	MEASURING	INSTRUMENTS
(a) Steel rule (b) caliper (c) depth gauge (e) Micro meter (f) gauge block (g) dial indicator or dial gauge			(d) vernier caliper

2 ANGULAR MEASURING INSTRUMENTS

- (a) Bevel protractor (b) Combination set (c) Sine bar

3 SURFACE MEASURING INSTRUMENTS

- (a) Spirit level (b) straight edge

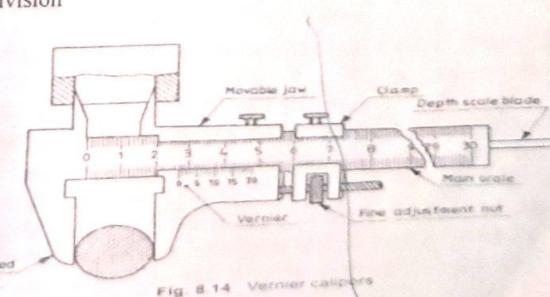
STEEL RULE: It is a strip of steel with graduation on its edges

CALIPERS: Used for transferring the dimensions both external and internal. They are made either with firm joint or spring caliper.

OUTSIDE CALIPER: Used for measuring outside dimensions of cylindrical shapes.

INSIDE CALIPER: Used for measure the diameter of holes and width of key ways. ✗

VERNIER CALIPER: They are used for measuring outside as well as inside dimensions accurately. It may be also used as depth guage. Least count = one main scale division – one vernier scale division



COMBINATION SET: It consists of a rule, square head, center head, and a protractor. This may be used for making mitres(45°) for locating the centre on the end of the round bar.

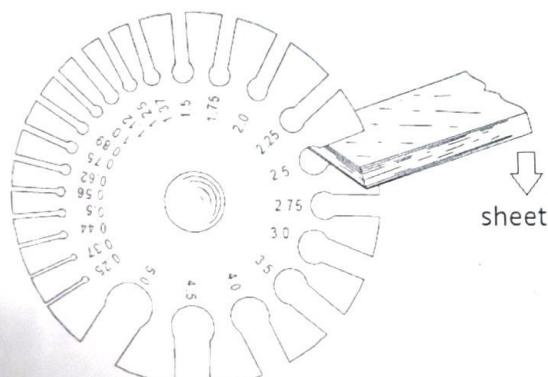
GUAGES:

Gauges are inspection tools used in production work to control the size and shape of the components.

PEELER GUAGES: These are thin steel blades hardened and ground to various sizes. These are used to check the clearance between the two mating parts. The blade thickness varies from 0.03 to 1.0mm and the length of the blade is about 100mm.

SCREW PITCH GUAGE: It is used to check the pitch of the screw. The pitch of the screw is directly on the gauge.

WIRE GUAGE: The wire gauge is used to check the diameter of wire from 0.1mm to 10mm



A wire gauge

PLATE GUAGE: Plate gauge (standard wire gauge) is used to measure thickness. Each slot is represented by number (SWG NUMBER), as the number increases the thickness decreases. The most common gauge used in sheet metal has 21 slots with gauge numbers ranging from 4 to 24.

RADIUS AND FILLET GUAGE: These are used to check the radii of curvature of convex and concave surfaces.

MICELLANEOUS TOOLS FILE CARD: It is a metal brush, used for cleaning the files, to free them from filings, clogged in between the teeth.

SCREW DRIVER: It is used for tightening and loosening the screws. It is made of steel and its tip is hardened. It is in variety of shapes and sizes.

SPANNERS: Spanners (or) wrenches are used for tightening and loosening the nuts and bolts. They are made of forged steel. The size of spanner denotes the size of the bolt on which it can work.

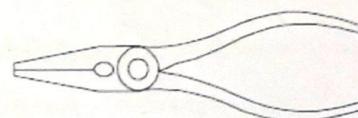
TYPES OF SPANNERS:

- Single end spanner
- Double-end spanner
- Ring spanner
- Box-end spanner
- Adjustable spanner

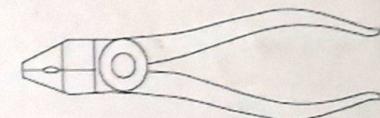
ALLEN KEY: Allen key (or) wrench is used for hollow sunk head bolts and screws

PLIERS:

- CUTTING PLIERS:** used for holding the work cutting thin soft wires.
- NOTE PLIERS:** used for holding the bending thin wires



(a) Long nose pliers.



(b) Combination pliers.

SAFETY PRECAUTIONS:

- Never wear loose clothes, wear the prescribed dresses while in workshop.
- Never enter the shop without shoes.
- Don't run or play on the shop floor.
- Keep the floor clear of metals chips, curls and waste pieces.
- Concentrate on the work and don't talk unnecessarily while operating machine.
- Do not operate any machine without getting conversant with its mechanism.
- Do not wear rings, watches etc. That could be caught in moving machinery.
- Do not attempt to oil, clean (or) adjust (or) repair any machine, when it is running.
- When you switch off the machine, do not leave before it has completely stopped running.
- Keep your body behind the cutting edge of an edged cutting tool.
- Never use a hammer with a loose head.
- Wear the goggles whenever there is a danger of flying matter/threat of exposure of harmful light rays.
- Do not clean chips without hands.
- Do not try to stop the machine with your hands (or) body.
- Keep all the hand tools in working condition.
- Slippery floors, poor ventilation, poor lighting, and inadequate space are the potential causes of accidents.
- Install fire extinguishers at places prone to fire accidents.
- Ensure availability of first aid box with contents in workshop.

EXPERIMENT NO. F1:

AIM: To do marking and chipping of mild steel flat of 5 mm thickness.

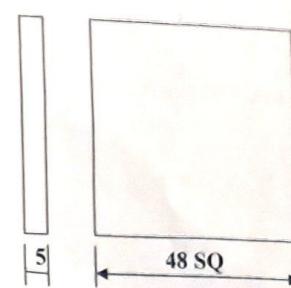
MATERIAL REQUIRED: MS FLAT of 50 mm X 50 mm X 5 mm.

TOOLS REQUIRED:

- 1) 150 mm Try square
- 2) 250 gm Ball peen hammers
- 3) Dot punch
- 4) Centre punch
- 5) Scriber
- 6) 15cm Steel rule
- 7) Odd leg Caliper
- 8) Vernier height Gauge
- 9) Chisel
- 12) 250mm Rough and Smooth square files
- 13) 6mm rough and Shank square files
- 14) 3mm Straight Shank Drill Bit.
- 15) Half round file
- 16) Divider.

PROCEDURE:

1. The given material is checked for (50X50X5) mm dimensions.
2. One edge of the given MS Flat is filed to straightness with rough and smooth files and check with try square for flatness.
3. An Adjacent edge is also filed such that it is a square to the first one and checked with try square. Wet chalk is applied on one side of the flat and dried for marking.
4. Marking is done in accordance with the dimensions using vernier height gauge
5. Using dot punch, dots are made along the marking lines.
6. The excess material is cut with hacksaw and then filed to correct size. Care taken to see that the marking dots are not crossed.
7. Finish the mating surfaces with rough file followed by smooth file.
8. Prepare the counterpart in similar way.
9. File the other surfaces also and remove burns and rust.

EXPERIMENT DIAGRAM:**NOTE:-**

1. All dimensions are in mm.

PRECAUTIONS:

Never remove chips with hand, use always a brush to remove chips.

Working tools should not be kept at the edge of the table.

While sawing, secure the work rigidly.

RESULTS:

✓

EXPERIMENT NO. F2:

AIM: To prepare a L-fit.

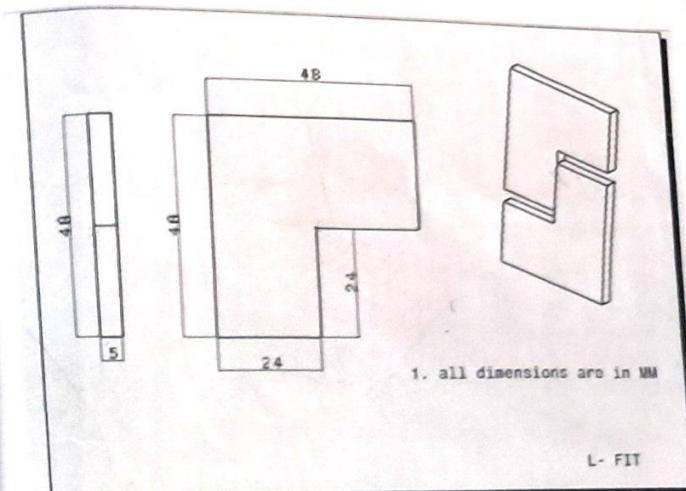
MATERIAL REQUIRED: MS FLAT of 50 mm X 50 mm X 5 mm.

TOOLS REQUIRED:

- 1) 150 mm Try square
- 2) 250 gm Ball peen hammers
- 3) Dot punch
- 4) Centre punch
- 5) scribe
- 6) 15cm Steel rule
- 7) Odd leg Caliper
- 8) Vernier height Gauge
- 9) Chisel
- 12) 250mm Rough and Smooth square files
- 13) 6mm rough and Shank square files
- 14) 3mm Straight Shank Drill Bit.
- 15) Half round file
- 16) Divider.

PROCEDURE:

10. The given material is checked for (40X40X5) dimensions.
11. One edge of the given MS Flat is filed to straightness with rough and smooth files and check with try square for flatness.
12. An Adjacent edge is also filed such that it is a square to the first one and checked with try square. Wet chalk is applied on one side of the flat and dried for marking.
13. Marking is done in accordance with the dimensions using vernier height gauge.
14. Using dot punch, dots are made along the marking lines.
15. The excess material is cut with hacksaw and then filed to correct size. Care taken to see that the marking dots are not crossed.
16. Finish the mating surfaces with rough file followed by smooth file.
17. Prepare the counterpart in similar way.
18. File the other surfaces also and remove burns and rust.

EXPERIMENT DIAGRAM:**PRECAUTIONS:**

Never remove chips with hand, use always a brush to remove chips.
Working tools should not be kept at the edge of the table.
While sawing, secure the work rigidly.

RESULTS: