WORKSHOP

DEPARTMENT OF MECHANICAL ENGINEERING

LAB MANUAL

OF

FITTING SHOP

INDIAN INSTITUTE OF TECHNOLOGY (INDIAN SCHOOL OF MINES), DHANBAD

Department of Mechanical Engineering

OBJECTIVES

The objectives of the Fitting Shop are:-

- ✓ To study the different tools and work holding devices used in the fitting shop.
- ✓ To study the different manufacturing operations used in the fitting shop.

OUTCOMES

The expected outcomes of the Fitting Shop are that the students will be able to:

- ✓ Relate the concepts, discussed in Manufacturing Process Course, practically.
- ✓ Learn the methods for measuring and marking.
- ✓ Apply these learning to make the parts/job more accurate and precise.

TUTORIAL ASSIGNMENTS

- ✓ To prepare a **Square Mild Steel Paper Weight** of dimension of 48mm*48mm*5mm.

1. INTRODUCTION:

Manufacturing processes are the steps through which raw materials are transformed into a final product. It can be broadly classified into four categories: (i) Casting (ii) Forming (iii) Fabrication (iv) Material removal processes.

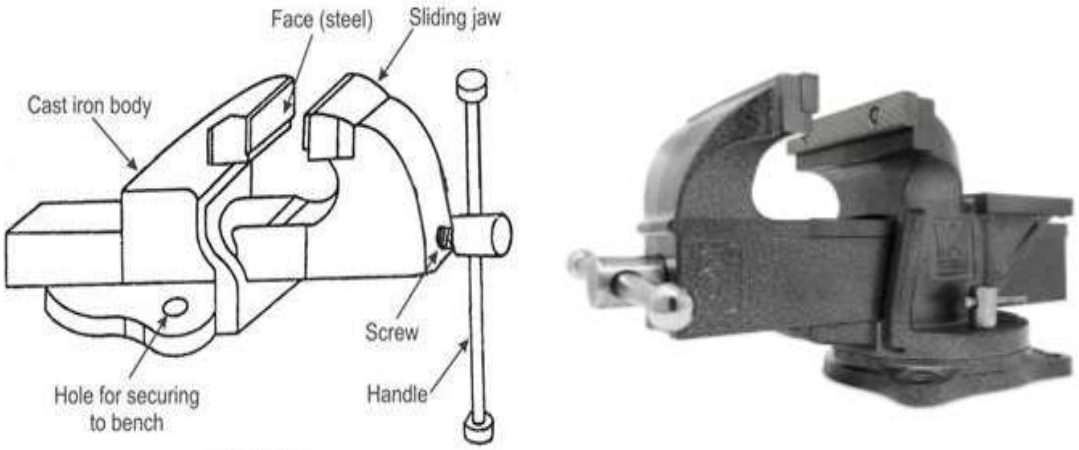
In engineering bench work and fitting have important role in finishing a job to the desired tolerance. Working on components with hand tools and instruments, mostly on work benches is generally referred to as ‘Fitting work’. 'Fitting' is the assembling together of the parts and removing metals to secure the necessary fit. 'Fit' means a tolerance relationship that exists between two matching or matched parts or component. The operations commonly employed in bench and fitting work may be classified as:

1) Filing	2) Marking	3) Sawing	4) Grinding
5) Drilling	6) Reaming	7) Tapping	8) Dieing

2. WORK HOLDING DEVICE:

a) Vice:

Vice is the most common device for holding the work. Various types of vice are used for various purposes. They include Bench vice, Leg vice, Pipe vice, hand vice, etc. Bench vice is a device commonly used for holding the work pieces. The body of the vice is made of cast-iron.



Bench vice: Schematic and real view

3. MARKING INSTRUMENTS:

a) Marking table:

A marking table is a heavily build cast iron table used for layout work on all sizes of jobs. This table provides a flat surface to mark lines with the help of height gauge, angle plate, V-block or surface gauge as per job requirements.

Marking table

Surface plate

b) Surface plate:

The surface plate is used for testing the flatness of the work piece and other inspection purposes. It is also used for marking on small works. It is more precise in flatness than the marking table. Surface plates are made of cast iron or hardened steel.

c) Try-square:

Try-square is used for checking the squareness of small works, when extreme accuracy as not required. The size of the try-square is specified by the length of the blade.

d) Odd-leg caliper or Jenny caliper or Hermaphrodite:

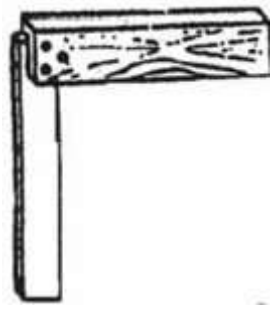
This is also called ‘jenny caliper’ or ‘hermaphrodite’. This is used for marking parallel lines from a finished edge and also for locating the centre of round bars. They are specified by the height of the leg up to the hinge point.

e) Divider:

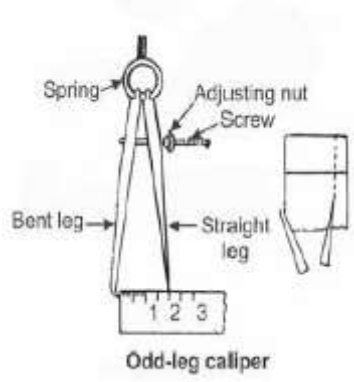
This is used for marking circles, arcs, laying out perpendicular lines, bisecting lines, etc.

f) Dot Punch and Centre punch:

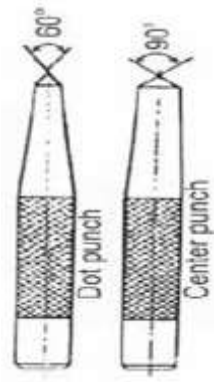
Dot punch is used to locate centre of holes and to provide a small centre mark for divider point etc. For this purpose, the punch is ground to a conical point having 60º included angle. This is similar to the dot punch, except that it is ground to a conical point having 90° included angle. It is used to mark the location of the centre where holes are to be drilled.



Try Square



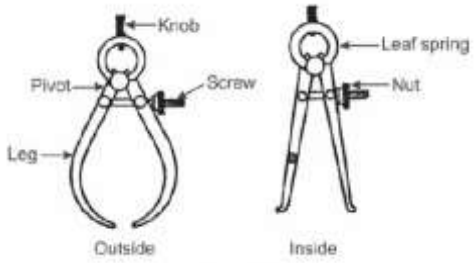
Odd-leg caliper



4. <u>MEASURING TOOLS</u>:

a) Inside Calipers and Outside calipers:

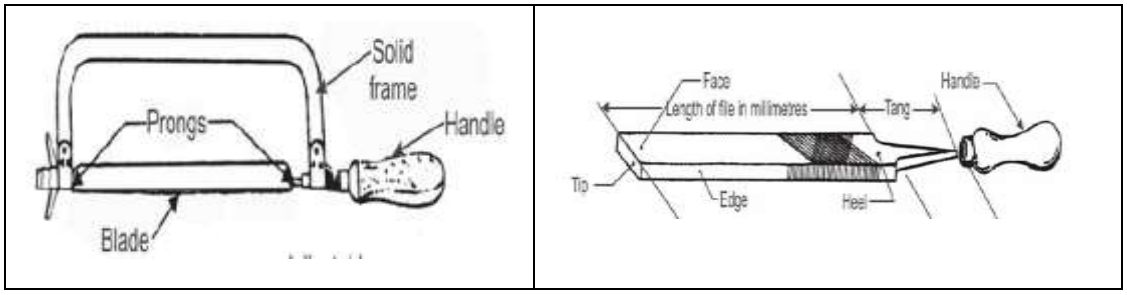
The Inside calipers are used to measure the internal size of an object. Outside calipers are used to measure the external size of an object.



<u>5. CUTTING TOOLS:</u>

a) Hacksaw:

The hacksaw is used for cutting metal by hand. It consists of a frame which holds a thin blade, firmly in position. The blade has a number of cutting teeth. The teeth of the hacksaw blade are staggered. These make the slots wider than the blade thickness, preventing the blade from jamming.



b) Files:

A file is a hardened steel tool, having slant parallel rows of cutting edges or teeth on its surfaces.

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

1) Hand File **2)** Flat File **3)** Square File

4) Round File **5)** Half Round File **6)** Needle File

Single and double cut files are further divided according to coarseness or spacing between the rows of the teeth in descending order of the roughness.

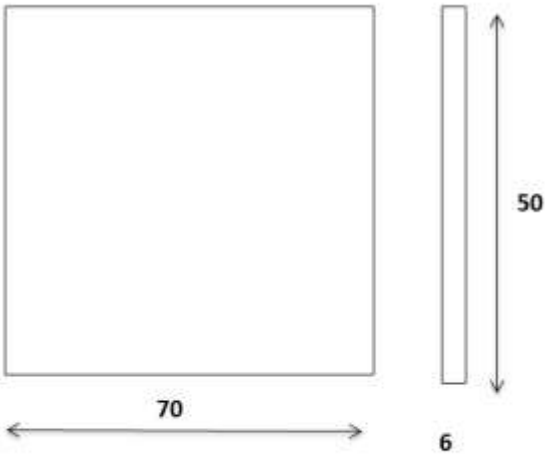
1) Rough (R) 2) Smooth (S) 3) Bastard (B)

4) Dead Smooth (DS) 5) Second cut (SC) 6) Super smooth (SS)

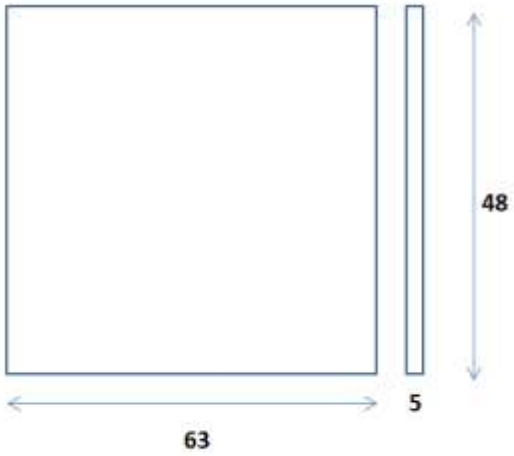
6. Procedure:

- The dimension of the given sample(s) is/are checked with the steel rule.
- The job is fixed rigidly in a bench vice and all the faces are filed using the rough flat file first and then the smooth flat file.
- The right angle of the two adjacent sides is checked using try-square.
- Chalk is then applied on the surface of the work piece.
- The given dimensions are marked by using vernier caliper.
- Using the dot punch, dots are punched along the above marked lines.
- The job is then fixed rigidly in a bench vice and cutting, along the marked lines, is done using hacksaw.
- With the help of drilling machine a hole is made so that the cylindrical rod would properly fix into that hole.
- Hammer is used to obtain the proper fit.

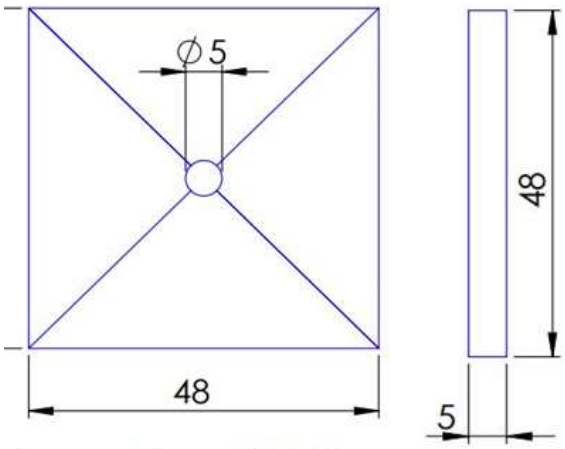
JOB PREPARATION



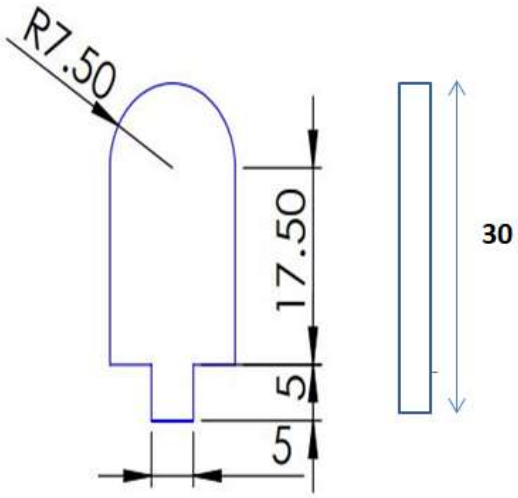
Raw Material: 70mmx50mmx6mm



Finished Material: 63mmx48mmx5mm



Square Paper Weight



Handle

7. SAFETY PRECAUTIONS:

The following are some of the safe and correct work practices in bench work and fitting shop:

1. Position the work piece area such that the cut to be made is close to the vice.

2. Position the work in a vice so that it does not overhang into an aisle /passage of other area.

3. Use soft jaws when holding finished work surfaces in a bench vice.

4. Select the hacksaw blade most suitable for the material and nature of the cutting operation.

5. Use a file with a properly fitted, tight handle.

6. Remove sharp projecting edges and burrs which produce inaccuracies in layout, measurement errors and improper fits.

7. Wear safety goggles or a protective shield when chipping and driving parts. Flying chips and other particles may cause eye injury.