

## FITTING

### Introduction

Fitting is assembling two or more machined components with necessary fit by hand work skills on bench or work at site. Although the assembly components are machined accurately on machines, still some hand work is required to place two component in position. The term bench work indicates production of usable items or product components by hand on bench. In fitting and bench work large number of tools and equipments are required to perform various operations. Fitter is a highly skilled person to carry out the fitting and bench work.

### Work material

#### (a) Selection of material

To shape metallic components is difficult task. Material for work is drawn very carefully after studying drawing to nearest size of work.

#### (b) Estimate of material

After deciding about the material to be used and type of standard section. The quantity of raw material can be worked out so as to meet out the size of work keeping some margin for cutting and filing. Using standard tables the weight of raw material required can be estimated.

#### (c) Cost of material

Common metals are available in the market in standard sections on weight basis. The cost is worked out by weight of material and its rate per kg.

## Fitting Processes

### Marking

Fixing dimensions on work is known as marking. The work is carried out first preparing two adjacent surfaces as reference surface for marking and then fixing the dimensions as per drawing. Keeping in view comparative flatness and smoothness, one side and adjacent one end are identified. These surfaces are then filed to make them perfectly flat and smooth maintaining their square ness.

Using surface plate, scale, V-block, surface gauge the dimensions are then fixed as per drawing with reference to reference surfaces. The layout lines are then punch marked to make them to last long.

### Chipping

The process of removing thick layers of metal by mean of cold chisels is known as chipping. The excess un wanted material is cut and removed using chisels. In handling the large surface area the work piece is placed in vice and grooves are formed by eliminating the material in the form of chips with the help of chisels. The remaining material is then removed by chipping to make the surface flat.

### Cutting/Sawing

Cutting/sawing is a process of Parting metal with the help of hacksaw. Cutting is carried out by setting suitable blade in hacksaw frame and adjusting the blade tension. The work piece is securely fixed in the vice. The cut is initiated by locating the position just outside the line with few teeth to form nick. To saw further the hack is moved to take cutting stroke with proper balance and 40-50 stroke per minute. The cutting is slow down at the end of cut to control the saw.

### Filing

In chipping & cutting operations 0.5-0.6 mm allowance is provided for filing to remove the burr from the cuts and clean the face of cuts. It is necessary to have this allowance to finish the final shape. The process of smoothing surfaces with files is known as filing. The filing is carried out by proper holding of work to the level of elbow in vice, adjusting position with proper footing and holding the file in correct way. In filing the file is moved forward horizontally with adequate pressure to remove material. It is brought to starting position without pressure for subsequent cut. The file is moved across the work with slow steady 50 to 60 stroke per minute.

#### (a) Straight filing

In straight filing the file is moved forward at right angle to length of work. The technique is used to smoothing thin pieces.

#### (b) Cross filing

In cross filing the two consecutive strokes are taken in cross direction at angle to work to cover maximum surface area and to remove maximum material from the work. This also removes the score marks of the file.

#### (c) Draw filing

In draw filing the file is placed at right angle across the work by holding blade with both hand close together. The file is moved up and down covering entire length of work. Draw filing is used for smoother cutting as finishing operation.

## **Scraping**

Scraping is process to make a fine, smooth surface by eliminating the material in the form of thin slices. Scrapers are used in this process.

## **Drilling**

Drilling is operation of producing circular in a metal work piece. The work is carried out on a drilling machine using appropriate size of drill.

## **Reaming**

For accurate hole, drilling is followed by reaming to correct shape, & size and surface finish of drill hole. The reamers remove little material from the drilled hole. For reamed hole first hole is made by selecting drill with 0.4mm allowance for reaming up to hole of 25 mm. It is followed by reaming with correct size of reamer.

## **Taping**

It is a operation of making internal threads using taps. In taping first a smaller size hole is drilled. The size if drill can be calculated from the following formula:

$$D = T - 2d$$

D is the diameter of tap drill size. T diameter of tap and d is depth of tread. For ISS threads  $d = 0.61p$ , where p is pitch of thread

Hand taps are made in sets of three : taper, plug and bottom tap known as Rougher, Intermediate and Finisher respectively. After drilling treads are cut using taps one by one.

## **Dieing**

It's a process of cutting external threads on round rod and bolt with help of dies. The solid die can be used for fixed diameter and adjustable die to cut threads on larger or smaller diameter work.

## **Limits fits and tolerances**

In mass production certain variations in size are allowed to ensure interchangeability of matching parts with certain degree of freedom. This system is known as system of limits & fits.

**Limits** : Limits are two extreme permissible sizes for dimension. The permissible largest size and smallest size are known as high and low limit respectively.

**Tolerances** : It is difference between high low limits of size. It covers reasonable imperfection in work.

**Allowance** : It is difference between dimension of hole and shaft for any type of fit.

# Tools

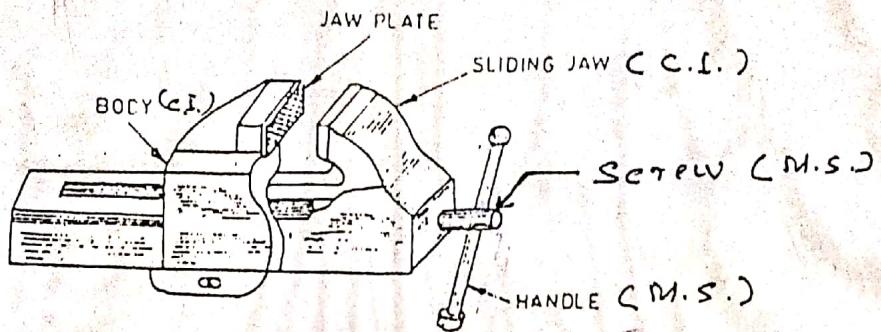
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## Tools in common use

Name	Specifications	Use	Specific precautions
Fitting Vice	Width, opening & depth of jaw Common size from 65. 75. 100. 125. 150. 200 mm width	Holding work piece	1 Keep Work surface horizontal & parallel to jaw. 2. Keep work surface 10 to 15 mm above jaw 3. use clamps & grips for holding soft material and finished works
Steel Scale / Steel Rule	Length of scale 15, 30, & 60 cm & Accuracy 0.5 or 1 in mm 1/16 or 1/64 in inch	For marking and measuring dimensions	Keep scale vertical to set height of scribe Keep eye vertical to read value
Try-square	Length of blade Common sizes non precision 20, 25 and 30 cm.	To check flatness & square ness & marking	1 Use edge of checking flatness 2. Keep stock in touch with prepared face to check square ness & marking. 3. use fitter try-square only
Universal Marking Block/surface gauge	Size of base & length of spindle	For marking. Drawing line, at required height	1.Keep gently on surface plate 2.Move in touch with S P to describe a line 3.Adjust height of scribe keeping steel scale vertical
Surface Plate	150x100 mm to 1x 75 m size Grade-A 0.005 Grade-B 0.02 flatness accuracy	For marking on small pieces and checking flatness	1.Do not keep tools on S P 2. Do not put punch mark keeping work piece on S P 3 Protect from rust & dirt. Clean & smeared with oil or grease after use
V-Block	Length & cross section	- To support scale to adjust height of scribe& work for marking - support work for drilling hole	1 Keep gently on surface plate 2.Move in touch with S.P. if required.
Angle Plate		- To support scale to adjust height of scribe& work for marking holding & supporting jobs	1.Keep gently on surface plate when used for marking 2.Clean before use
Scriber	By length 150-250 mm	Scribing line on metal	1. Ensure sharpness of point 2. Maintaining angle to draw line

Chisels	Width & shape (Flat, cross-cut, diamond point, half round and side) of cutting edge Size of flat chisels 16-32 mm width & 100-400 mm length	Cutting & chipping	<ul style="list-style-type: none"> <li>Select proper chisel for work</li> <li>Maintain correct position and angle when working</li> <li>Grip at proper place with adequate pressure</li> <li>Leave no chance for slip</li> </ul>
Scrapers	Length & shape Size 100 mm upwards	Shaving or paring thin slices fro fine smooth surface	<ul style="list-style-type: none"> <li>Select right scraper</li> <li>Maintain correct position and angle when working</li> <li>Grip at proper place with adequate pressure</li> <li>Keep eye on work surface</li> <li>Select correct drill</li> <li>Hold work in machine vice</li> <li>Locate position of hole &amp; put mark with dot punch</li> <li>Grip at proper place with adequate pressure</li> <li>Ensure correct location of drill on machine</li> </ul>
Drill	Flat/straight/twist drill. Twist drill may be parallel shank 0.20-40mm or tapered shank 3.0to 100 mm	For making circular holes	<ul style="list-style-type: none"> <li>Select correct drill</li> <li>Hold work in machine vice</li> <li>Locate position of hole &amp; put mark with dot punch</li> <li>Grip at proper place with adequate pressure</li> <li>Ensure correct location of drill on machine</li> </ul>
Tapes	Diameter of bolt Set of three pieces Rougher, Intermediate and Finisher	To cut internal treads such as in holes	<ul style="list-style-type: none"> <li>Select nearest size of drill</li> <li>Follow correct sequence of tap</li> <li>Use lubricant while cutting threads</li> </ul>
Dyes	Diameter of bolt solid /adjustable die	To external threads on bars	<ul style="list-style-type: none"> <li>Select appropriate Die</li> <li>Use lubricant while cutting threads</li> </ul>
Reamer	Hand/machine/expanding Diameter of hole to be reamed	For making holes of correct size with smooth finish	<ul style="list-style-type: none"> <li>Select nearest size of drill</li> <li>Keep reamer vertical</li> </ul>
Ball peen or Engineer's or chipping hammer	By weight Size 0.11 to .01 kg	General purpose hammer mainly used for chipping & riveting	<ol style="list-style-type: none"> <li>Hold at right place</li> <li>Ensure tight ness of handle</li> </ol>
Cross peen hammer	By weight Size 0.22 to .01 kg	Used for bending stretching, hammering at corners	-do-
Straight peen hammer	By weight Size.0.11 to .01 kg	Stretching or preening work	-do-

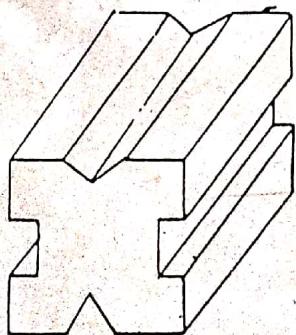
Dot Punch	Prick punch/ Centre punch	Punch mark on layout lines Centres of hole	1 Ensure sharpness of point 2 Put punch mark by supporting work properly on plane surface
Combination Set	Length of rule 200-100 mm	Measuring & setting liner/angular dimensions. Check level Locate centre of rounds	1 Handle carefully 2 Use correct combination 3 Place in box if not in use
Files	Length, Cut, Roughness (Grade), & shape 100-200 mm length for fine work 200-450 mm length for heavier work	Cutting smoothing & fitting work	1 Handle carefully 2 File should not touch jaw plates of vice during filing 3 Do not store in bunch. Place separately in wooden rack 4 Do not strike against metal to remove chips



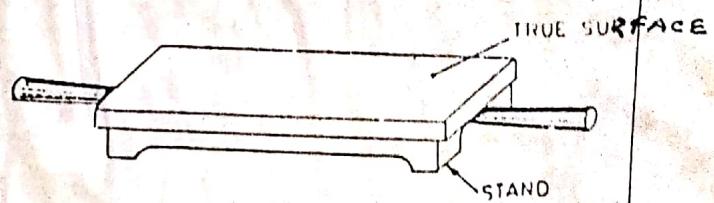
Sketch Fitting/Parallel Jaw Vice



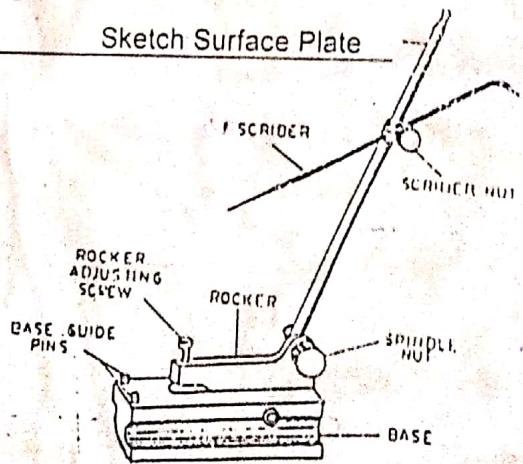
Sketch Steel Scale



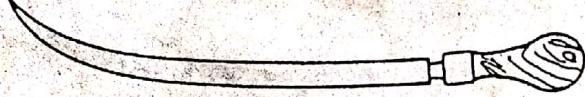
Sketch V-Block (C.I.)



Sketch Surface Plate



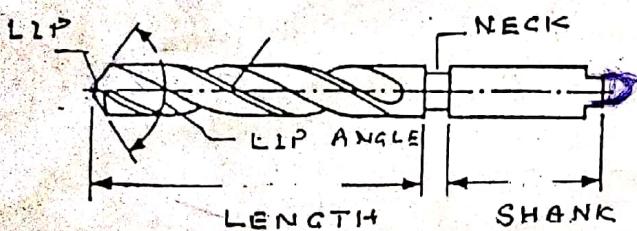
Sketch Universal Marking Block



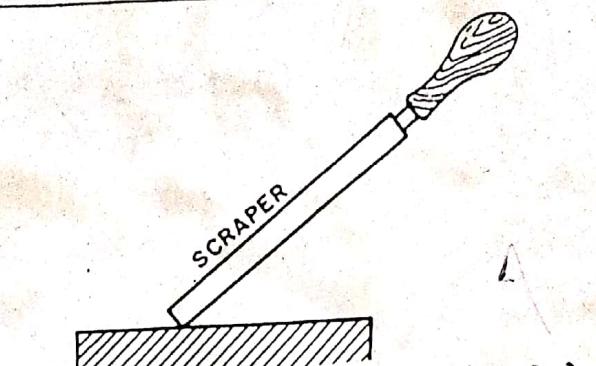
CURVED SCRAPER

Sketch

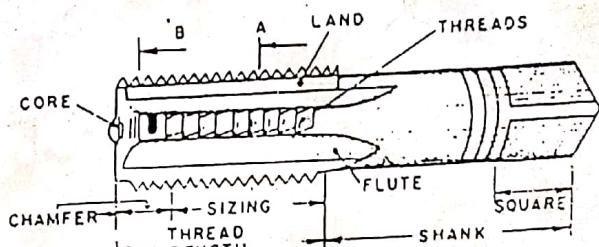
Scaper (L.A.S.)



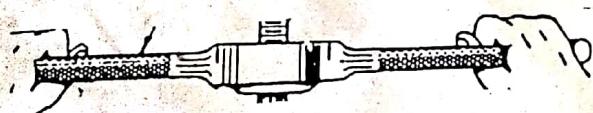
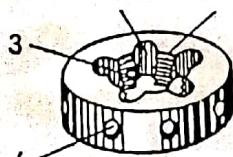
Sketch Drill (H.S.S.)



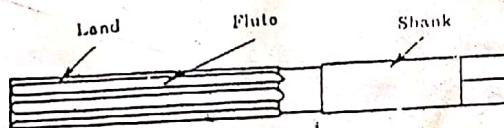
Sketch Scappers (L.A.S.)



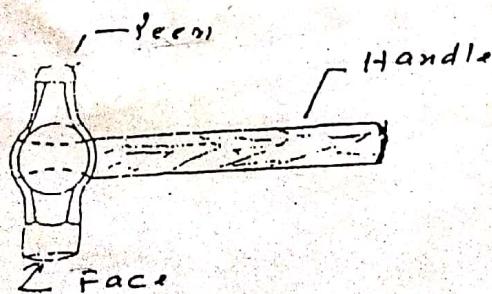
Sketch Tape (H.S.S.)



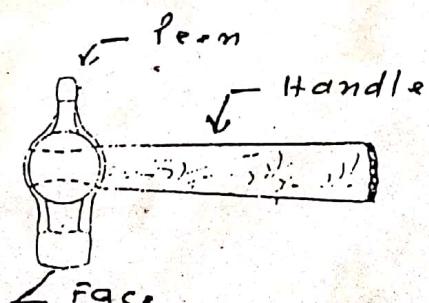
Sketch Dye



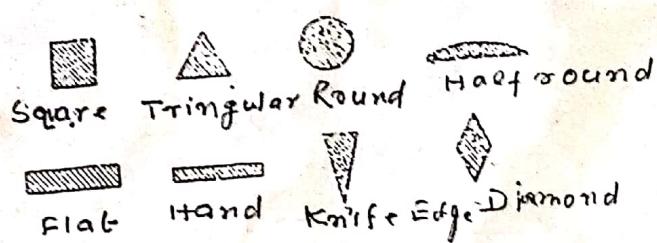
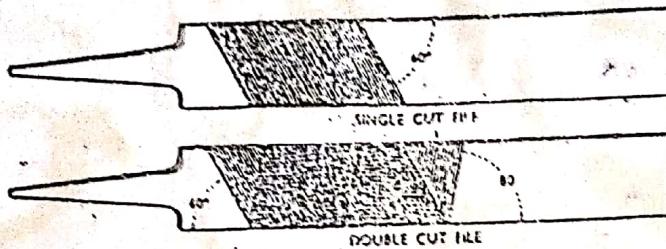
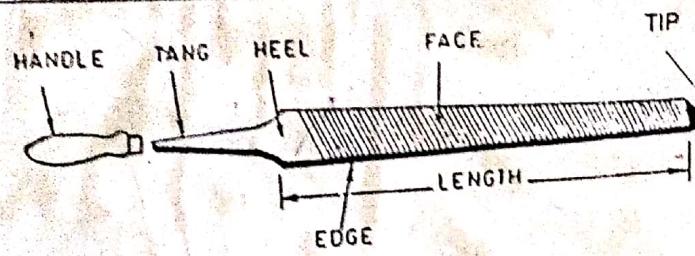
Sketch Reamer (H.S.S.)



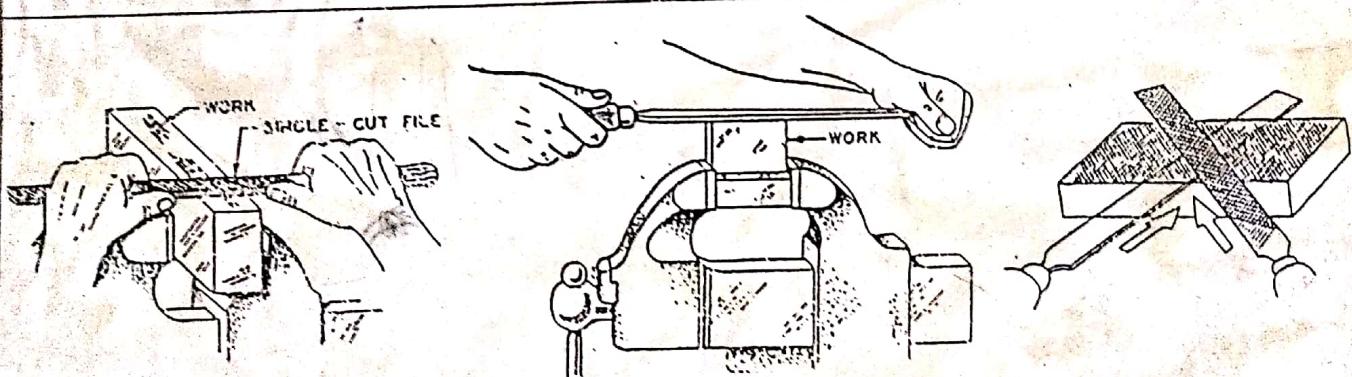
Sketch Ball Peen Hammer (C.S.)



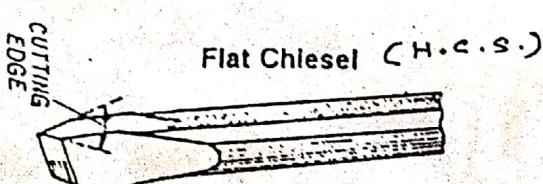
Sketch Cross Peen Hammer (C.S.)



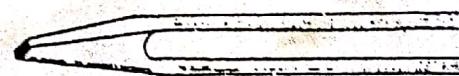
Sketch types of files (L.A.S.)



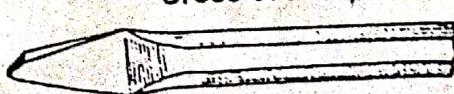
Sketch file operation (straight file, cross file and draw filing)



Half Round Chisel (H.C.S.)



Cross cut Chisel



Diamond Point Chisel



Sketch Chisels (H.C.S OR L.A.S.)