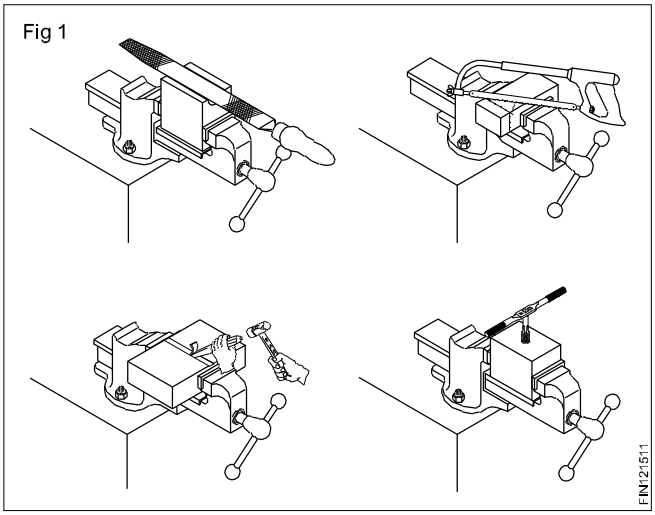
Bench vice

Objectives: At the end of this lesson you shall be able to
- **state the uses of bench vice**
- **specify the size of the bench vice**
- **name the parts of the bench vice**
- **state the uses of vice clamps.**
- **mention the care and maintenance of vices**

Vices are used for holding the workpieces. They are available in different types. The vice used for bench work is the bench vice or called Engineer's vice.

A bench vice is made of cast iron or cast steel and it is used to hold work for filing, sawing, threading and other hand operations. (Fig 1)

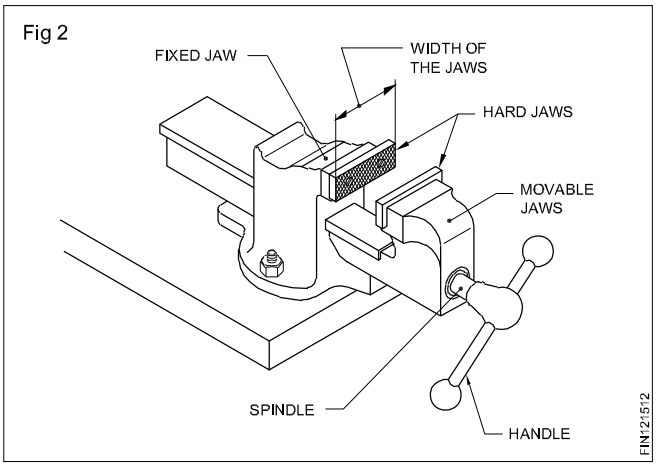
Fig 1



The size of the vice is stated by the width of the jaws.eg. 150mm parallel jaw bench vice

Parts of a bench vice (Fig 2)

Fig 2



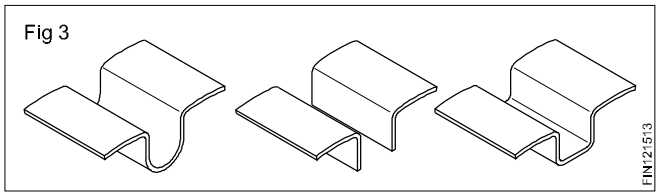
The following are the parts of a vice.

Fixed jaw, movable jaw, hard jaws, spindle, handle, box-nut and spring are the parts of a vice.

The box-nut and the spring are the internal parts.

Vice clamps or soft jaws (Fig 3)

Fig 3



To hold a finished work use soft jaws (vice clamps) made of aluminium over the regular jaws. This will protect the work surface from damage.

Do not over-tighten the vice as, the spindle may be damaged.

Care and maintenance of vices

- Always keep all threaded and moving parts clean by wiping the vice with a cloth after each use.
- Make sure to oil and lubricate the joints and sliding parts.
- To oil the sliding section, open the jaws completely and apply a layer of grease to the screen.
- Remove the rust if appears on the vice using rust remover chemical.
- When the vice is not in use bring the jaws lightly gap together and place the handle in a vertical position.
- Avoid striking the handle of the vice by a hammer for tightening fully, otherwise the handle will become bend or damaged.

Hacksaw frames and blades

Objectives: At the end of this lesson you shall be able to
- **name the different types of hacksaw frames**
- **specify hacksaw blades**
- **name the different type of hacksaw blades**
- **describe the method of sawing**

Hacksaw frame: A hacksaw frame is used along with a blade to cut metals of different sections, and is specified by the type and maximum length of the blade that can be fixed.

Example

Adjustable hacksaw frame - tubular - 250 - 300mm or 8" - 12"

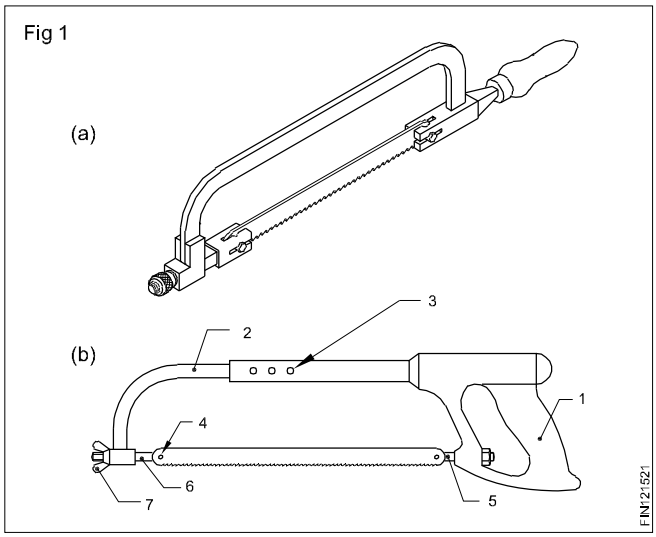
Types of hacksaw frames

Solid frame (Fig 1a)**:** Only a blade of a particular standard length can be fitted to this frame. e.g 300 mm or 250 mm.

Adjustable frame (flat type)**:** Different standard lengths of blades can be fitted to this frame i.e. 250 mm and 300 mm.

Adjustable frame (tubular type) (Fig 1b)**:** This is the most commonly used type. It gives a better grip and control, while sawing.

Fig 1



Parts of a hacksaw frame

1 Handle

2 Frame

3 Tubular frame with holes for length adjustment

4 Retaining pins

5 Fixed blade-holder

6 Adjustable blade-holder

7 Wing-nut

A hacksaw blade is made of either low alloy steel (LA) or high speed steel (HSS), and is available in standard lengths of 250 mm and 300mm. (Fig 2)

Parts of a hacksaw blade (Fig 2)

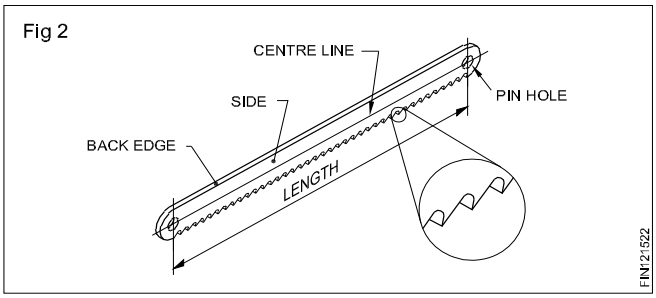
1 Back edge

2 Side

3 Centre line

4 Pin holes

Fig 2



Type of hacksaw blades

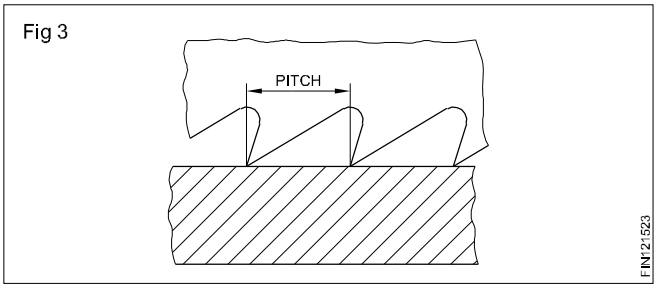
All-hard blade: The full length of the blade between the pins is hardened and it is used for harder metals such as tool steel, die steel and HCS.

Flexible blade: Only the teeth are hardened. Because of their flexibility these blades are useful for cutting along curved lines. Flexible blades should be thinner than all-hard blades.

Pitch of the blade (Fig 3)**:** The distance between adjacent teeth is known as the 'pitch' of the blade.

Classification	Pitch
Coarse	1.8 mm
Medium	1.4 mm & 1.0 mm
Fine	0.8 mm

Fig 3



Specification: Hacksaw blades are specified by the length, pitch and type of material. (The width and thickness of blade is standardised)

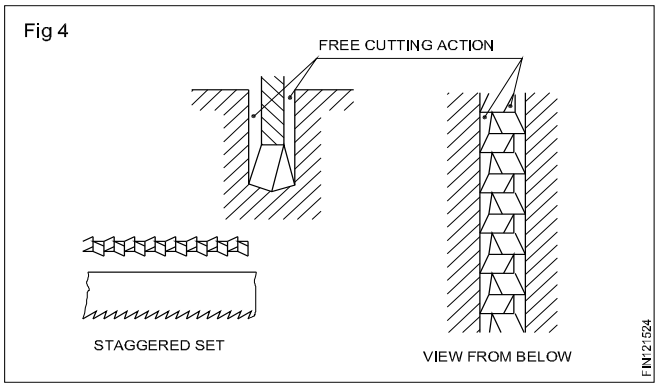
Example

300 x 1.8 mm pitch LA all-hard blade.

To prevent the hacksaw blade binding when penetrating into the material, and to allow free movement of the blade, the cut is to be broader than the thickness of the hacksaw blade. This is achieved by the setting of the hacksaw teeth. There are two types of hacksaw teeth settings.

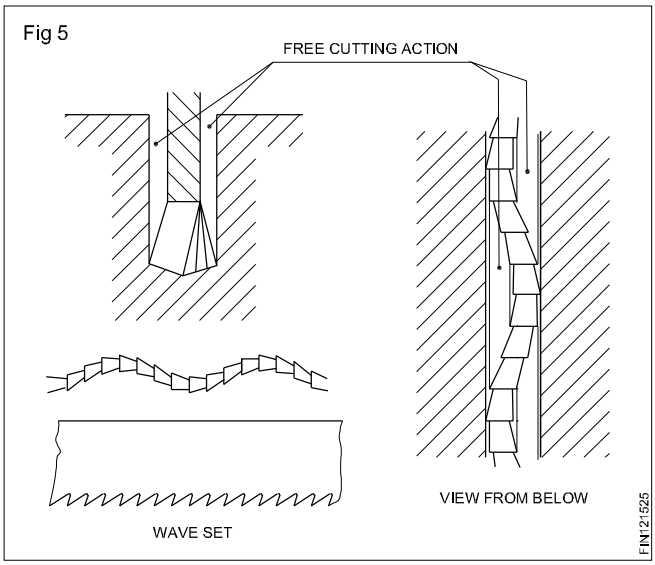
Staggered set (Fig 4)**:** Alternate teeth or groups of teeth are staggered. This arrangement helps for free cutting, and provides for good chip clearance.

Fig 4



Wave set (Fig 5)**:** In this, the teeth of the blade are arranged in a wave-form. The types of sets for different pictures are as follows:

Fig 5



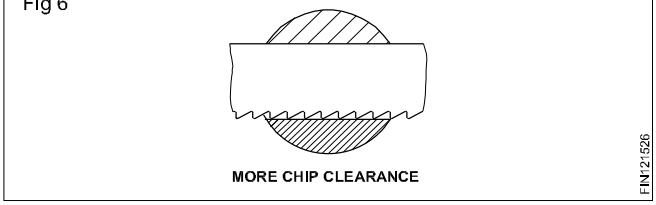
Pitch	Type of set
0.8 mm	Wave-set
1.0 mm	Wave-set or staggered
Over 1.0 mm	Staggered

For the best results, the blade with the right pitch should be selected and fitted correctly.

Selection of blade: The selection of the blade depends on the shape and hardness of the material to be cut.

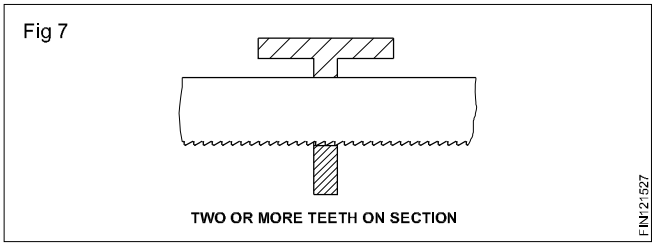
Pitch selection (Fig 6)**:** For soft materials such as bronze, brass, soft steel, cast iron, heavy angles etc. use a 1.8 mm pitch blade.

Fig 6



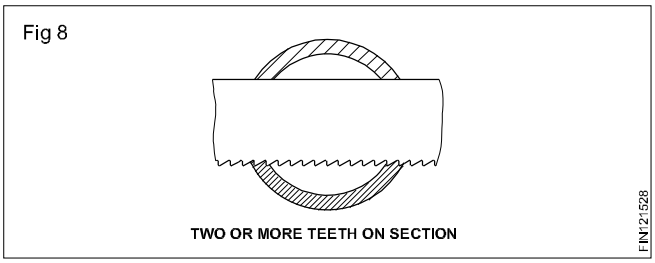
For tool steel, high carbon, high speed steel etc. use a 1.4 mm pitch. For angle iron, brass tubing, copper, iron pipe etc. use a 1 mm pitch blade. (Fig 7)

Fig 7



For conduit and other thin tubing, sheet metal work etc. use a 0.8 mm pitch. (Fig 8)

Fig 8



Method of sawing

Select the correct blade for the material to be cut.

HSS - Blades are used for tough resistant materials

High Carbon Steel - General cutting

Select the correct number of teeth / inch the general rule is that atleast 3 teeth should extend across the surface of the material to be cut.

The hand holds the hacksaw handle, and the index finger is support the handle and also points in the direction of cutting.

The other hand holds the frame, near the wing nut. Cutting/ sewing should be carried out close to the jaws of the vice. This ensures that the metal does not flex or bend under the force of the hacksaw and the sawing motion.

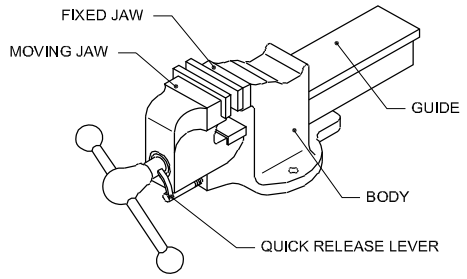
Types of vices

Objectives: At the end of this lesson you shall be able to
- **state the different types of vices**
- **state the uses of quick relasing vice, pipe vice, hand vice, pin vice and leg vice.**

There are different types of vices used for holding work-pieces. They are quick releasing vice, pipe vice, hand vice, pin vice and toolmaker's vice.

Quick releasing vice (Fig 1)**:** A quick releasing vice is similar to an ordinary bench vice but the opening of the movable jaw is done by using a trigger (lever). If the trigger at the front of the movable jaw is pressed, the nut disengages the screw and the movable jaw can be set in any desired place quickly.

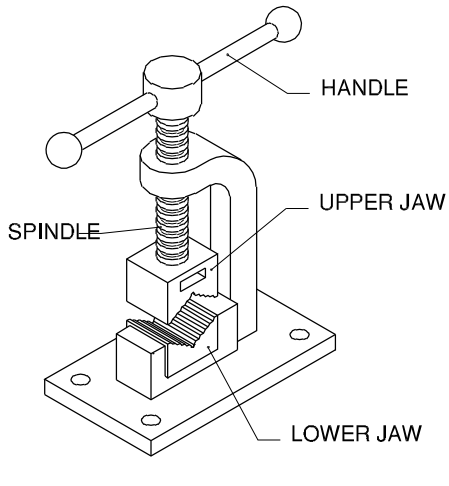
Fig 1



Pipe vice (Fig 2)**:** A pipe vice is used for holding round sections of metal, tubes and pipes. In the vice, the screw is vertical and movable. The jaw works vertically.

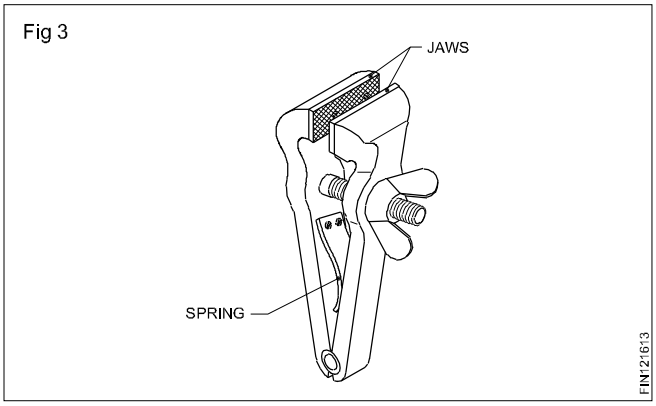
The pipe vice grips the work at four points on its surface. The parts of a pipe vice are shown in Fig 2.

Fig 2



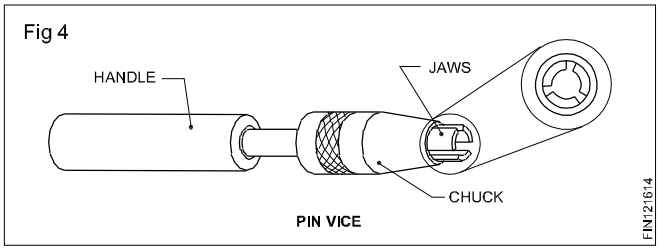
Hand vice (Fig 3)**:** Hand vices are used for gripping screws, rivets, keys, small drills and other similar objects which are too small to be conveniently held in the bench vice. A hand vice is made in various shapes and sizes. The length varies from 125 to 150 mm and the jaw width from 40 to 44 mm. The jaws can be opened and closed using the wing nut on the screw that is fastened to one leg, and passes through the other.

Fig 3



Pin vice (Fig 4)**:** The pin vice is used for holding small diameter jobs. It consists of a handle and a small collet chuck at one end. The chuck carries a set of jaws which are operated by turning the handle.

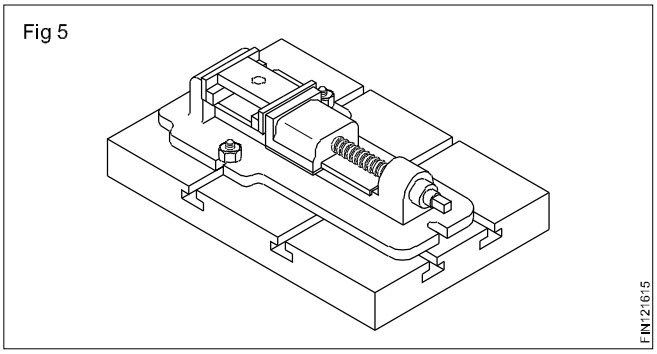
Fig 4



Toolmaker's vice (Fig 5)**:** The toolmaker's vice is used for holding small work which requires filing or drilling and for marking of small jobs on the surface plate. This vice is made of mild steel.

Toolmaker's vice is accurately machined.

Fig 5



Leg vice

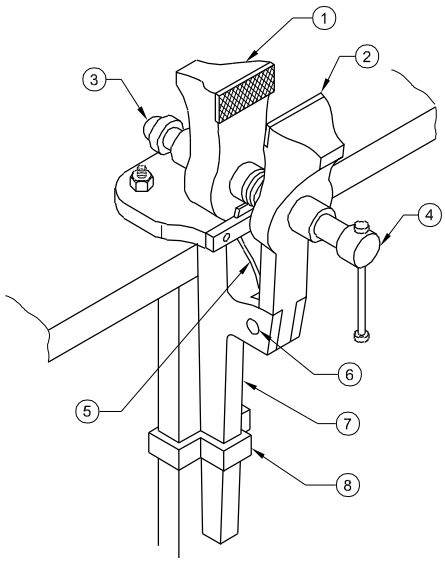
A leg vice is a holding device generally used in a forge shop for bending and forging work. It is made fo mild steel to avoid breakage while hammering.

Main pats of a leg vice (Fig 6**)**

The following are the main parts of a leg vice.

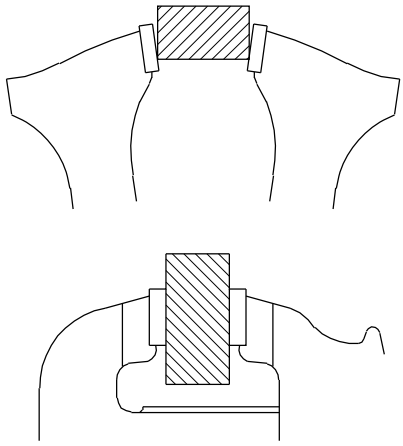
1 Solid jaw
2 Movable jaw
3 Threaded jaw
4 Spindle
5 Spring
6 Pivot
7 Leg
8 Clamp

Fig 6



Since the hinged jaw moves in a radial path, the job held in this vice in not gripped properly because of the line contact. (Fig 7) Hence a work which can be carried out on a bench vice is not held on a leg vice. Jobs which require hammering only are held on a leg vice.

Fig 7

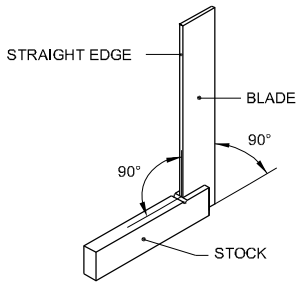


Try square

Objectives: At the end of this lesson you shall be able to
- **name the parts of a try square**
- **state the uses of a try square.**

The try square (Fig 1) is an instrument which is used to check squareness (angles of 90°) of a surface.

Fig 1



The accuracy of measurement by a try square is about 0.002 mm per 10 mm length, which is accurate enough for most workshop purposes. The try square has a blade with parallel surfaces. The blade is fixed to the stock at 90°.

Try squares are made of hardened steel.

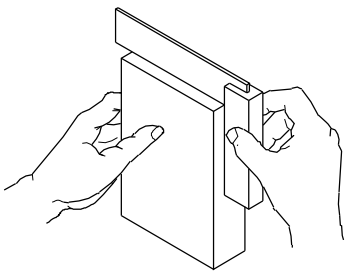
Try squares are specified according to the length of the blade i.e. 100 mm, 150 mm, 200 mm.

Uses:

The try-square is used to:

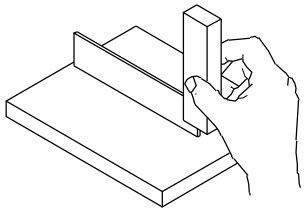
– check the squareness (Fig 2)

Fig 2



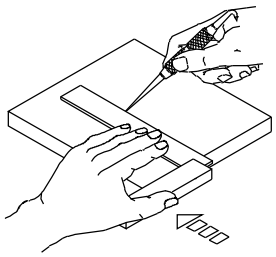
– check the flatness (Fig 3)

Fig 3



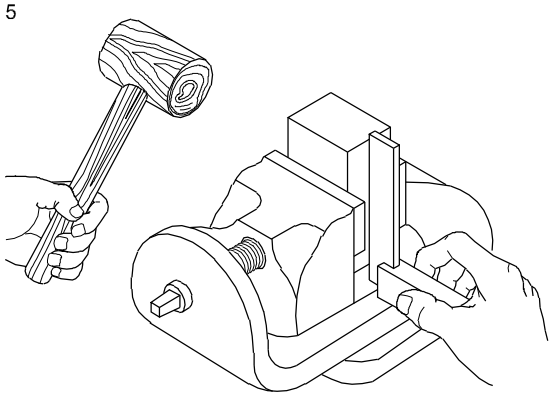
– mark lines at 90° to the edges of workpieces (Fig 4)

Fig 4



– set workpieces at right angles. (Fig 5)

Fig 5



Elements of a file

Objectives: At the end of this lesson you shall be able to
- **name the parts of a file**
- **state the material of a file.**

Methods of material cutting

The three methods of metal cutting are abrasion (Fig.1), fusion (Fig 2) and incision (Fig 3)

Fig 1

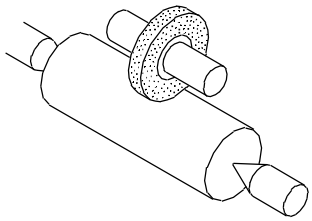


Fig 2

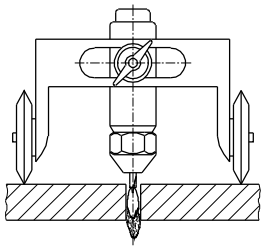
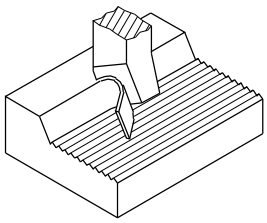


Fig 3



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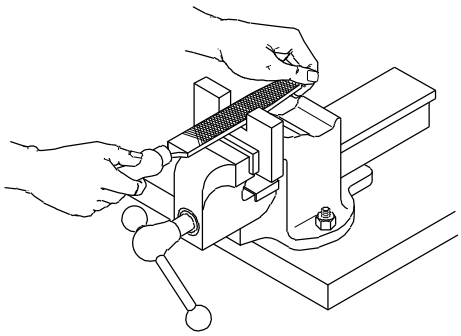
Filling is a method for removing excess material from a workpiece by using a file which acts as a cutting tool. Figure 4 shows how to hold a file. Files are available in many shapes and sizes.

Fig 4



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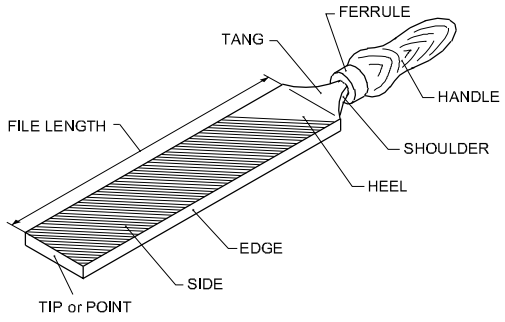
Parts of a file (Fig 5)

The parts of a file can be seen in figure 5, are

Fig 5



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Tip or Point
the end opposite to tang

Face or side
The broad part of the file with teeth cut on its surface

Edge
The thin part of the file with a single row of parallel teeth

Heel
The portion of the broad part without teeth

Shoulder
the curved part of the file separating tang from the body

Tang
The narrow and thin part of a file which fits into the handle

Handle
The part fitted to the tang for holding the file

Ferrule
A protective metal ring to prevent cracking of the handle.

Materials

Generally files are made of high carbon or high grade cast steel. The body portion is hardened and tempered. The tang is however not hardened.

Cut of files

Objectives: At the end of this lesson you shall be able to
- **name the different cuts of files**
- **state the uses of each type of cut.**

The teeth of all file are formed by cuts made on its face. Files have cuts of different types. Files with different cuts have different uses.

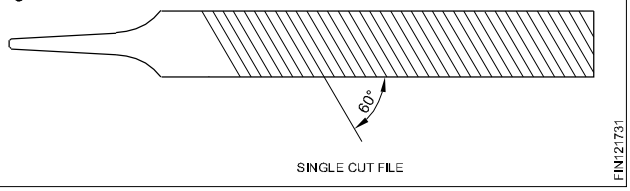
Types of cuts

Basically there are four types.
Single cut, Double cut, Rasp cut and Curved cut.

Single cut file (Fig 1)

A single cut file has rows of teeth cut in one direction across its face. The teeth are at an angle of 60^0 to the centre line. It can cut chips as wide as the cut of the file. Files with this cut are useful for filing soft metals like brass, aluminium, bronze and copper.

Fig 1

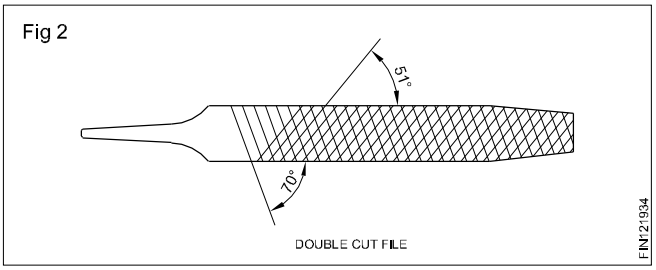


Single cut files do not remove stock as fast double cut files, but the surface finish obtained is much smoother.

Double cut file (Fig 2)

A double cut file has two rows of teeth cut diagonal to each other. The first row of teeth is known as OVERCUT and they are cut at an angle of 70^0. The other cut, made diagonal to this, is known as UPCUT, and is at an angle of 51^0. This removes stock faster than the single cut file.

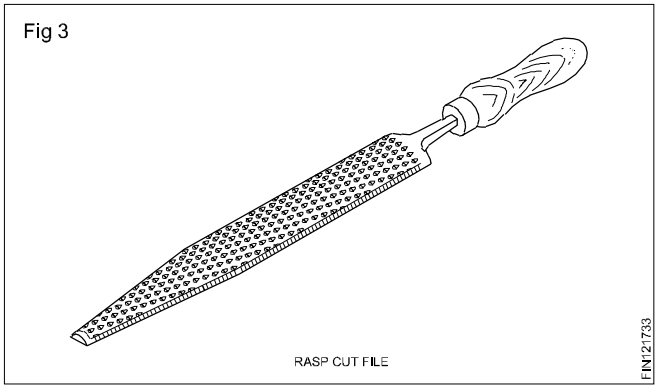
Fig 2



Rasp cut file (Fig 3)

The rasp cut has individual, sharp, pointed teeth in a line, and is useful for filing wood, leather and other soft materials. These files are available only in half round shape.

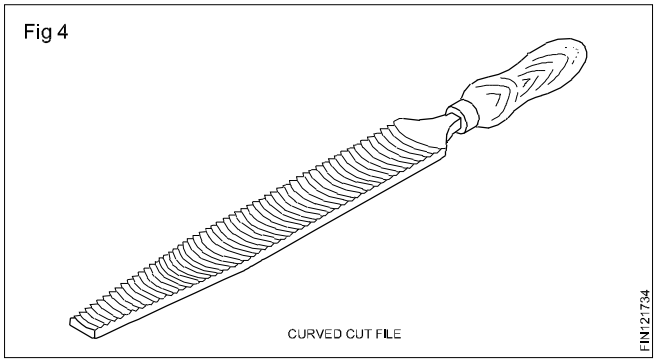
Fig 3



Curved cut file (Fig 4)

These files have deeper cutting action and are useful for filing soft materials like - aluminium, tin, copper, and plastic.

Fig 4



The curved cut files are available only in a flat shape.

The selection of a file with a particular type of cut is based on the material to be filed. Single cut files are used for filing soft materials. But certain special files, for example, those used for sharpening saws, are also of single cut.

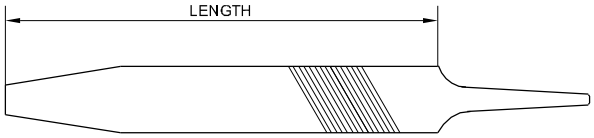
File specifications and grades

Objectives: At the end of this lesson you shall be able to
- **state how files are specified**
- **name the different grades of files**
- **state the application of each grade of file.**

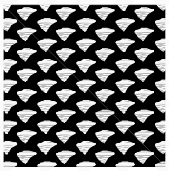
Files are manufactured in different types and grades to meet the various needs.

Files are specified according to their length, grade, cut and shape.

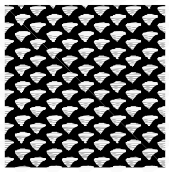
Length is the distance from the tip of a file to the heel.



File grades are determined by the spacing of the teeth.



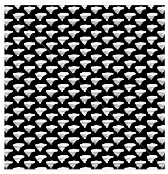
A **rough file** is used for removing rapidly a larger quantity of metal. It is mostly used for trimming the rough edges of soft metal castings.



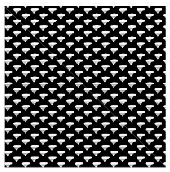
A **bastard file** is used in cases where there is a heavy reduction of material

A **second cut file** is used to give a good finish on metals. It is excellent to file hard metals. It is useful for bringing the jobs close to the finishing size.

It may also be observed that the number of cutting edges in rows of a file changes according to the Length of a file.



A **smooth file** is used to remove small quantity of material and to give a good finish.



A **dead smooth** file is used to bring the material to accurate size with a high degree of finish.

The most used grades of files are bastard, second cut, smooth and dead smooth. These are the the grades recommended by the bureau of indian standards (BIS)

Different sizes of files with the same grade will have varying sizes of teeth. In longer files, the teeth will be coarser.

The number of cutting edge in rows in each of the above grades over a Length of 10mm as shown in Table (1).

TABLE (1)

Grade of files (Number of cuts over the length of 10mm)					
Length of file	**Rough**	**Bastard**	**Second cut**	**Smooth**	**Deadsmooth**
150mm	8	13	17	24	33
200mm	7	11	16	22	31
250mm	6	10	15	20	30
300mm	5	9	14	19	28

Types of files

Objectives: At the end of this lesson you shall be able to
- **identify the different shape of files(types)**
- **state the uses of flat files, Hand files square, round, half round, triangular and knife-edge files**
- **state the correct shape of files for filing different profiles.**

For filing and finishing different profiles, files of different shapes are used

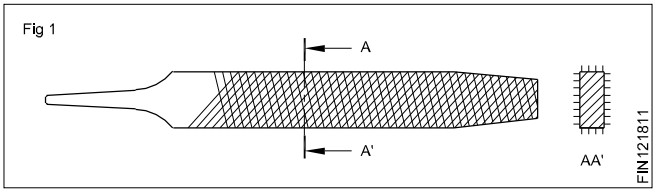
The shape of files is stated by its cross section.

Common files of different shapes: Flat file, Hand file, Square file, Round file, Half round file, Triangular file and Knife-edge file.

Flat file (Fig 1)

These files are of a rectangular cross section. The edges along the width of these files are parallel up to two-thirds of the length, and then they taper towards the point. The faces are double cut, and the edges single cut. These files are used for general purpose work. They are useful for filing and finishing external and internal surfaces.

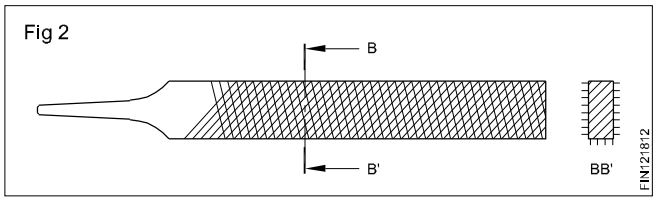
Fig 1



Hand file (Fig 2)

These files are similar to the flat files in their cross section. The edges along the width are parallel throughout the length. The faces are double cut. One edge is single cut whereas the other is safe edge. Because of the safe edge, they are useful for filing surfaces which are at right angles to surfaces already finished.

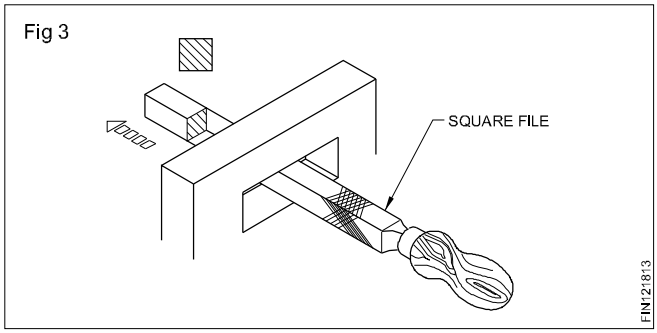
Fig 2



Flat files are general purpose files. They are available in all grades. Hand files are particularly useful for filling at right angles to a finished surface.

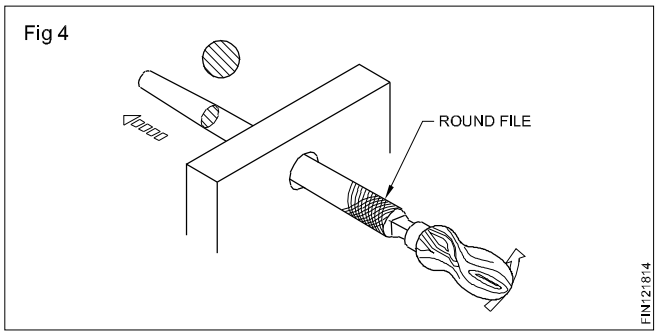
Square File: The square file is square in its cross section. It is used for filing square holes, internal square corners, rectangular openings, keyways and splines. (Fig 3)

Fig 3



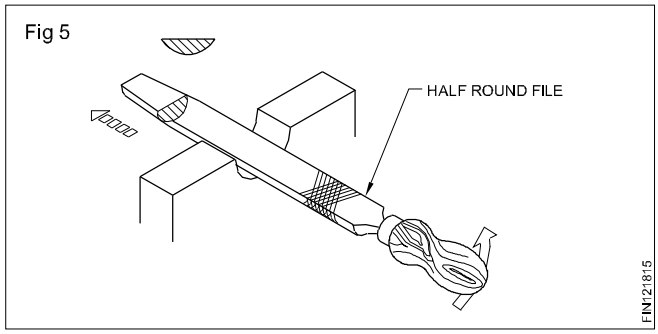
Round file: A round file is circular in its cross section. It is used for enlarging the circular holes and filing profiles with fillets. (Fig.4)

Fig 4



Half round file: A half round file is in the shape of a segment of a circle. It is used for filing internal curved surfaces. (Fig.5)

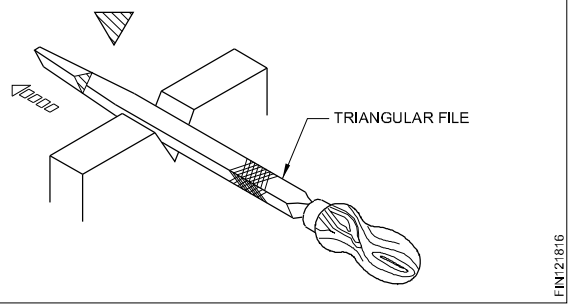
Fig 5



Knife edge file: A knife edge file has the cross section of a sharp triangles. It is used for filing narrow grooves and angles above 10^{o} (Fig.7)

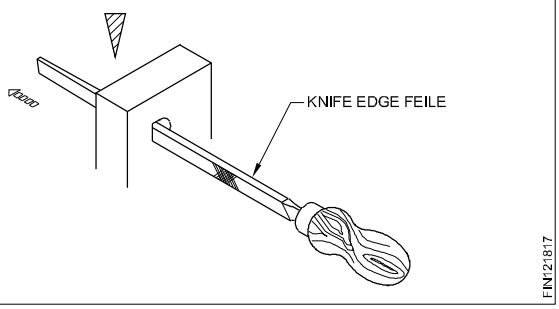
The above files have one third of their lengths tapered. They are available both single and double cuts.

Fig 6



Triangular file: A triangular file is of a triangular cross section. It is used for filing corners and angles which are more than 60°. (Fig.6)

Fig 7



Square, round, half-round and triangular files are available in lengths of 100, 150, 200, 250, 300 and 400mm. These files are made in bastard, second cut and smooth grades.

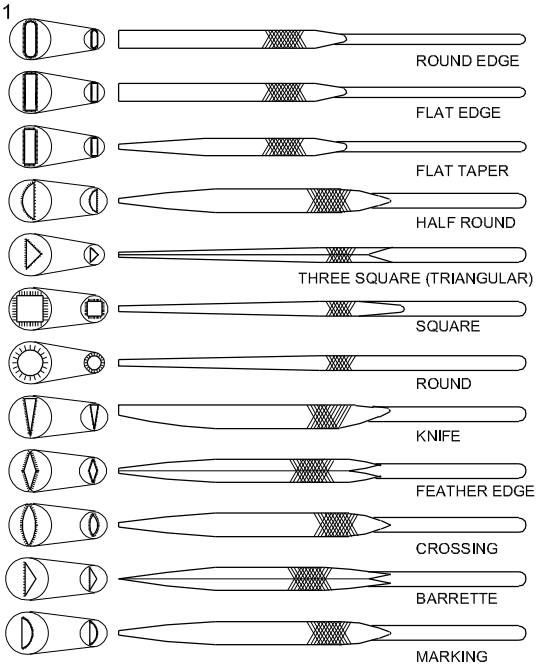
Needle files

Objectives: At the end of this lesson you shall be able to
- **name the different shapes of needle files**
- **designate needle files as per BIS.**

Needle files are usually available in sets with assorted shapes. These types of files are used for delicate, light kinds of work. These files are available in bastard and smooth grade.

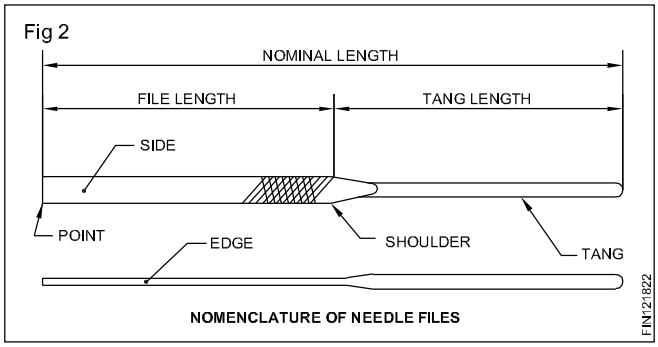
Shapes: The common shapes of needle files are shown in figure 1. The shapes are round edge, flat edge, flat taper, half round, triangular, square, round, knife, feather edge, crossing, barret and marking. (Fig 1)

Fig 1



Nomenclature of needle files. (Fig.2)

Fig 2



Length: These files are available in a nominal length of 120mm to 180mm.

Grades: The grades of cut may be identified by the cut number as follows

- bastard - Cut 0.

- smooth - Cut 2.

Designation of needle files: The needle files are designated by their names

- grade of cut

- nominal length

- BIS number

Example

A flat edge needle file with grade of cut bastard, having a nominal length of 160mm shall be designated as flat edge needle file bastard, 160 IS 3152

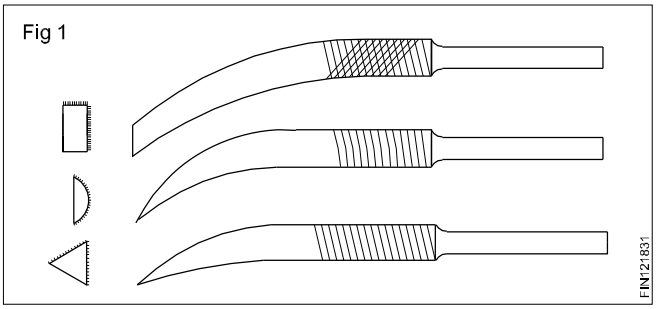
Special files

Objectives: At the end of this lesson you shall be able to
- **name the different types of special files**
- **state the uses of each type of special files.**

In addition to the common type of files, files are also available in a variety of shapes for 'special' applications. These are as follows.

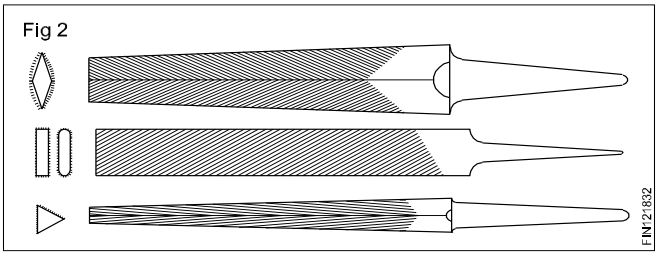
Riffler files (Fig 1)**:** These files are used for die-sinking, engraving and in silversmith's work. They are made in different shapes and sizes and are made with standard cuts of teeth.

Fig 1



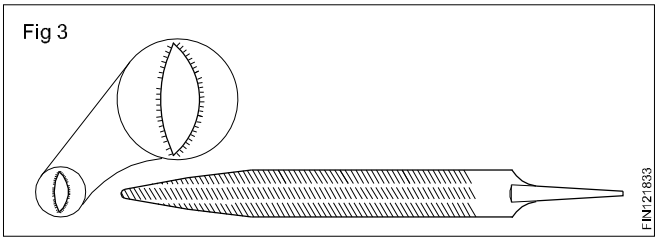
Mill saw files (Fig 2)**:** Mill saw files are usually flat and have square or rounded edges. These are used for sharpening teeth of wood-working saws, and are available in single cut.

Fig 2



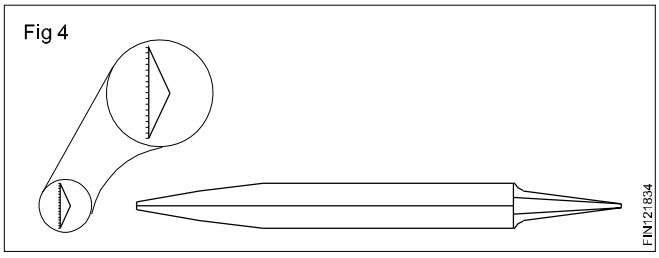
Crossing file (Fig 3)**:** This file is used in the place of a half round file. Each side of the file has different curves. It is also known as 'fish back' file.

Fig 3



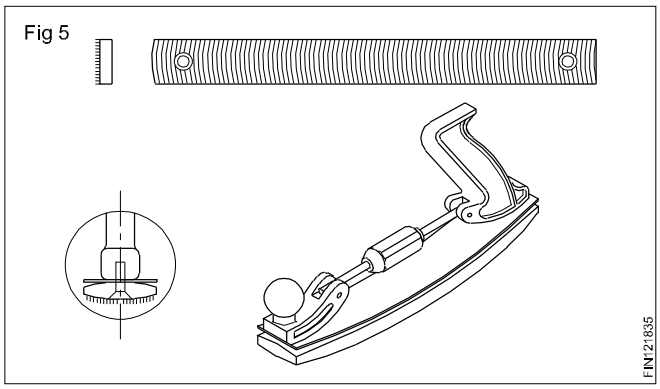
Barrette file (Fig 4)**:** This file has a flat, triangular face with teeth on the wide face only. It is used for finishing sharp corners.

Fig 4



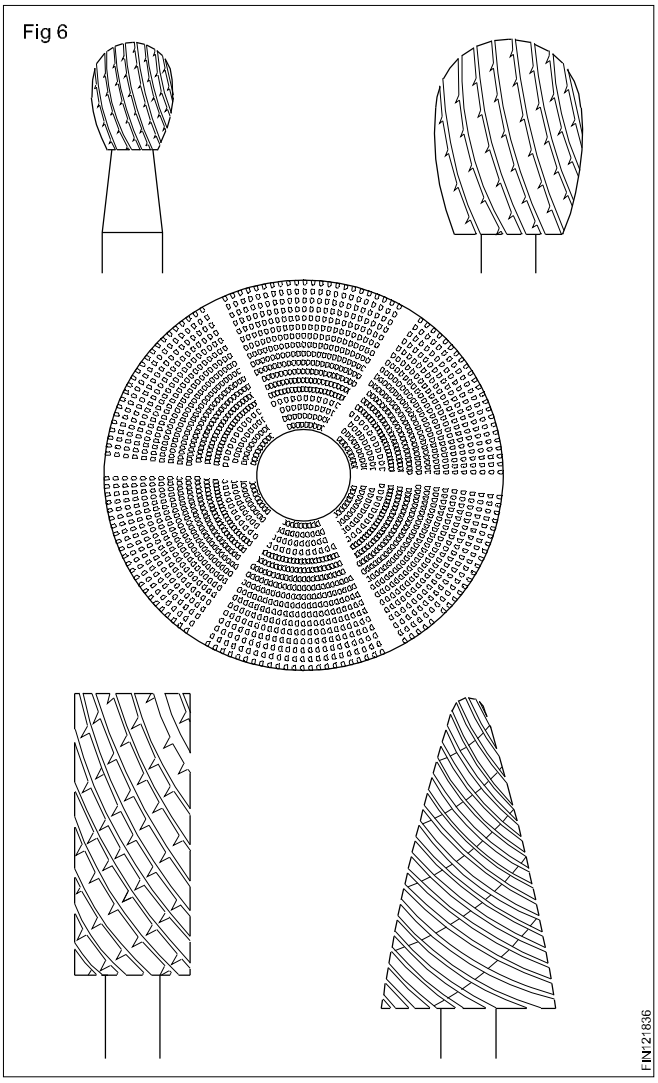
Tinker's file (Fig 5)**:** This file has a rectangular shape with teeth only at the bottom face. A handle is provided on the top. This file is used for finishing automobile bodies after tinkering.

Fig 5



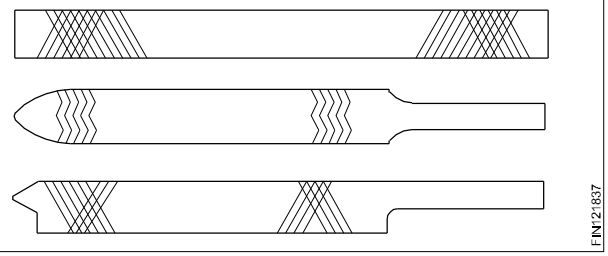
Rotary files (Fig 6)**:** These files are available with a round shank. They are driven by a special machine with a portable motor and flexible shaft. These are used in diesinking and mould-making work.

Fig 6



Machine files for hand filing machine (Fig 7)**:** Machine files are of double cut, having holes or projections to fix to the holder of the filing machine. The length and shape will vary according to the machine capacity. These files are suitable for filing the inner and outer surfaces, and are ideal for diesinking and other tool-room work.

Fig 7



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Pinning of files

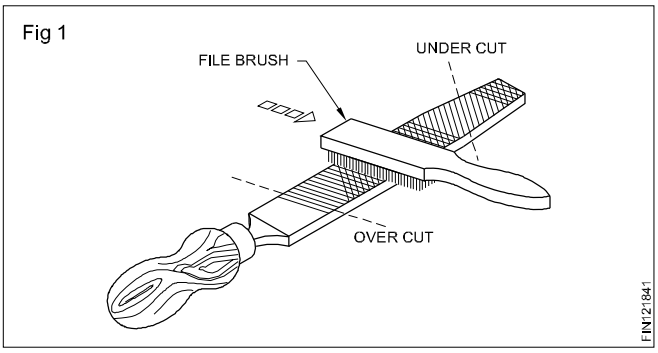
Objective: At the end of this lesson you shall be able to
- **clean the files.**

During filing, sometimes the metal chips (filings) will clog between the teeth of files. This is known as 'pinning' of files.

Files which are pinned will produce scratches on the surface being filed, and also will not bite well.

Pinning of the files is removed by using a file brush also called a file card, (Fig 1) with either forward or backward stroke.

Fig 1



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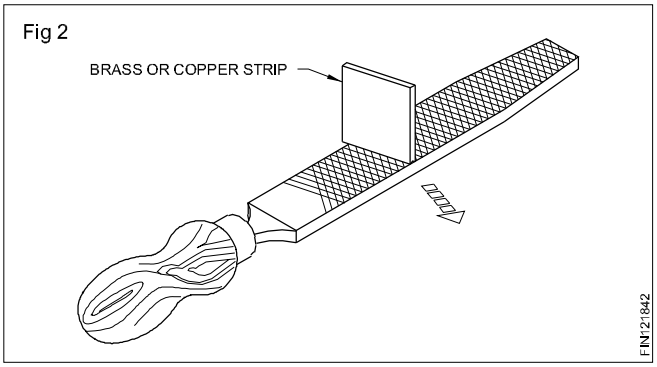
Filings which do not come out easily by the file card should be taken out with a brass or copper strip. (Fig 2)

Fig 2



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For new files, use only soft metal strips (brass or copper) for cleaning. The sharp cutting edges of the files will wear out quickly if a steel file card is used. When filing a workpiece to a smooth finish more 'pinning' will take place because the pitch and depth of the teeth are less.

Application of chalk on the face of the file will help reduce the penetration of the teeth and 'pinning'.

Clean the file frequently in order to remove the filings embedded in the chalk powder.

Care and maintenance

Objective: At the end of this lesson you shall be able to
- **write the care and maintenance of file.**

- Do not use files having the blunt cutting edge
- Remember that files cut on the push stroke. Never apply the pressure on the pull stroke, or you could crush the file teeth, blunt them or cause them to break off.
- Prevent from pinning.
- Giving your files teeth a light brush with oil during long storage.
- Normally do not apply any oil while filing.
- Files should be stored separatelly so that their faces cannot rub against each other or against other tools.

Convexity of files

Objective: At the end of this lesson you shall be able to
- **list the reasons for convexity on files.**

Most files have the faces slightly bellied lengthwise. This is known as convexity of a file. This should not be confused with the taper of a file. A flat file has faces which are convex and it also tapers slightly in width and thickness.

Purpose: If the file is parallel in thickness, all the teeth on the surface of the work will cut. This would require more downward pressure to make the file 'bite' and also more forward pressure to make the file to cut.

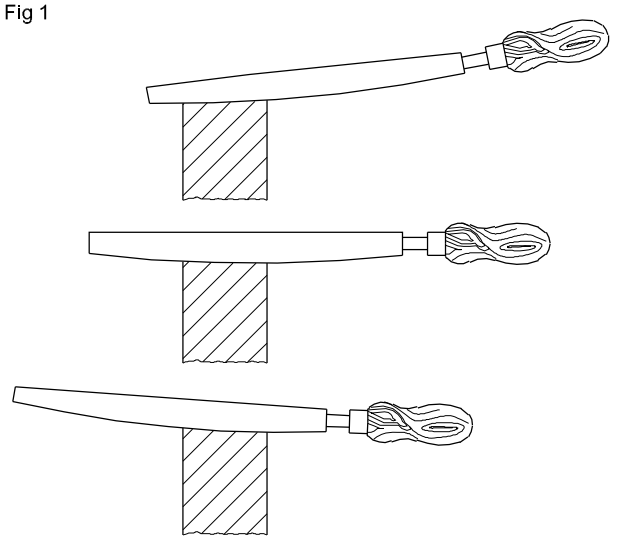
It is more difficult to control a file of uniform thickness.

To produce a flat surface with a file of parallel thickness, every stroke should be straight. But it is not possible due to the see-saw action of the hand.

If the file is made with parallel faces, while giving heat treatment, one face may warp and become concave, and the file will be useless for flat filing.

Excessive chip removal at the front or rear workpiece edge is prevented and filing of the flat surface is made easier because of the convexity on the cutting faces. (Fig 1)

Fig 1



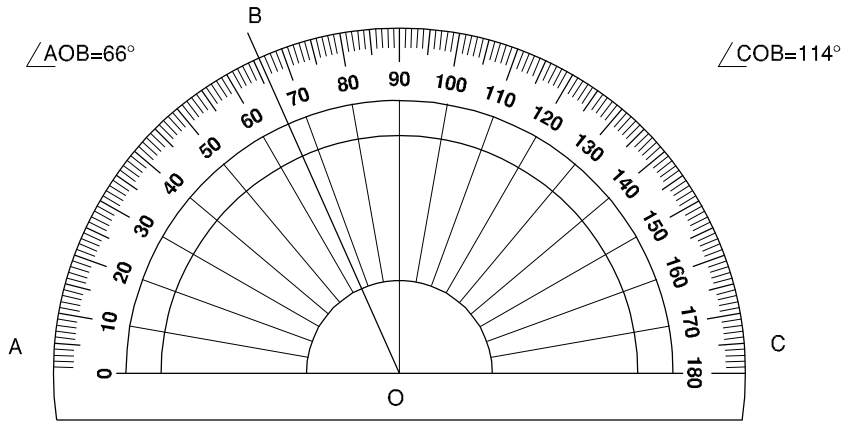
Measurement of angles

Objectives: At the end of this lesson you shall be able to
- **state the units and fractional units of angles**
- **express degrees, minutes and seconds using symbols.**

The unit of an angle

For angular measurements a complete circle is divided into 360 equal parts. Each division is called a degree. (A half circle will have 180°) (Fig 1)

Fig 1



Subdivisions of an angle

For more precise angular measurements, one degree is further divided into 60 equal parts. This division is one MINUTE (‘). The minute is used to represent a fractional part of a degree and is written as 30° 15’.

One minute is further divided into smaller units known as seconds (“). There are 60 seconds in a minute.

An angular measurement written in degrees, minutes and seconds would read as 30° 15' 20".

Examples for angular divisions

1	complete circle	360°
1/2	circle	180°
1/4	of a circle	90°
	(right angle)	

Sub divisions 1 degree or 1° = 60 mts or 60'
1 min or 1' = 60 secs or 60"

Angular measuring instruments (Semi-precision)

Objectives: At the end of this lesson you shall be able to
- **state the names of semi-precision angular measuring instruments**
- **differentiate between bevel and universal bevel gauges**
- **state the features of bevel protractors.**

The most common instruments used to check angles are the:

bevel or bevel gauge (Fig 1)

universal bevel gauge (Fig 2)

bevel protractor. (Fig 3)

Fig 1

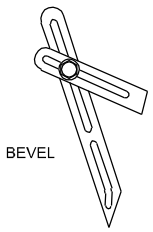


Fig 2

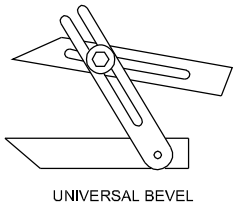


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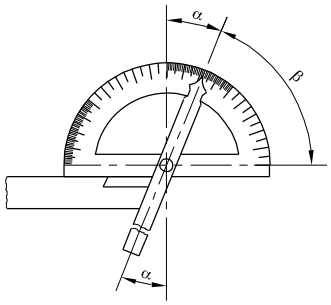
Fig 3



BEVEL PROTRACTOR

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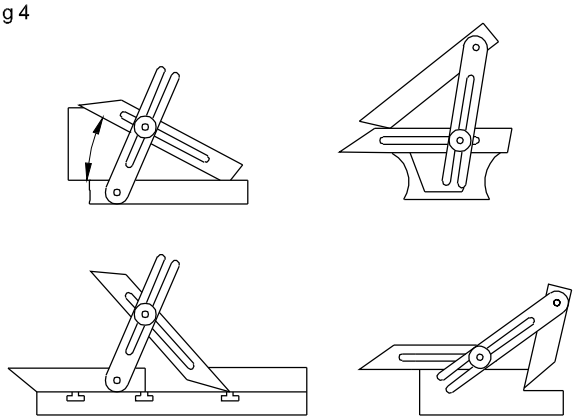
Bevel gauges : The bevel gauges cannot measure angles directly. They are, therefore, indirect angular measuring instruments. The angles can be set and measured with bevel protractors.

Universal bevel gauges : The universal bevel gauge has an additional blade. This helps in measuring angles which cannot be checked with an ordinary bevel gauge. (Fig 4)

Fig 4



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Bevel protractor (Fig 3)**:** The bevel protractor is a direct angular measuring instrument, and has graduation marked from 0° to 180°. Angles can be measured within an accuracy of 1° using this instrument. (Fig 3)

Combination set

Objectives: At the end of this lesson you shall be able to
- **name the parts of a combination set**
- **state the uses of each attachment in a combination set**

Combination sets can be used for different types of work, like layout work, measurement and checking of angles.

The combination set (Fig 1) has a

Protractor head	(1)
Square Head	(2)
Centre head, and a	(3)
Rule	(4)

Protractor Head

The protractor head can be rotated and set to any required angle.

The protractor head is used for marking and measuring angles within an accuracy of 1^0. The spirit level attached to this is useful for setting jobs in a horizontal plane. (Fig.6)

Square Head

The square head has one measuring face at 90^0 and another at 45^0 to the rule.

It is used to mark and check 90^0 and 45^0 angles. It can also be used to set workpieces on the machines and measure the depth of slots. (Fig 2,3 and 4)

Centre Head

This along with the rule is used for locating the centre of cylindrical jobs. (Fig 5)

For ensuring accurate results, the combination set should be cleaned well after use and should not be mixed with cutting tools, either while using or storing.

Fig 1

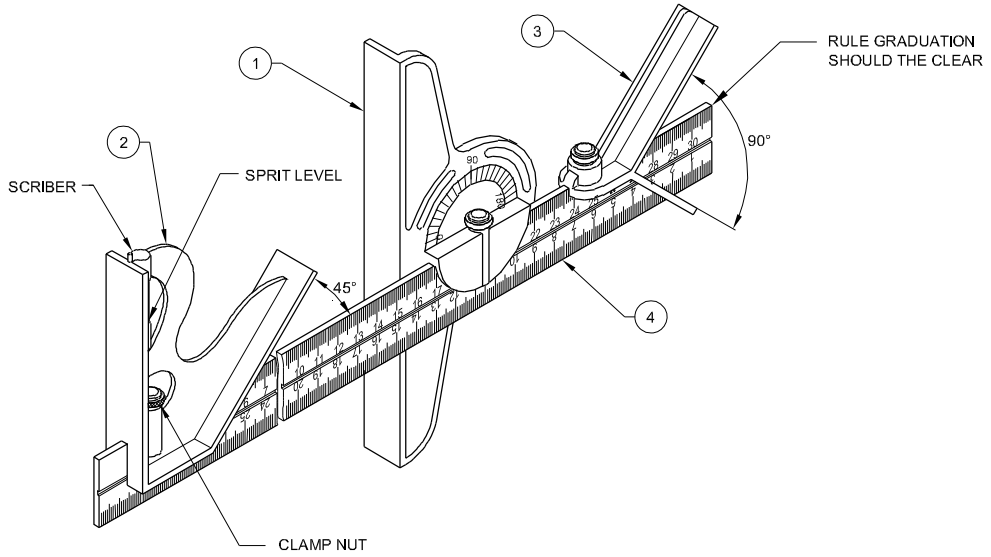


Fig 2

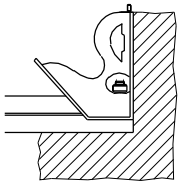


Fig 4

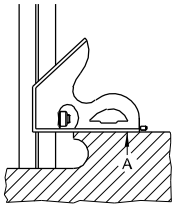


Fig 3

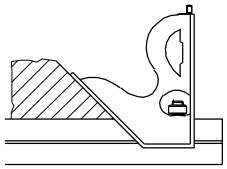


Fig 5

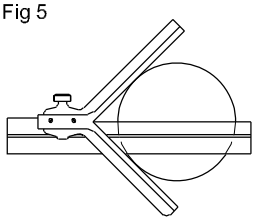
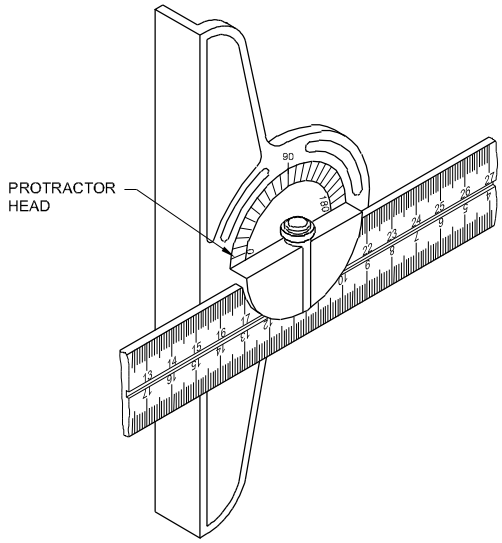


Fig 6



Measuring standards (English & metric)

Objective: At the end of this lesson you shall be able to

- **describe the measuring standards of english and metric units.**

Necessity

All physical quantities are to be measured in terms of standard quantities.

Unit

A unit is defined as a standard or fixed quantity of one kind used to measure other quantities of the same kind.

Classification

Fundamental units and derived units are the two classifications.

Fundamental units

Units of basic quantities of length, mass and time.

Derived units

Units which are derived from basic units and bear a constant relationship with the fundamental units.

Ex : Area, Volume, Pressure, Force, etc.

System of units

F.P.S. system is the British system in which the basic units of length, mass and time are foot, pound and second respectively.

C.G.S. system is the metric system in which the basic units of length, mass and time are centimetre, gram and second respectively.

M.K.S system is another metric system in which the basic units of length, mass and time are metre, kilogram and second respectively.

S.I. units is referred to as Systems International units which is again of metric and the basic units, their names and symbols are Listed in table - 1

Table 1

Basic Quantity	Metric Unit		British unit	
	Name	Symbol	Name	Symbol
Length	Metre	m	Foot	F
Mass	Kilogram	kg	Pound	P
Time	Second	S	Second	S
Current	Ampere	A	Ampere	A
Temperature	Kelvin	K	Farenheit	F^o
Light intensity	Candela	Cd	Candela	Cd

Fundamental units and derived units are the two classification of units.

Length, mass and time are the fundamental units in all the systems (ie) F.P.S, C.G.S, M.K.S and S.I systems.