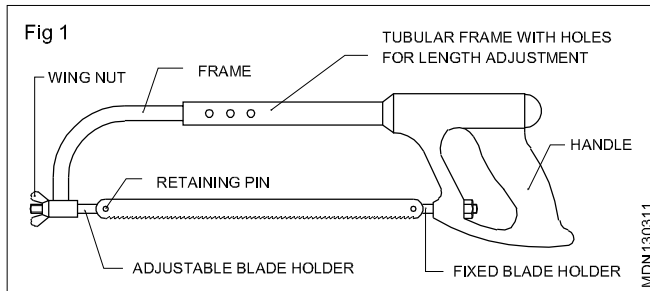


Hacksaw frame and blade

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

- name the parts of a hacksaw frame
- specify hacksaw frames
- state the different types of hacksaw frames and their uses.

The hand hacksaw is used along with a blade to cut metals of different sections. It is also used to cut slots and contours.



The parts are identified in the (Fig 1)

Types of hacksaw frames

The two different types of hacksaw frames are solid frame and adjustable frames.

Solid frame

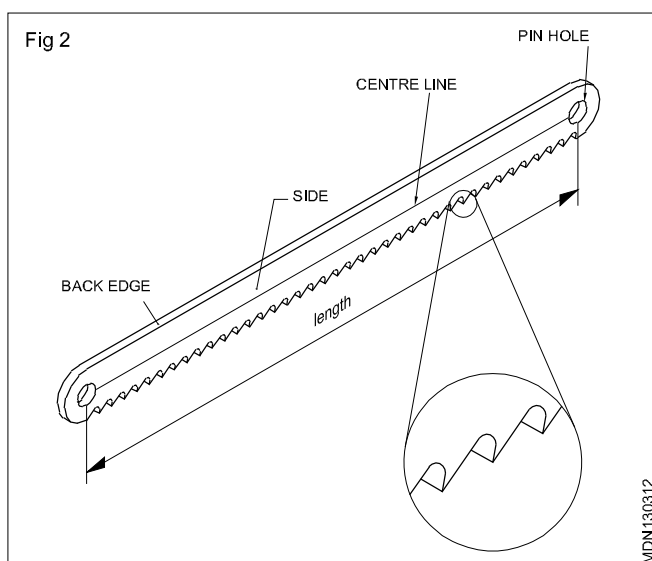
Only a particular standard length of blade can be fitted to this frame.

Adjustable frame (Flat type)

Different standard lengths of blades can be fitted to this frame.

Adjustable frame (Tubular type)

This is the most commonly used type. It gives a better grip and control, while sawing.



For proper working. It is necessary to have frames of rigid construction.

Hacksaw blades (Fig. 2)

A hacksaw blade is a thin narrow steel band with teeth and two pin holes at the ends. It is used along with a hacksaw frame. The blade is made of either low alloy steel (LAS) or high speed steel (HSS) and is available in standard lengths of 250 mm and 300 mm.

Types of hacksaw blades

Two types of hacksaw blades are available - all hard blades and flexible blades.

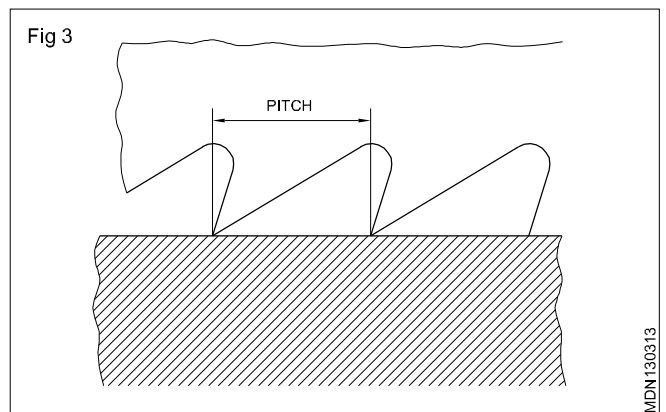
All hard blades

These are hardened to the full width between the pin holes.

Flexible blades

For these types of blades. Only the teeth are hardened. Because of their flexibility, these blades are useful for cutting along curved lines.

Pitch of the blade (Fig. 3)



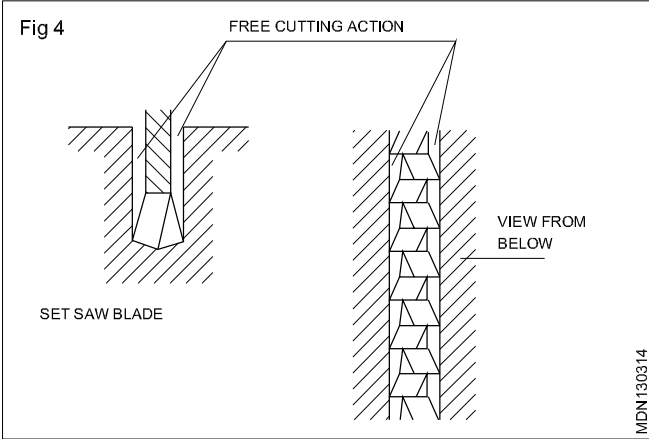
The distance between adjacent teeth is known as the pitch of the blade.

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

Hacksaw blades are designated according to their length, pitch and type.

To prevent the saw 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 saw blade. This is achieved by the setting the saw teeth. There are two types of saw 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.

Wave set (Fig. 5)

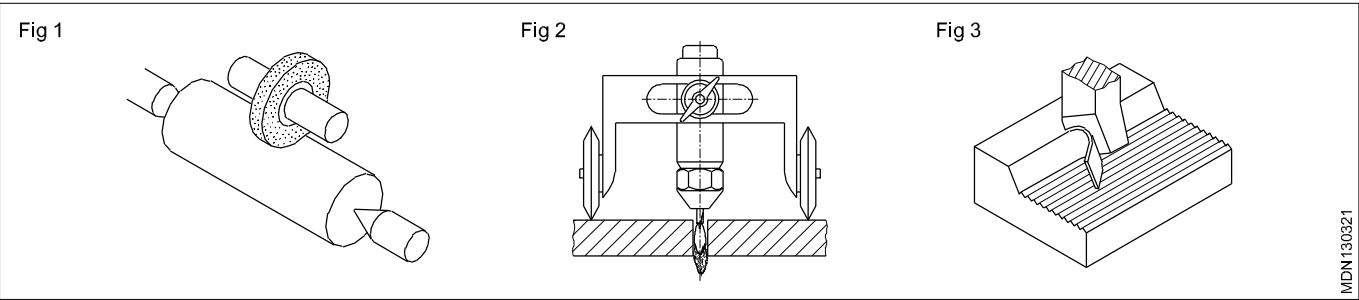
In this, the teeth of the blade are arranged in a wave form. Sets of blades can be classified as follows

Elements of a file

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

Methods of Material Cutting

The three methods of metal cutting are abrasion (Fig.1). Fusion (Fig 2) and Incision (Fig 3)



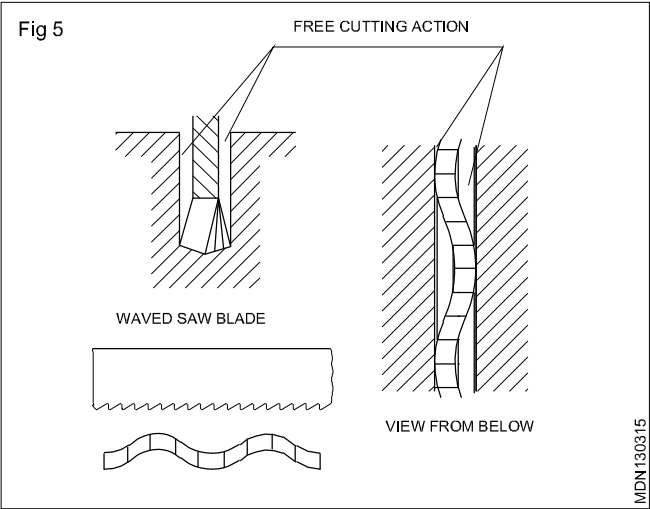
Filing is a method for removing excess material from a work pieces by using a file which acts as a cutting tool. (Fig 4) shows how to hold a file. Files are available many shapes and sizes.

Parts of a file (Fig 5)

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

Tip or Point

The end opposite to tang



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

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

Face or side

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

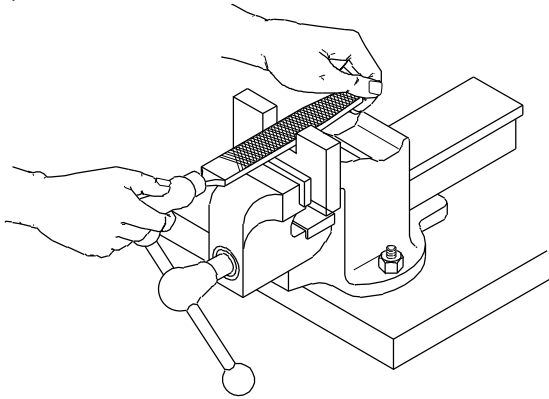
Edge

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

Heel

The portion of the broad part without teeth.

Fig 4



MDN130324

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

Parts of a file (Fig 5)

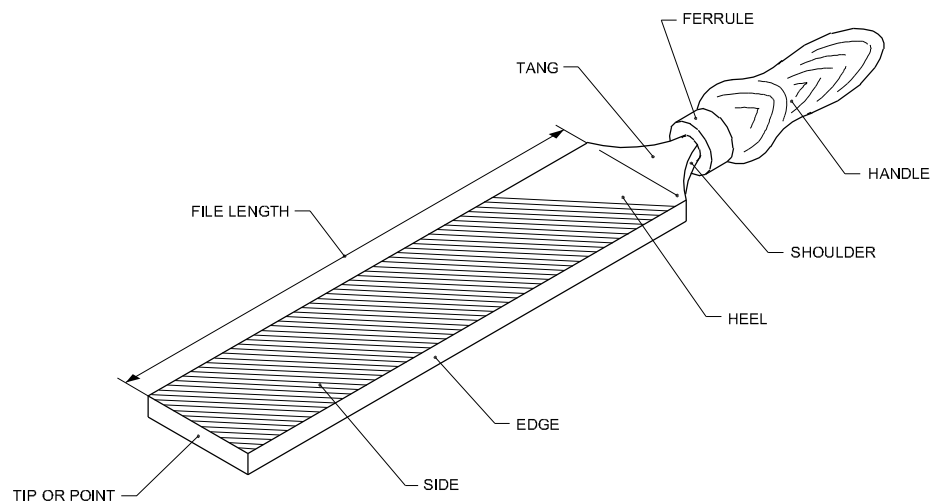
Ferrule

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.

Fig 5



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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 a 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.

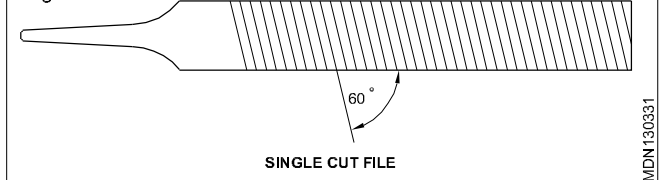
Single cut. Double cut. Rasp cut and curved cut.

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° to the centre line. It can 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.

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

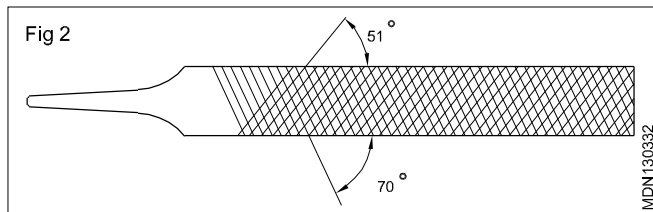
Fig 1



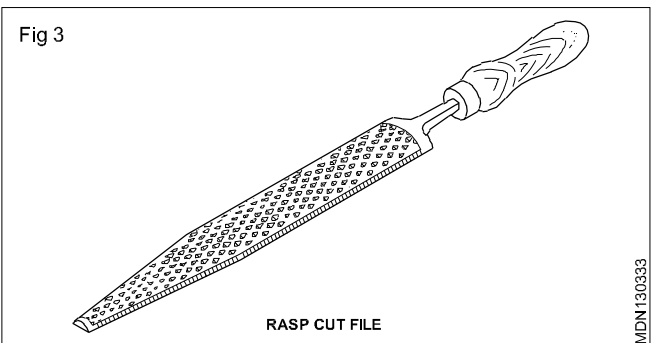
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Double cut file (Fig. 2)

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° . The other cut, made diagonal to this, is known as UPCUT and is at an angle of 51° . This removes stock faster than the single cut file.

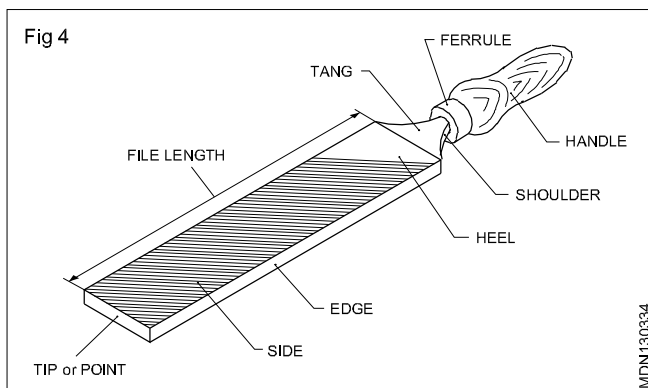


Rasp out file (Fig. 3)



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.

Curved cut file (Fig. 4)



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

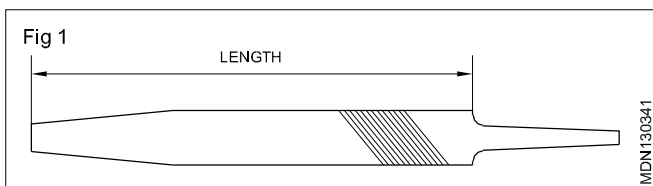
Objectives : At the end of this lesson you shall be able to

- 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.

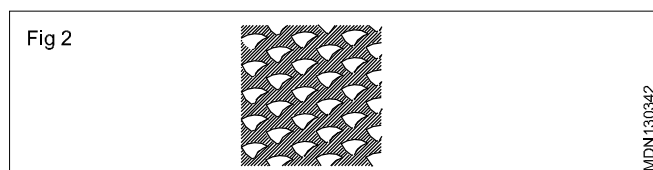
Files are specified according to their length, grade, cut and shape.

Length is the distance from the tip of a file to the heel. (Fig 1)

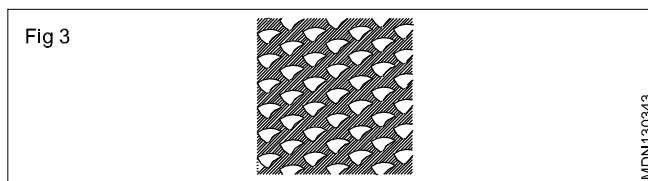


File grades are determined by the spacing of the teeth.

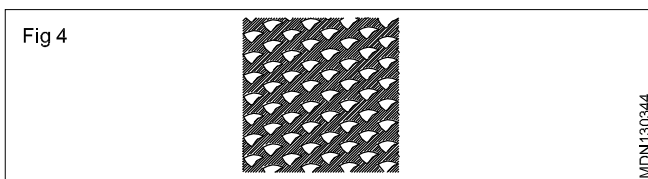
A round file (Fig 2) is used for removing rapidly a larger quantity of metal. It is mostly used for trimming the rough edges of soft metal castings.



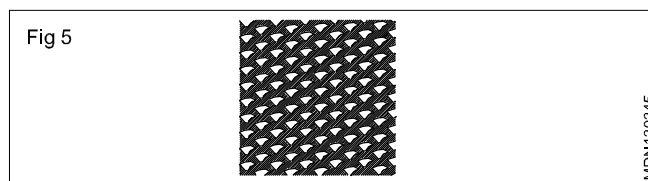
A bastard file (Fig 3) is used in cases where there is a heavy reduction of material.



A second cut file (Fig 4) 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.

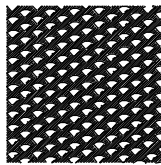


A smooth file (Fig 5) is used to remove small quantity of material and to give a good finish.



A **dead smooth** (Fig 6) file is used to bring to accurate size with a high degree of finish.

Fig 6



MDN130346

The most used grades of files are bastard, second cut, smooth and dead smooth. These are 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.

File - Applications

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

- state the features of flat and hand files
- state the application of flat and hand files.

Files are made in different shapes so as to be able to file and finish components to different shapes.

The shape of files is usually specified by their cross section.

The files useful for this exercise are flat files and hand files.

Flat files

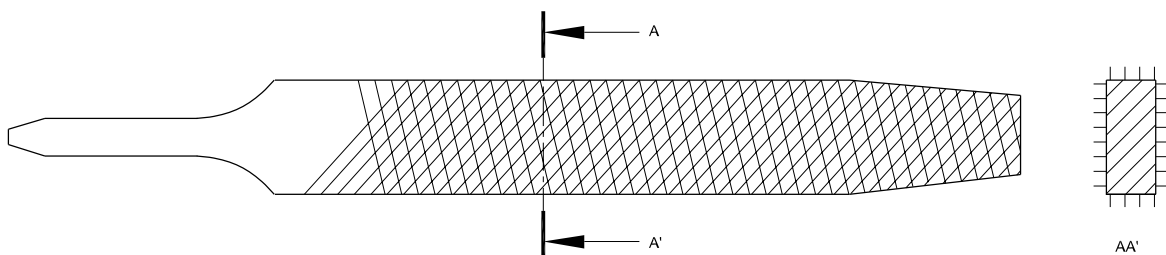
These files are of a rectangular cross section. The edges along the width of these files are parallel up to two-thirds of the length, and then they taper towards the point. The

faces are double cut, and the edges single cut. These files are used for general purpose work. They are useful for filling and finishing external and internal surfaces.

Hand files (Fig 1)

These files are similar to the flat files in their cross section. The edges along the width are parallel through 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 filling surfaces which are at right angles to surfaces already finished.

Fig 1



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Shapes of files

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

- name the different shapes of files
- state the uses of Square, Round, Half Round, Triangular and Knife-edge files.

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

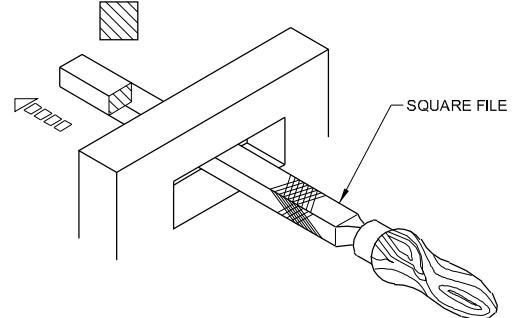
Half round file, Triangular file and Knife-edge file.

(Flat and hand files have already been discussed).

Square File

The square file is square in its cross section. It is used for filling square holes, internal square corners, rectangular opening, keyways and spines. (Fig 1)

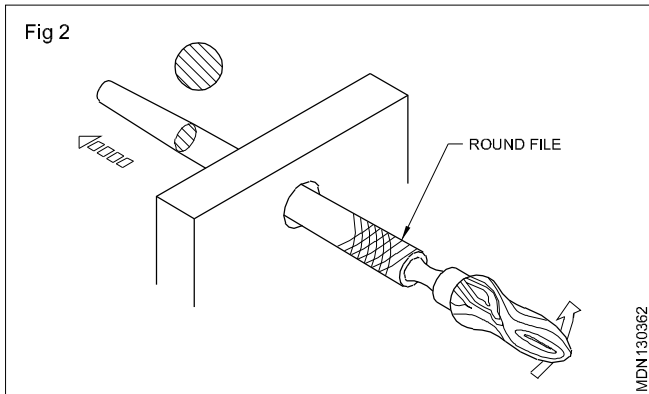
Fig 1



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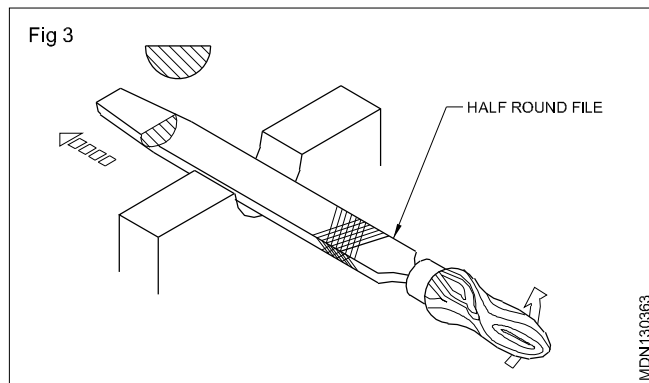
Round file

A round file is circular in its cross section. It is used for enlarging the circular holes and filing profiles with fillets. (Fig 2)



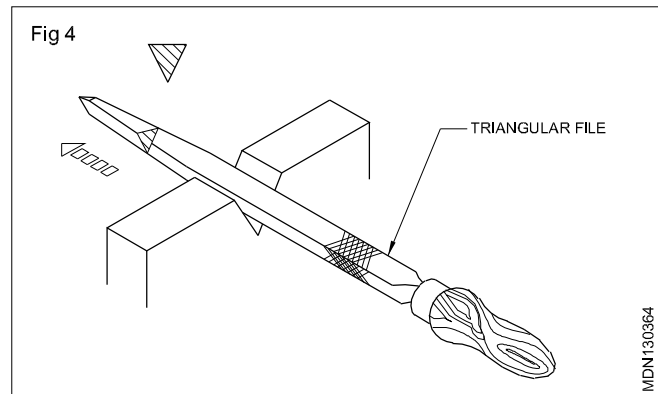
Half round File

A half round file is in the shape of a segment of a circle. It is used for filing internal curved surfaces (Fig 3)



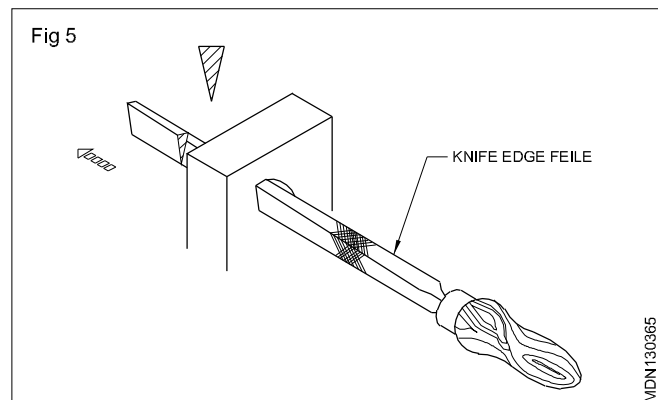
Triangular File

A triangular file is of a triangular cross section. It is used for filing corners and angles which are more than 60°. (Fig 4)



Knife-edge File

A knife-edge file has the cross section of a sharp triangle. It is used for filing narrow grooves and angles above 10°. (Fig 5)



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

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

Off- hand grinding with bench and pedestal grinders

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

- state the purposes of off-hand grinding
- state the features of bench and pedestal grinders.

Off-hand grinding is the operation of removing material which does not require great accuracy in size or shape. This is carried out by pressing the workpiece by hand against a grinding wheel.

Off-hand grinding is performed for rough grinding of jobs and sharpening of scribes, punches, chisels, twist drills single point cutting tools etc.

Off-hand grinding is performed with a bench or pedestal grinder (Fig 1 and 2)

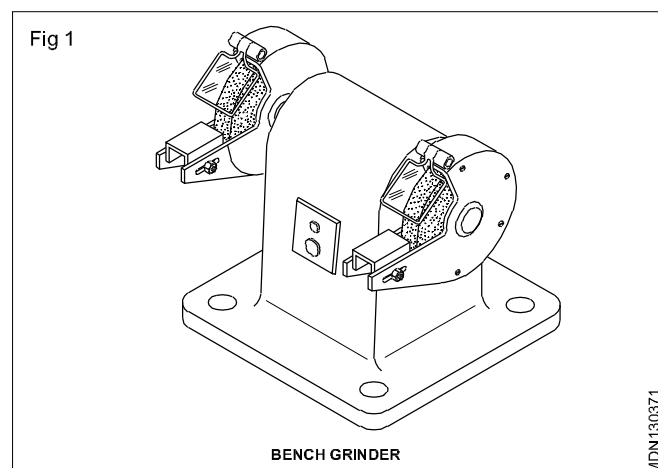
Bench grinders

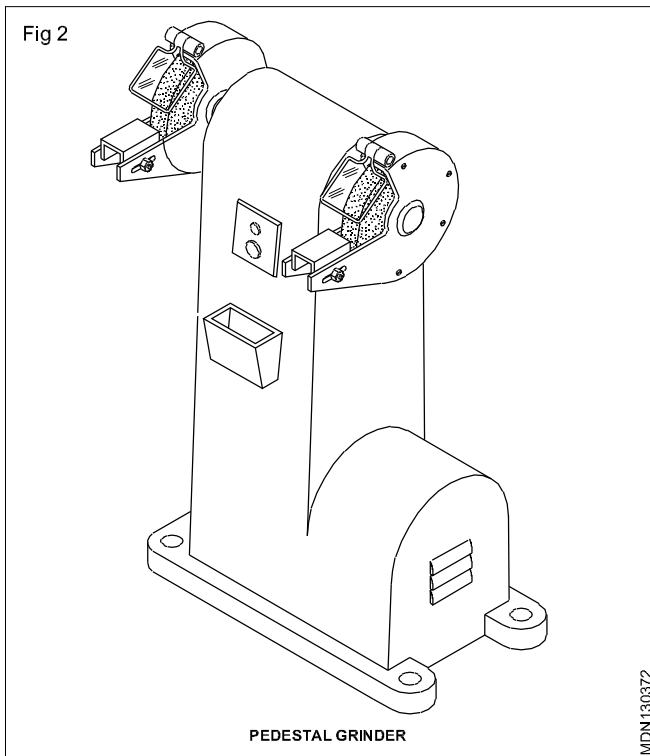
Bench grinders are fitted to a bench or table, and are useful for light duty work.

Pedestal grinders

Pedestal grinders are mounted on a base (pedestal), which

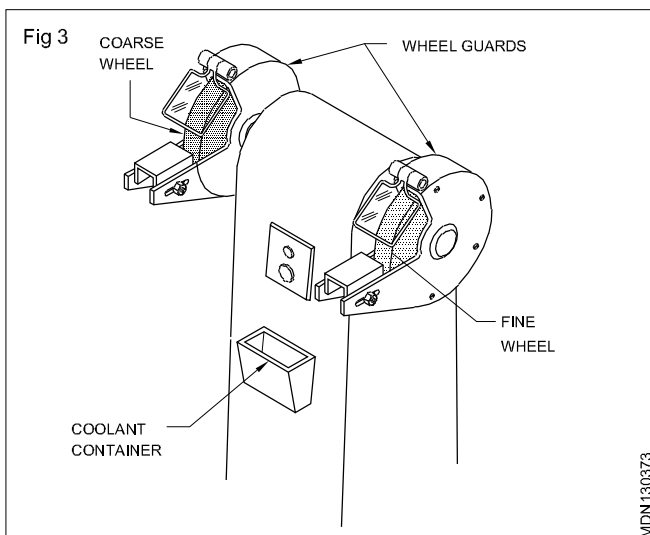
is fastened to the floor. They are used for heavy duty work.





These grinders consist of an electric motor and two spindles for mounting grinding wheels. On one spindle a coarse-grained wheel is fitted, and on the other, a fine grained wheel. For safety, while working, wheel guards are provided. (Fig 3)

A coolant container is provided for frequent cooling of the work. (Fig 3)



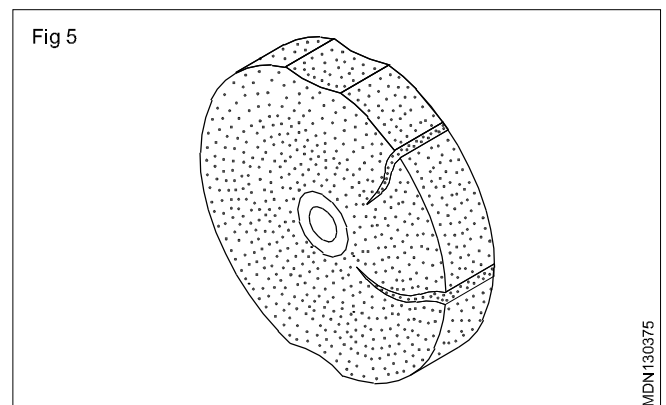
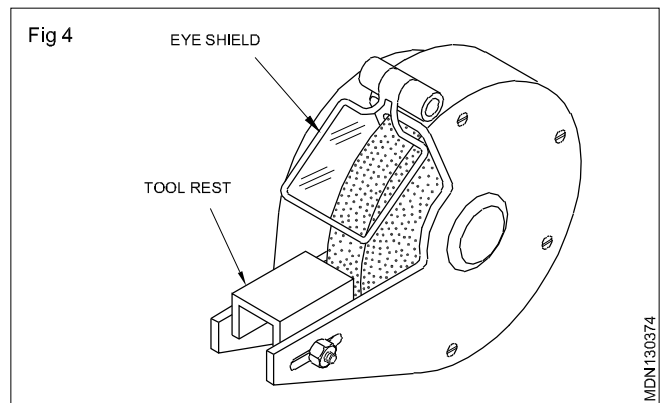
Adjustable work-rests are provided for both wheels to support the work while grinding. These work-rests must be set very close to the wheels. (Fig 4)

Extra eye-shields are also provided for the protection of the eyes. (Fig 4)

While grinding

Adjust the tool-rest as close to the wheel as possible. The maximum recommended gap is 2 mm. This will help to prevent the work from being caught between the tool-rest and the wheel. (Fig 5)

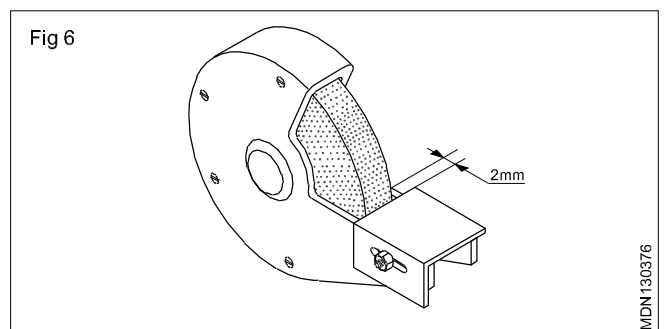
Small jobs should be held with pliers or other suitable tools. (Fig 5)



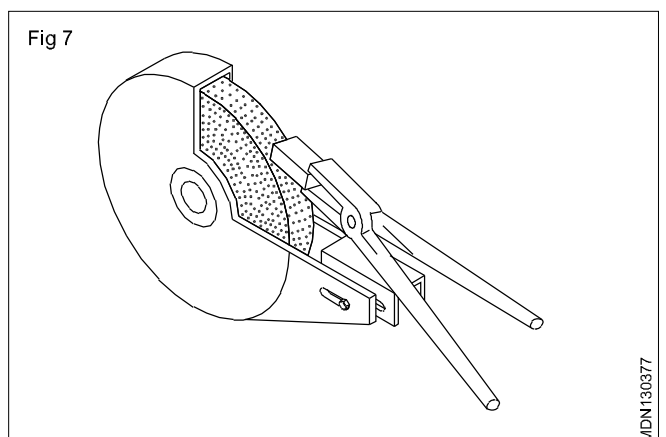
Never hold jobs with cotton waste or similar materials.

Use gloves for your hands while grinding heavy jobs.

Do not grind on the side of the grinding wheels. (Fig 6)



Move the work across the full face of the wheel to prevent uneven wearing of the grinding wheel. (Fig 7)



Safe working on off - hand grinders

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

- **work safety on an off-hand grinder.**

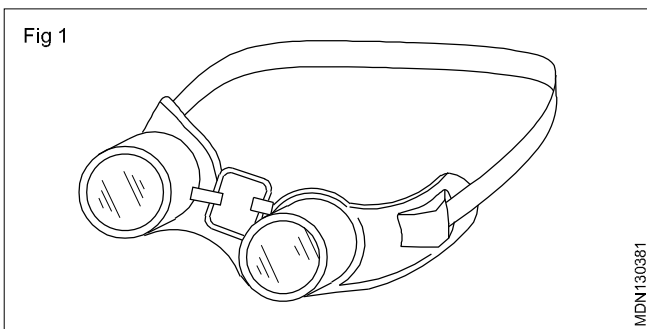
How to work on an off-hand grinder?

While working on off-hand grinders, it is important to observe the following safety measures.

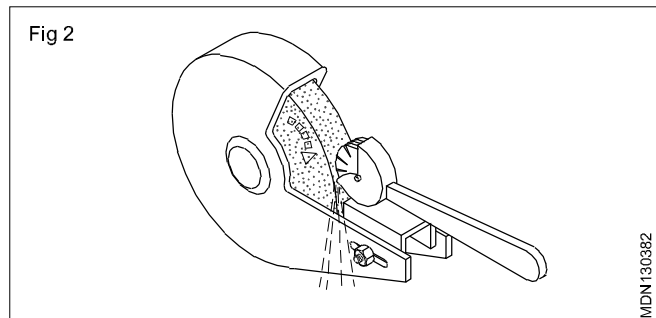
BEFORE STARTING

Make sure the grinding wheel guards are in place.

Wear safety goggles while grinding. (Fig 1)



Do not work on grinding wheels which are loaded or glazed. Dress and true wheels whenever necessary. (Fig.2)



If any abnormal sound is noticed, stop the machine. Cracked or improperly balanced wheels are dangerous.

Stand on one side of the machine while starting.

Indian standard system of limits & fits-terminology

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

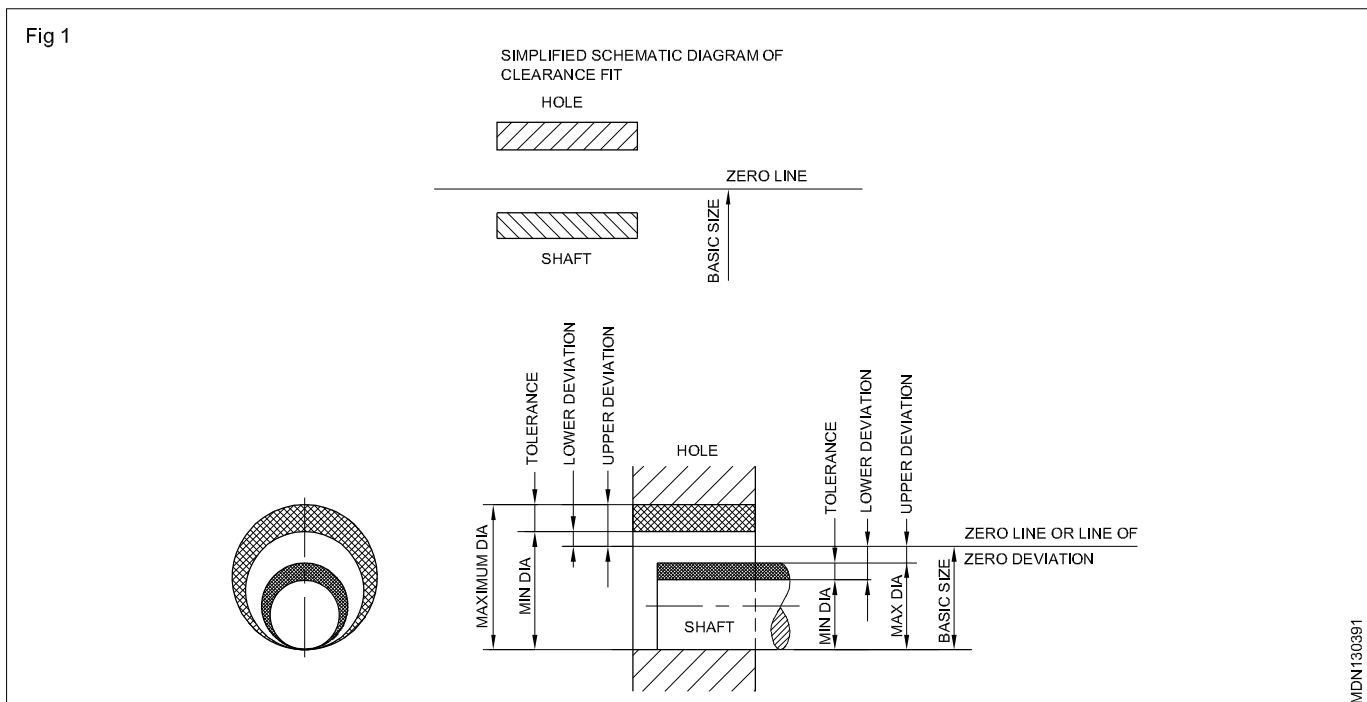
- **state the terms under the BIS system of limits and fits.**
- **define each term under the BIS system of limits and fits.**

Size

It is a number expressed in a particular unit in the measurement of length.

Basic size

It is the size based on which the dimensional deviations are given. (Fig 1)



Actual size

It is the size of the component by actual measurement after it is manufactured. It should be between the two limits of size if the component is to be accepted.

Limits of size

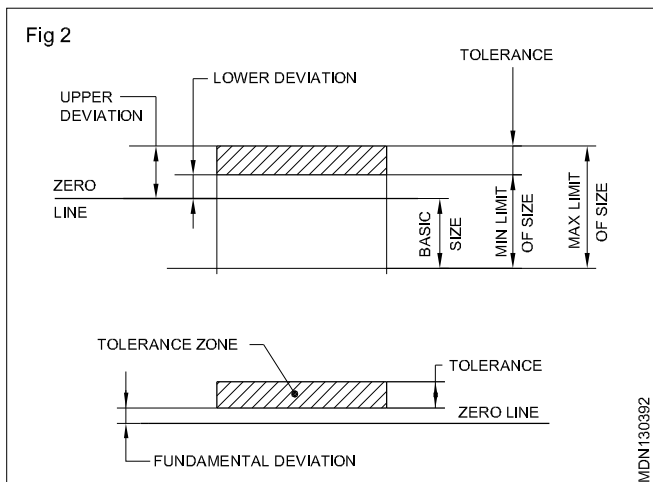
These are the extreme permissible sizes within which the operator is expected to make the component. (Fig 2) (Maximum and minimum limits)

Maximum limit of size

It is the greater of the two limit sizes. (Fig 2) (Table 1)

Minimum limit of size

It is the smaller of the two limits of size. (Fig 2) (Table 1)



Hole

In the BIS system of limits & fits, all internal features of a component including those which are not cylindrical are designated as 'hole'. (Fig 3)

Shaft

In the BIS system of limits & fits, all external features of a component including those which are not cylindrical are designated as shaft. (Fig 3)

Deviation

It is the algebraic difference between a size, to its corresponding basic size. It may be positive, negative or zero. (Fig 2)

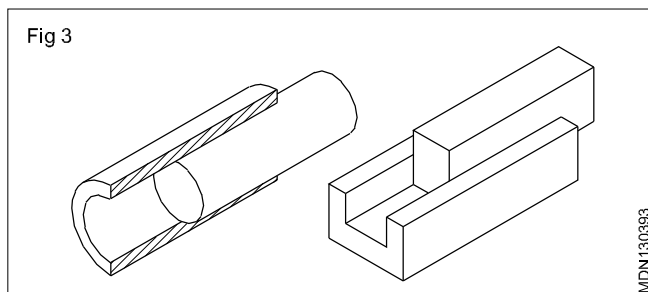


TABLE 1 (Examples)

Sl.No	Size of Component	Upper Deviation	Lower Deviation	Max-Limit of size	Min-Limit of Size
1	+0.008 20-0.005	+0.008	-0.005	20.008	19.995
2	+0.028 20+0.007	+0.028	+0.007	20.028	20.007
3	-0.012 20-0.021	-0.012	-0.021	19.988	19.979

Upper deviation

It is the algebraic difference between the maximum limit of size and its corresponding basic size. (Fig 2) (Table 1)

Lower deviation

It is the algebraic difference between the minimum limit of size and its corresponding basic size (Fig 2) (Table 1)

Upper deviation is the deviation which gives the maximum limit of size. Lower deviation is the deviation which gives the minimum limit of size.

Actual deviation

It is the algebraic difference between the actual size and its corresponding basic size (Fig 2)

Tolerance

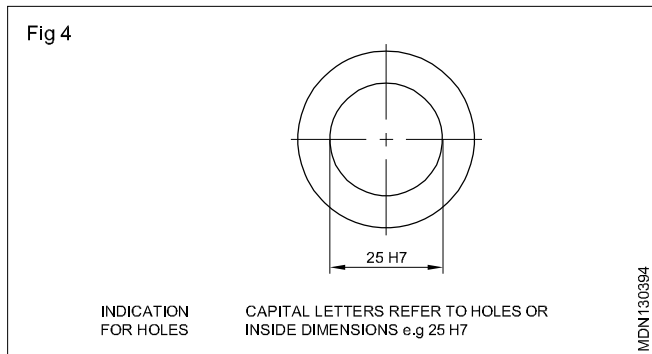
It is the difference between the maximum limit of size and the minimum limit of size. It is always positive and is expressed only as a number without a sign. (Fig 2)

Zero line

In graphical representation of the above terms, the zero line represents the basic size. This line is also called as the line of zero deviation. (Fig 1 and 2)

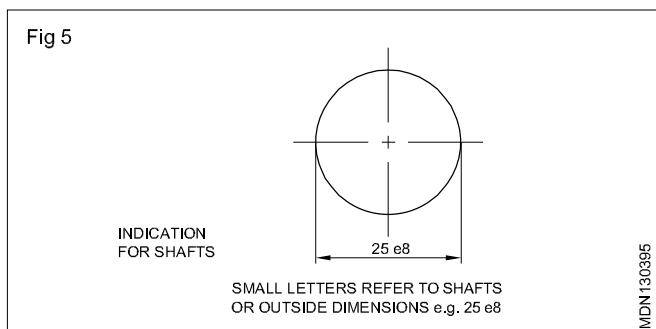
Fundamental deviation

There are 25 fundamental deviations in the BIS system represented by letter symbols (capital letters for holes and small letters for shafts). i.e for holes - ABCD.....Z excluding I, L, O, Q&W. (Fig 4)

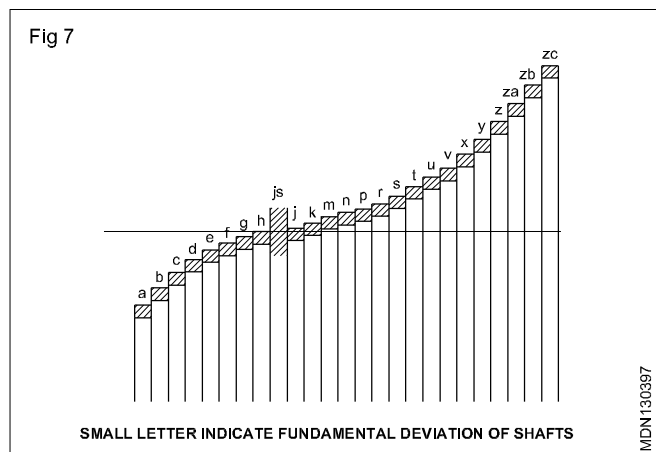
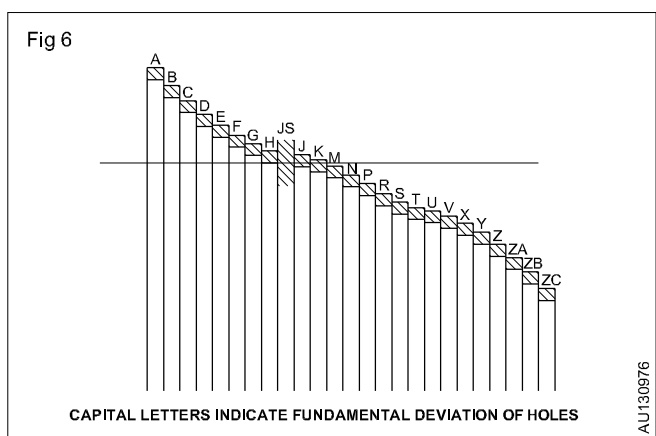


In addition to the above, four sets of letters, JS, ZA, ZB & ZC are included. For fine mechanisms CD, EF and FG are added. (Ref. IS:919 Part II - 1979)

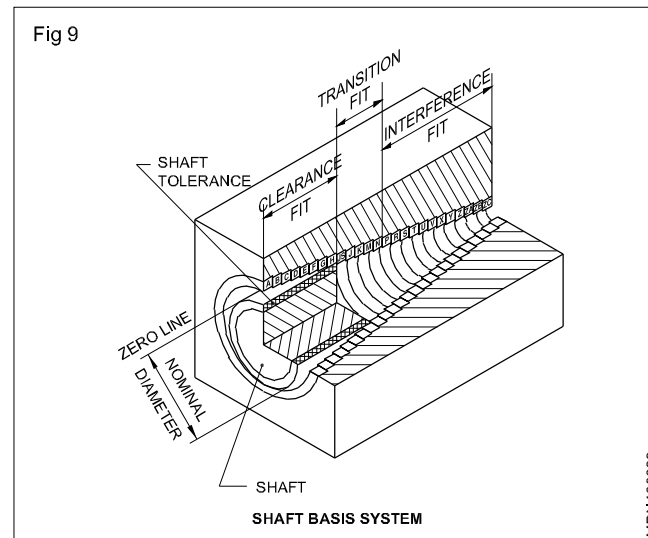
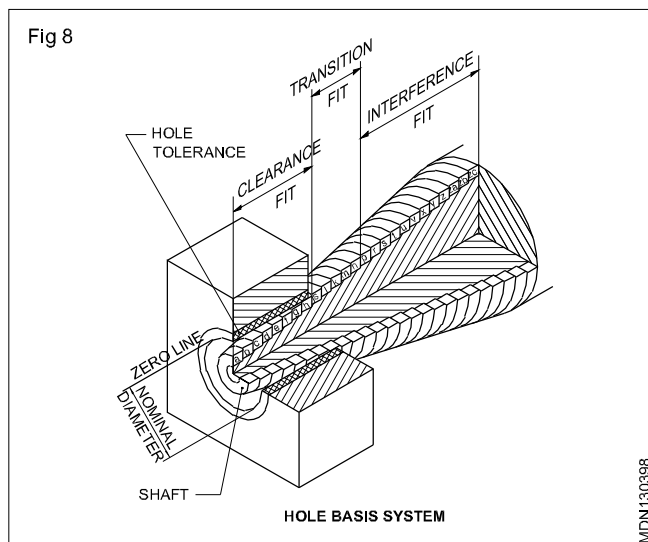
For shafts, the same 25 letter symbols but in small letters are used. (Fig 5)



The position of tolerance zone with respect to the zero line is shown in figs 6 and 7

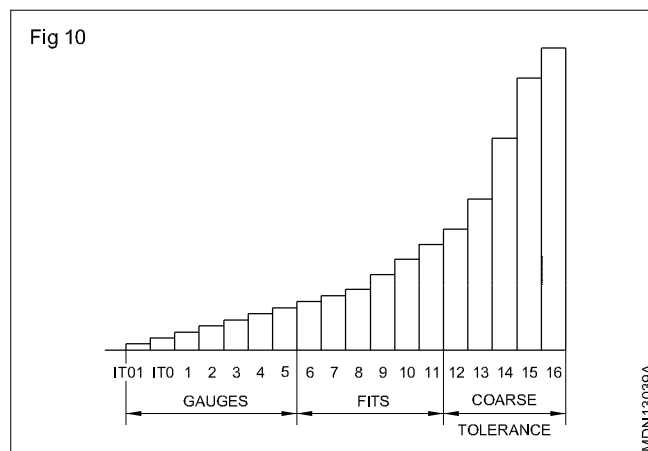


The fundamental deviations are for achieving the different classes of fits. (Fig 8 and 9)



Fundamental tolerance

This is also called as 'grade of tolerance'. In the Indian Standard System, there are 18 grades of tolerances represented by number symbols, both for hole and shaft, denoted as IT01, IT0, IT1.... to IT16. (Fig 10) A high number gives a large tolerance zone.



The grade of tolerance refers to the accuracy of manufacture.

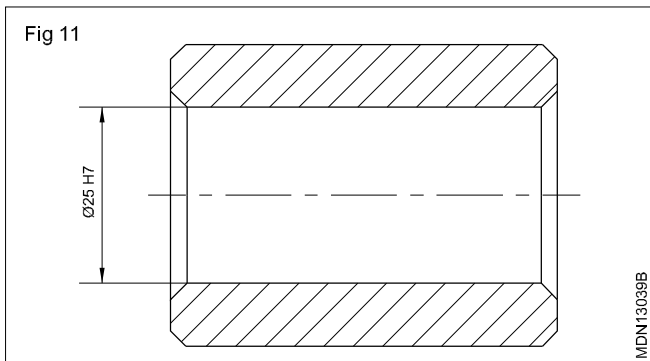
In a standard chart, the upper and lower deviations for each combination of fundamental deviation and fundamental tolerance are indicated for sizes ranging upto 500 mm. (Refer to IS 919)

Toleranced size

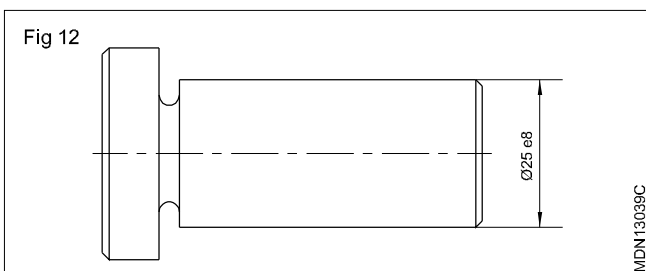
This includes the basic size, the fundamental deviation and the grade of tolerance.

Example

25H7 - toleranced size of a hole whose basic size is 25. The fundamental deviation is represented by the letter symbol H and the grade of tolerance is represented by the number symbol 7. (Fig 11)



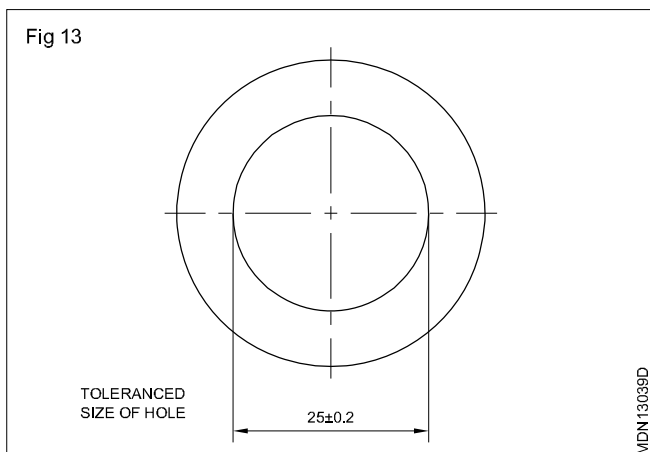
25 e8 - is the toleranced size of a shaft whose basic size is 25. The fundamental deviation is represented by the letter symbol e and the grade of tolerance is represented by the number 8. (Fig 12)



A very wide range of selection can be made by the combination of the 25 fundamental deviations and 18 grades of tolerances.

Example

In fig. 13, a hole is shown as 25 ± 0.2 which means that 25 mm is the basic dimension and ± 0.2 is the deviation.



As pointed out earlier, the permissible variation from the basic dimension is called 'DEVIATION'.

The deviation is mostly given on the drawing with the dimensions.

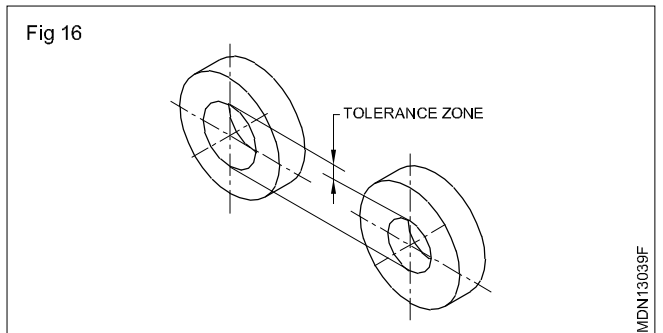
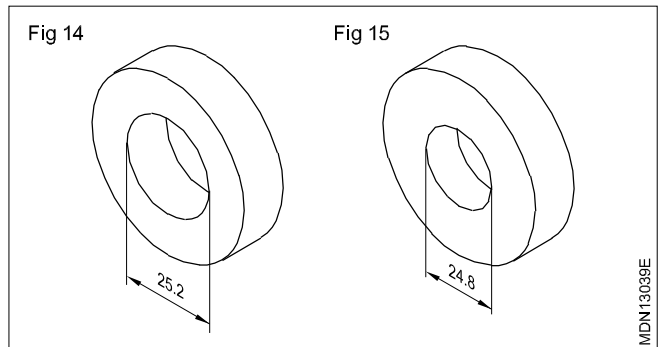
In the example 25 ± 0.2 , ± 0.2 is the deviation of the hole of 25 mm diameter. (Fig 13) This means that the hole is of acceptable size if its dimension is between

$$25 + 0.2 = 25.2 \text{ mm}$$

$$\text{or } 25 - 0.2 = 24.8 \text{ mm.}$$

25.2 mm is known as the maximum limit. (Fig 14)

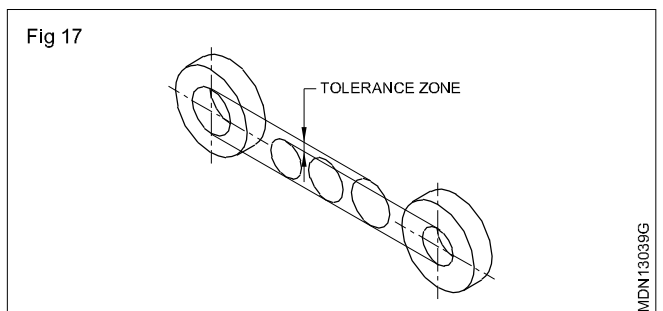
24.8 mm is known as the minimum limit. (Fig 15)



The difference between the maximum and minimum limits is the TOLERANCE. Tolerance here is 0.4 mm. (Fig 16)

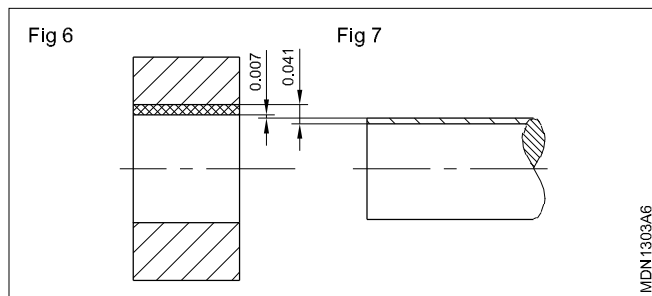
All dimensions of the hole within the tolerance zone are of acceptable size as in Fig 17.

As per IS 696, while dimensioning the components as a drawing convention, the deviations are expressed as tolerances.



The minimum clearance is $20.000 - 19.993 = 0.007$ mm. (Fig 6)

The maximum clearance is $20.021 - 19.980 = 0.041$ mm. (Fig 7)



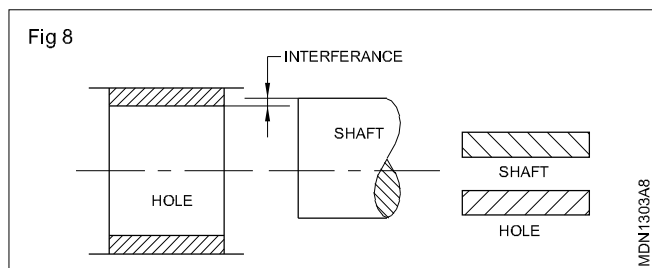
There is always a clearance between the hole and the shaft. This is the clearance fit.

Interference

It is the difference between the size of the hole and the shaft before assembly, and this is negative. In this case, the shaft is always larger than the hole size.

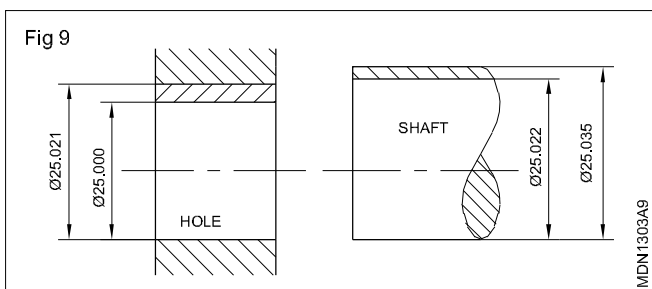
Interference Fit

It is a fit which always provides interference. Here the tolerance zone of the hole will be below the tolerance zone of the shaft. (Fig 8)



Example Fit 25 H7/p6 (Fig 9)

The limits of hole are 25.000 and 25.021 mm and the limits of the shaft 25.022 and 25.035 mm. The shaft is always bigger than the hole. This is an interference fit.



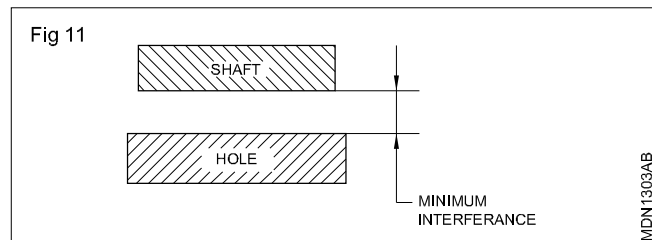
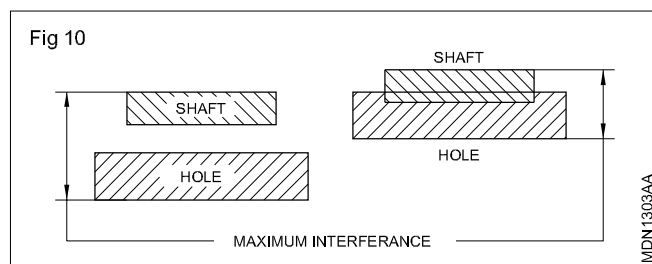
Maximum interference

In an interference fit or transition fit, it is the algebraic difference between the minimum hole and the maximum shaft. (Fig 10)

Minimum interference

In an interference fit, it is the algebraic difference between the maximum hole and the minimum shaft. (Fig 11)

In the example (Fig 9)



The maximum interference is $= 25.035 - 25.000$

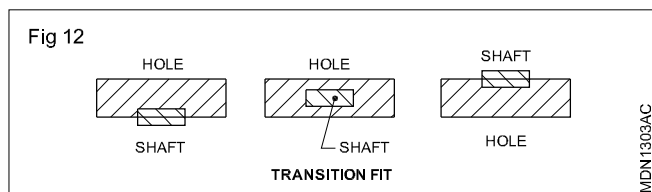
$= 0.035$

The minimum interference is $= 25.022 - 25.021$

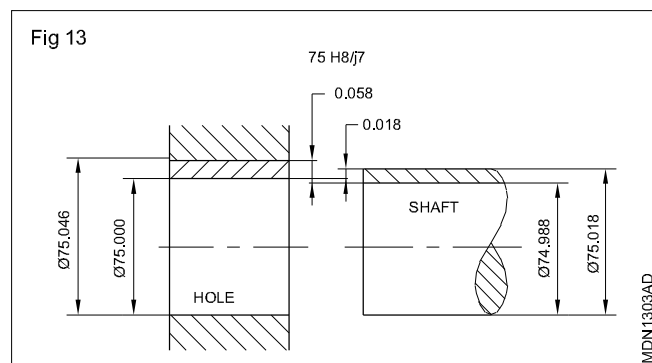
$= 0.001$

Transition fit

it is a fit which may sometimes provide clearance, and sometimes interference. When this class of fit is represented graphically, the tolerance zones of the hole and shaft will overlap each other. (Fig 12)



Example Fit 75 H8/j7 (Fig 13)



The limits of the hole are 75.000 and 75.046 mm and those of the shaft are 74.988 and 74.988 mm.

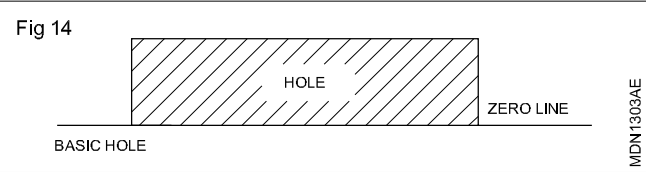
Maximum Clearance $= 75.046 - 74.988 = 0.058$ mm.

If the hole is 75.000 and the shaft 75.018 mm, the shaft is 0.018 mm, bigger than the hole. This results in interference. This is transition fit because it can result in a clearance fit or an interference fit.

Hole basis system

In a Standard system of limits and fits, where the size of the hole is kept constant and the size of the shaft is varied to get the difference class of fits, then it is known as, the hole basis system.

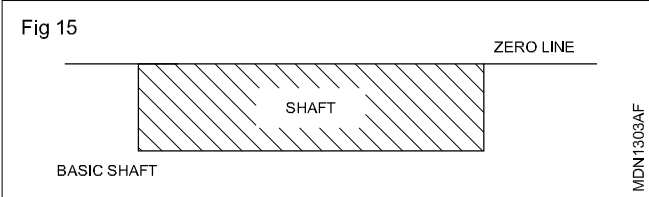
The fundamental deviation symbol 'H' is chosen for the holes, when the hole basis system is followed. This is because the lower deviation of the hole 'H' is zero. It is known as 'basic hole'. (Fig 14)



Shaft basis system

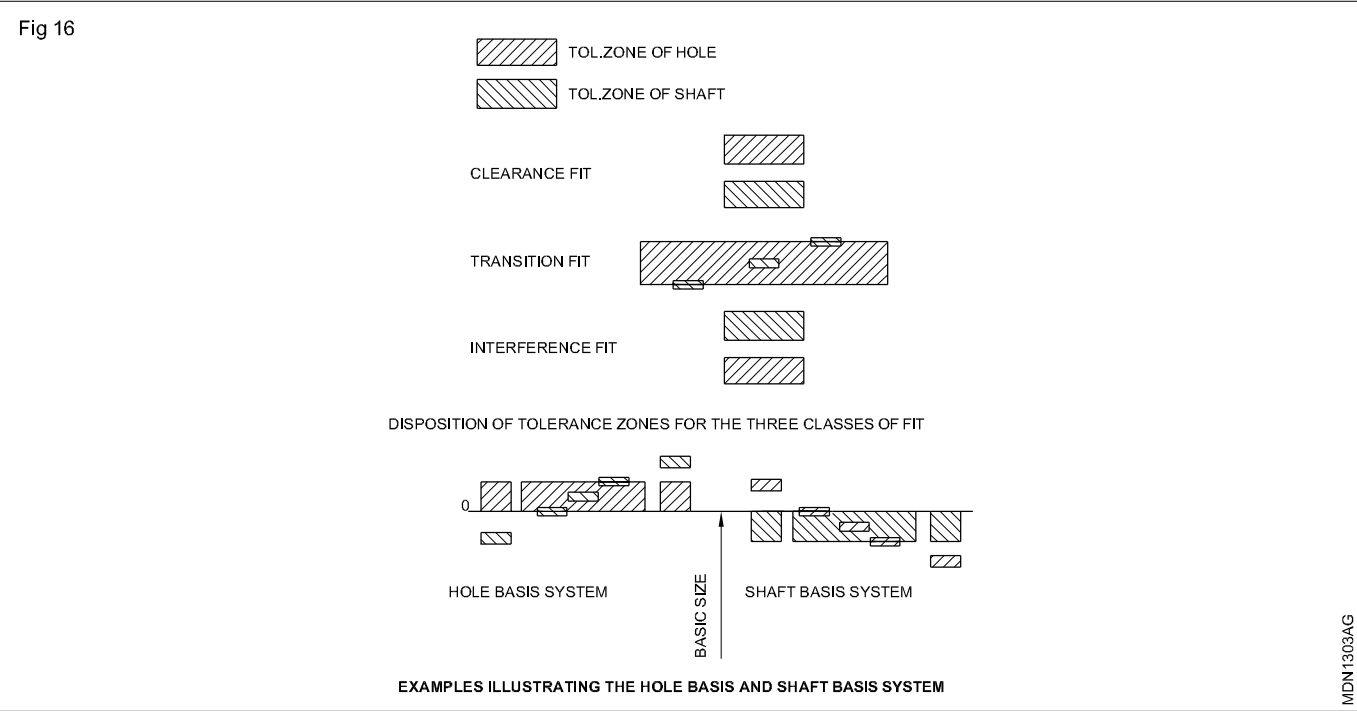
In a standard system of limits and fits, where the size of the shaft is kept constant and the variations are given to the hole for obtaining different class of fits, then it is known as shaft basis. The fundamental deviation symbol 'h' is chosen for the shaft when the shaft basis is followed.

This is because the upper deviation of the shaft 'h' is zero. It is known as 'basis shaft'. (Fig 15)



The hole basis system is followed mostly. This is because, depending upon the class of fit, it will be always easier to alter the size of the shaft because it is external, but it is difficult to do minor alterations to a hole. Moreover the hole can be produced by using standard toolings.

The three classes of fits, both under hole basis and shaft basis, are illustrated in (Fig 16)



Soldering

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

- state the process of soldering
- state the method of application of soldering iron
- state the different types of solder and their application.

There are different methods of joining metallic sheets. Soldering is one of them.

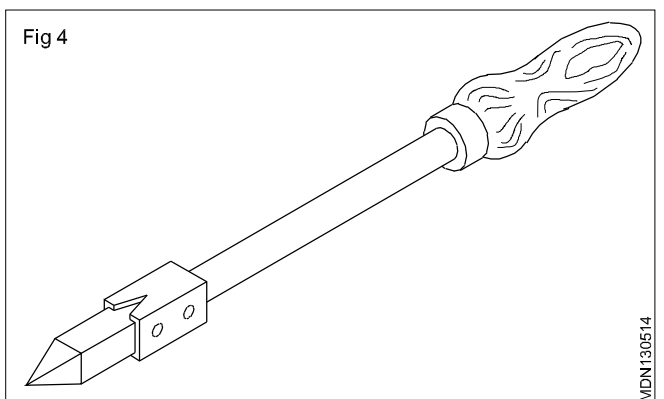
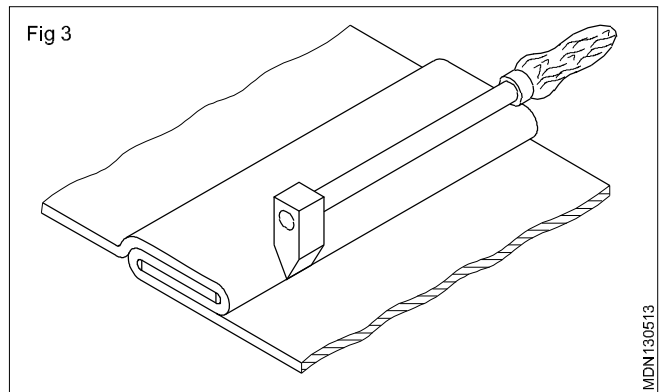
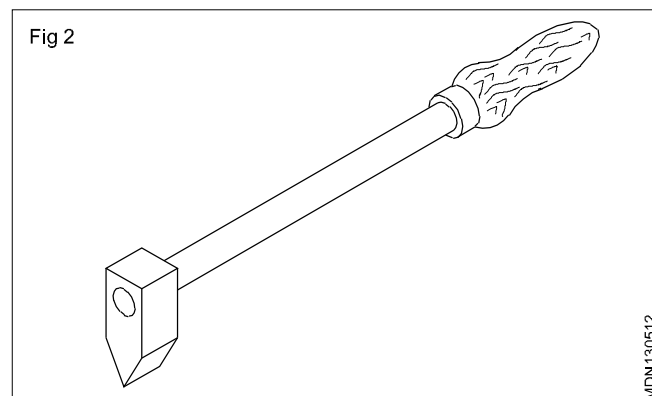
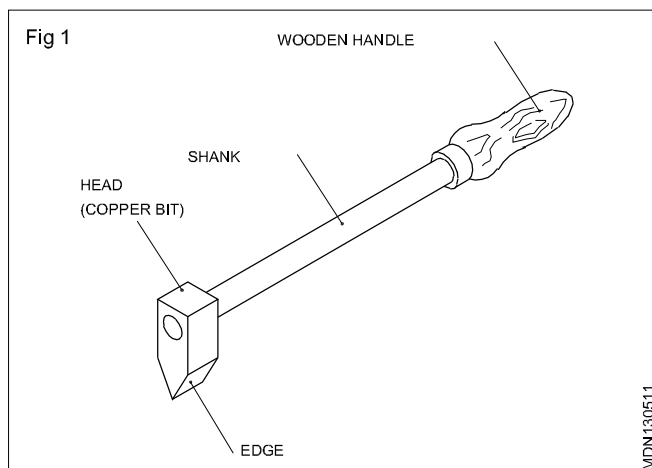
Soldering is the process by which metallic materials are joined with the help of another liquified metal (solder)

The melting point of the solder is lower than that of the materials being joined.

The solder wets the base material without melting it.

Soldering iron (Fig 1)

The soldering iron is used to melt the solder and heat the metal that are to be joined together.



A soldering iron has the following parts.

- Head (copper bit)
- Shank

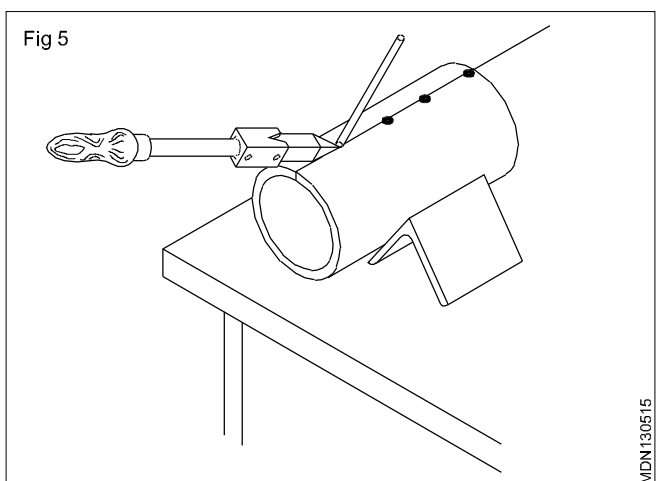
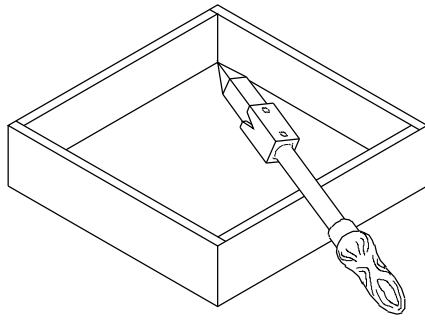


Fig 6



MDN130516

- Wooden handle
- Edge

Shape of head (Fig 1, 2 & 3)

The head of the iron is made of forged copper. This is because copper has a good heat conductivity and has a strong affinity for the solder so that the solder melts easily and sticks to the bit.

The edge is V shaped from two sides of a square. This is called Hatching type soldering iron

This type is used for straight soldering joints.

The other type is the square pointed soldering iron or a standard workshop pattern soldering iron. For this type the edge is shaped to an angle on four sides to form a pyramid shape.

Metal : The filler metal is distributed between the closely fitted surfaces of the joint by capillary action' Coalescence is a joining or uniting of materials. (Figs 5 & 6)

Brazewelding : A welding process variation in which a filler metal, having a liquidus above 840°F (450°C) and below the solidus of the base metal, is used. Unlike brazing, in braze welding the filler metal is not distributed in the joint by capillary action.

Brazing has been used for centuries. Blacksmiths, jewelers, armorers and other crafters used the process on large and small articles before recorded history. This joining method has grown steadily both in volume and popularity. It is an important industrial process, as well as jewelry making and repair process. The art of brazing has become more of a science as the knowledge of chemistry, physics and metallurgy has increased.

The usual terms Brazing and Braze welding imply the use of a nonferrous alloy. These nonferrous alloys consist of alloys of copper, tin, zinc, aluminum, beryllium, magnesium, silver, gold and others

Brass is an alloy consisting chiefly of copper and zinc. Bronze is an alloy consisting chiefly of copper and tin. Most rods used in both brazing and braze welding on ferrous metals are brass alloys rather than bronze. The brands which are called bronze usually contain a small percent (about one percent) of tin.

Brazing and braze welding principles: Brazing is an adhesion process in which the metals being joined are heated but not melted; the brazing filler metal melts and flows at temperatures above 840°F (450°C). Adhesion is the molecular attraction exerted between surfaces.

A brazed joint is stronger than a soldered joint because of the strength of the alloys used. In some instances it is as strong as a welded joint. It is used where mechanical strength and leakproof joints are desired. Brazing and braze welding are superior to welding in some applications. since they do not affect the heat treatment of the original metals as much as welding.

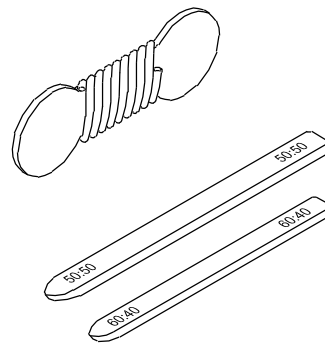
Brazing and braze welding wrap the original metals less and it is possible to joining dissimilar metals. For example. steel tubing may be brazed to cast iron, copper tubing brazed to steel and tool steel brazed to low carbon steel.

Brazing is done on metals which fit together tightly. The metal is drawn into the joint by capillary action (A liquid will be drawn between two tightly fitted surfaces. This drawing action is known as Capillary action). Very thin layers of filler metals are used when brazing. The joints and the material being brazed must be specially designed for the purpose. When brazing, poor fit and alignment result in poor joints and in inefficient use of brazing metal.

In braze welding, joint designs used for oxyfuel gas or arc welding are satisfactory. When braze welding, thick layers of the brazing filler metal is used.

Solders (Fig. 7)

Fig 7



MDN130517

Pure metals or alloys are used for solders

Solders are applied in the form of wires, sticks, ingots, rods, threads, tapes, formed sections, powder and pastes

Types of solders

There are two types of solders

- soft solder
- hard solder

One distinguishes between soft solders whose melting points are below 450°C and hard solders whose melting points are above 450°C.

Soft solders

These are alloys of the metals-tin, lead, antimony, copper, cadmium and zinc and are used for soldering heavy (thick) and light metals.

Hard solders

These are alloys of copper, tin, silver, zinc, cadmium and phosphorus, and are used for soldering heavy metals.

Brazing

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

- describe the method of brazing
- state advantages and disadvantages of brazing
- difference between soldering and brazing.

Brazing (Fig. 1): Brazing is a metal joining process which is done at temperature of above 450°C as compared to soldering which is done at below 450°C.

Process:

Clean the area of the joint thoroughly by wire brushing, emerying and by chemical solutions for removing oil, grease paints etc.

Flame joints tightly using proper clamping, (Maximum gap permitted between the two joining surfaces is only 0.08mm)

Apply the flux in paste form (for brazing iron and steel a mixture of 75% borax powder with 25% boric acid (liquid form) to form a paste is used). Usually the brazing flux contains chlorides, fluorides, borax, borates, fluoborates, boric acid, wetting agents and water. So suitable flux combination is selected based on metal being used.

Brazing is employed where a ductile joint is required.

Brazing filler rods/metals melt at temperature from 860°C 950°C and are used to braze iron and its alloys.

Brazing fluxes: Fused borax is the general purpose flux of most metals.

It is applied on the joint in the form of a paste made by mixing up with water.

Brazing is to be done at a lower temperature, fluorides of alkali materials are commonly used. These fluxes will remove refractory oxides of aluminium, chromium, silicon and beryllium.

Torch brazing: The base metal is heated to the required temperature by the application of the oxy-acetylene flame.

Conditions to obtain satisfactory brazed or soldered joint

Wet the base metal

Spread the filler metal and make contact with the joint surfaces. The solder will be drawn into the joint by capillary action.

Suggested joint designs for soldering and brazing.

Advantages of brazing

The completed joint requires little or no finishing

The relatively low temperature at which the joint is made minimizes distortion.

There is no flash or weld spatter.

The brazing technique does not require as much skill as the technique for fusion welding

The process can be easily mechanised

The process is economical owing to the above advantages.

Disadvantages of brazing

If the joint is exposed to corrosive media, the filler metal used may not have the required corrosive resistance.

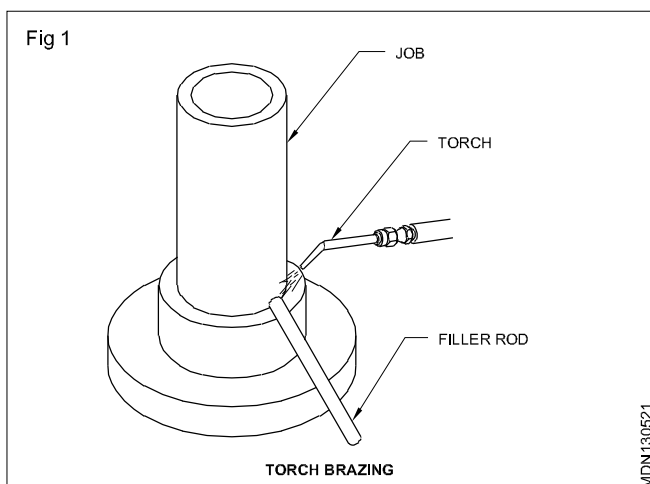
All the brazing alloys lose strength at an elevated temperature.

The colour of the brazing alloy which ranges from silver white to copper red may not match the base metal very closely.

Brazing and braze welding: Both brazing and braze welding are metal joining processes which are performed at temperatures above 840°F (450°C) as compared to soldering which is performed at temperatures below 840°F (450°C)

The American Welding Society defines these processes as follows:

Brazing - A group of welding processes which produces coalescence of materials by heating them to a suitable temperature and by using a filler metal having a liquidus above 840°F (450°C) and below the solidus of the base.



Gasket

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

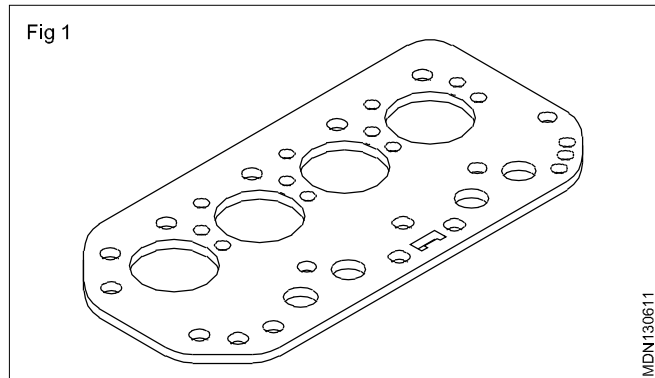
- **state the need of gaskets**
- **state the materials of gaskets**

The gasket (Fig. 1) in automobiles has to combat sealing problems caused by high and low temperatures, expansion and contraction, vibration, pressure or vacuum, corrosion and oxidation, inadequate sealing reduces the service life and efficiency of the components.

The seals which are used between two stationary components are called static seals. The most common static seal is gasket. Gaskets are designed to suit particular needs and are manufactured from different materials like copper, aluminium, cork fibre, asbestos, synthetic rubber, paper and various combinations of these materials. In latest In latest semi-liquid is also used as gasket.

Cylinder head gaskets are the most complicated in design and construction because they must withstand extreme pressure, vibration, high temperature and expansion

changes. They must seal against compression, oil and coolants. They must resist extrusion, elongation, oxidation and chemicals. The cylinder head gasket consists of a multi-layer of materials with coolant and oil passages.



Oil seal

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

- **state the use of oil seals**
- **explain different types of oil seals**
- **state the material used for oil seals.**

Seals

Seals are sealing parts on static or moving inter faces of machines, devices pipes and tank reservoir seals are used for sealing spaces as different pressure against each other, ie combustion chamber & oilways etc. oil seals have flexible lip that rubs against a shaft or housing to prevent leakage of fluid (grease, oil etc.)

All seal are used to retain or separate lubricant on fluid

Types of oil seal

- i) Flexible lip
- ii) radial lip
- iii) rotary shaft seal

configuration

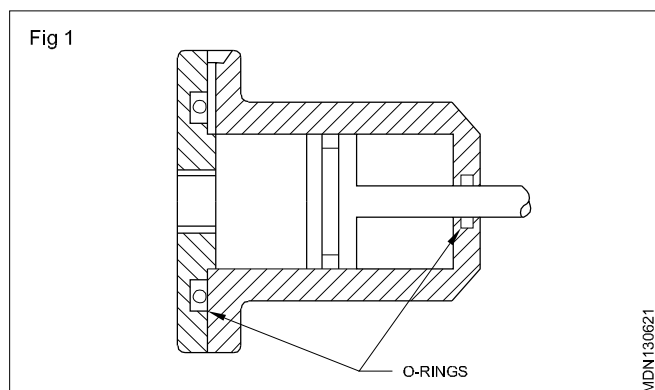
- a) single lip
- b) double lip
- c) triple lip
- d) Fan lip

Seals capable of sealing two components which move or rotate insulation to each other are called dynamic seals. The most common dynamic seal is called 'O' rings which

are moulded to close tolerances in the cross-sectional areas and to the inner and outer diameters.

Bearing Isolator (Fig. 1)

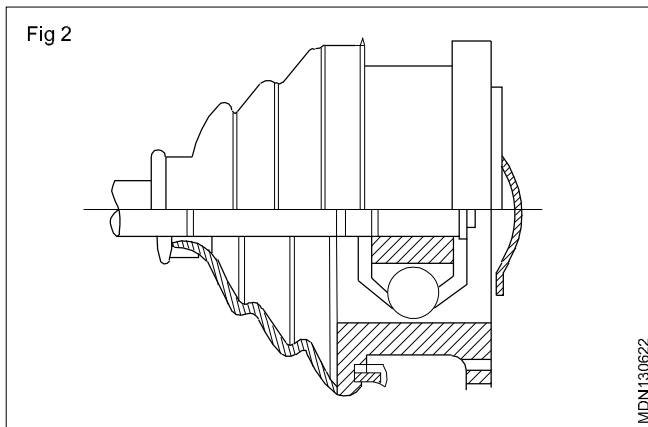
Bearing Isolator are dynamically designed to protect bearing from outside contaminant. The contain rotor (rotating) & stator (Stationary) member same bearing Isolator are of labyrinth construction of other use o-rings.



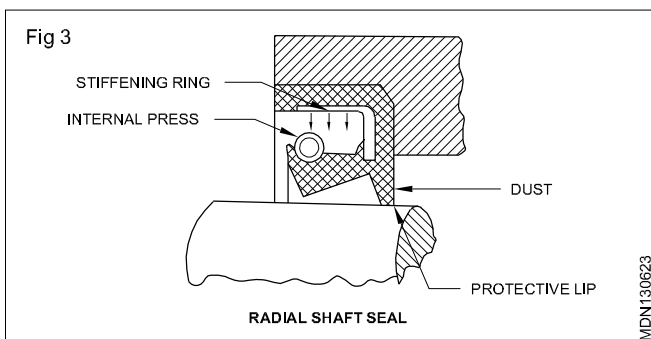
Specifications

Sealing orientation (Fig 2 & 3)

- Rod seals or shaft seals are type of radial seal.
- Radial seal are pressfit into a housing bore with the sealing up contacting the shaft.



- Piston seals are radial seal. These seals are fit on a shaft with sealing lip contacting the housing bore. V rings are external lip seals.
- Symmetrical seal works equally as a rod or piston seal.
- An axial seal seals axially against a housing or machine component.
- Material - Nylon, Rubber, polythen, PTFE etc.



Sealants:

Type of sealant:

There are three types of sealant used.

- 1 The Teflon tape
- 2 Pipe tape
- 3 Anaerobic resin compound

1 Teflon tape

The purpose of this Teflon tape (whir), no sticking tape is the serve as a lubricant when threaded part of pipe a piping system are being assemblies.

2 Pipe tape

This material relies on a solvent carrier and hardware when the solvent evaporator. The resulting seal adheres to all plastic, metal pipes and effective blocks leak paths.

3 Anaerobic resin compound

This sealant is confined within the threads of the metal pipe connection and air in exuded. It maintains the sealing properties even after heat aging, excellent then prelature and solvent remittance.

Key concepts

- Tape does not truly seal, it lubricator.
- Tape can harden and become brittle.
- Anaerobic must be combatable with pipe fitting material.

Sealant selection factors

- Material
- Temperature
- Pressure
- Vibration