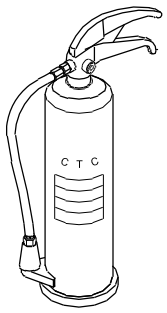
Fig 7



EMN110617

General procedure to be adopted in the event of a fire

1 Raise a loud alarm by using any of the following.

Adopt any one method of giving an alarm signal for fire breaking in your institute/ workshop.

– Raising your voice and shouting Fire! Fire!Fire! .... to call the attention of others.

– Running towards the fire shouting Fire! Fire! and actuate fire alarm/bell/siren. This alarm/bell/siren to be actuated only in case of fire.

– Any other means by which the attention of others can be called and are made to understand there is a fire break out.

2 On receipt of the fire alarm signal, do the following:

– stop the normal work you are doing

– turn OFF the power for all machinery and equipments

– switch OFF fans/air circulators/exhaust fans

– switch OFF the mains if accessible.

3 If you are not involved in fire fighting team, then,

– evacuate the working premises

– close the doors and windows, but do not lock or bolt

– assemble at a safe open place along with the others

– if you are in the room/place where the fire has broken out, leave the place calmly through the emergency exit.

4 If you are involved in the fire fighting team,

– take instructions/give instructions for an organized way of fighting the fire.

If you are taking instructions,

– follow the instructions systematically. Do not be panic. Do not get trapped in fire or smoke in a hurry.

If you are giving instructions,

– assess the class of fire(class A,B,C or D)

– send for sufficient assistance and fire brigade

– judge the magnitude of the fire. Locate locally available suitable means to put-out the fire.

– ensure emergency exit paths are clear of obstructions. Attempt to evacuate the people and explosive materials, substances that can serve as further fuel for fire within the vicinity of the fire break.

– Allot clear activity to persons involved in firefighting by name to avoid confusion.

– Control and extinguish the fire using the right type of fire extinguisher and making use of the available assistance effectively.

5 After fully extinguishing the fire, make a report of the fire accident and the measures taken to put out the fire, to the authorities concerned.

Reporting all fires however small they are, helps in the investigation of the cause of the fire. It helps in preventing the same kind of accident occurring again.

Environment, health and safety (EHS) : is a discipline and specialty that studies and implements practical aspects of environmental protection and safety at work. In simple terms it is what organizations must do to make sure that their activities do not cause harm to anyone.

Regulatory requirements play an important role in EHS discipline and EHS managers must identify and understand relevant EHS regulations, the implications of which must be communicated to executive management so the company can implement suitable measures. Organizations based in the United states are subject to EHS regulations in the code of federal regulations particularly CFR 29,40, and 49. Still, EHS management is not limited to legal compliance and companies should be encouraged to do more than is required by law, if appropriate.

From a health and safety standpoint, it involves creating organized efforts and procedures for identifying workplace hazards and reducing accidents and exposure to harmful situations and substances. It also includes training of personnel in accident prevention, accident response, emergency preparedness, and use of protective clothing and equipment.

From an environmental standpoint, it involves creating a systematic approach to complying with environmental regulations, such as managing waste or air emissions all the way to helping site's reduce the company's carbon footprint.

Sucessful HSE programs also include measures to address ergonomics, air quality, and other aspects of workplace safety that could affect the health and well-being of employees and the overall community.

Basic hand tools

Objectives : At the end of this lesson you shall be able to
- **state the types of screwdrivers**
- **explain the parts of a combination plier and their uses**
- **state the uses of diagonal cutters**
- **state the uses of nose pliers and their types**
- **state the uses of tweezers and their types.**

Basic Hand tools

There are innumerable types of hand tools used for different types of work. Some of the basic tools which are a must for a mechanic electronics are dealing in are :

– screwdrivers

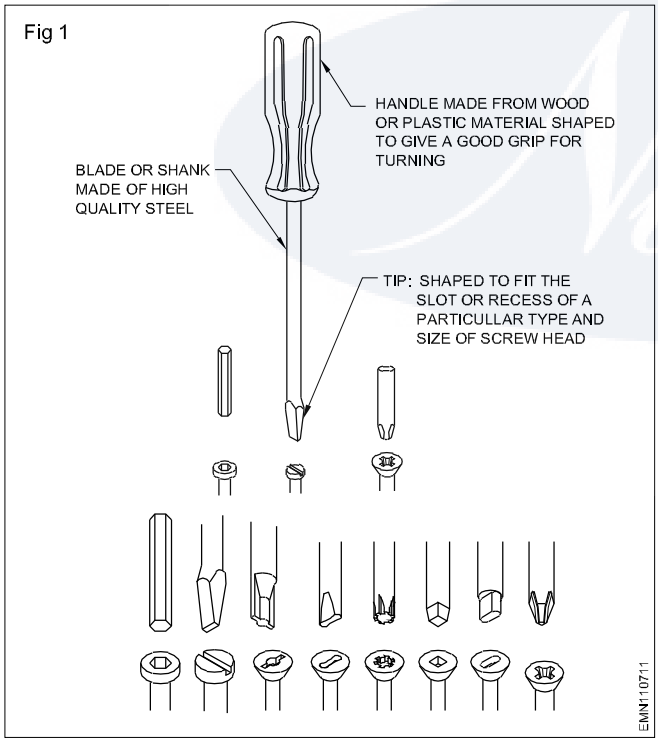
– pliers, and

– tweezers.

Screwdrivers

A screwdriver is a tool used to tighten or loosen screws. A simple screwdriver and its parts are shown in Fig 1.

Fig 1



When a screwdriver is used to tighten or loosen screws. The blade axis of a screwdriver must be linked up with that of the screw axis If this is not taken care of, the screwdriver tip/screw head/threads in the hole will get damaged.

In order not to damage the slot and/or the tip of the screwdriver, it is very important that the tip is correctly shaped and matches the size of the slot the tip to be lifted out of the slot. When turning a screw downward pressure has to be exerted on the screwdriver in order to keep the tip in the slot.

It is important that the width and thickness of a flat screwdriver tip correspond to the dimensions of the slot it is used with. Its width should be slightly less than the length of the slot and its thickness should be almost equal to the width of the slot.

A flat tip which is too wide might cause damage to the workpiece.

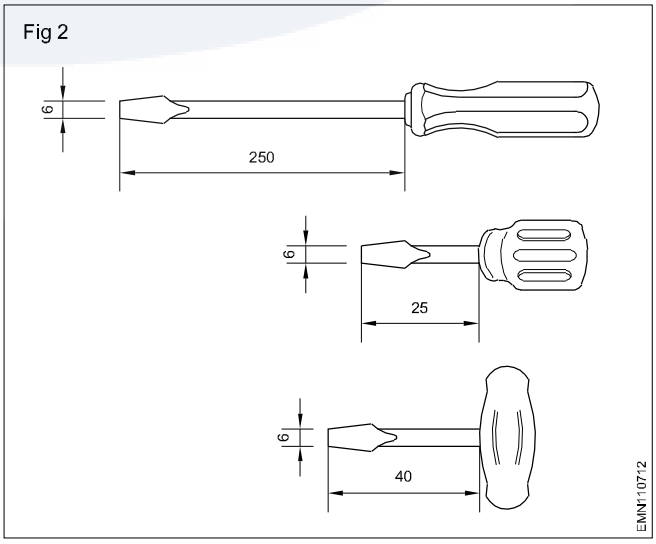
Screwdrivers with flat tips are specified in size by the length of their blade and by the width of their tip. These dimensions are given in millimetres (mm).

Screwdrivers are available in many sizes, ranging from blade lengths from 25 mm to 300 mm and widths of tips ranging from 0,5 mm to 18 mm.

Length of blade L and Length of tip W

Normally there is no relationship between the length of the blade and the width of the tip of a screwdriver. A screwdriver with a 6 mm wide tip can have blade lengths ranging from 25 to 250 mm. It can also have various forms of handles as shown in Fig 2.

Fig 2



There are, however, screwdrivers which are made to an industrial specification such as DIN, ISI etc. These screwdrivers have fixed dimensions and for each size of screwdriver the width of its tip and the length of its blade is specified.

A Phillips cross-type screwdriver tip. It is used to tighten and loosen screws with a Phillips cross-type recess.

Using a screwdriver

The general procedure for using a screwdriver is given below.

– Select a suitable screwdriver having the required blade length, width of tip and thickness of tip.

– Check that the tip of the screwdriver is flat and square.

Worn out tips tend to slip off while turning and may cause injury. Make sure your hands and the screwdriver handle are dry and free from grease. Hold the screwdriver with the axis in line with the axis of the screw. Set the tip of the screwdriver in the screw slot. Be sure of the direction in which the screwdriver is to be twisted. Twist the handle gently and steadily.

Do not apply too much pressure in the axial direction of the screw. This may damage the screw threads.

Never try to use a screwdriver as a lever; this could break the tip or bend the blade and make the screwdriver unusable.

Pliers

Pliers are tools which are used for:

– holding, gripping, pulling and turning small parts and components,

– shaping and bending light sheet metal parts,

– forming, bending, twisting and cutting small diameter wires.

Pliers consist basically of a pair of legs which are joined by a pivot. Each leg consists of a long handle and a short jaw.

If the legs of the pliers are crossed at the pivot, the jaws will close when pressure is applied to the handles. In some pliers the jaws will close when pressure is applied to the handles.

Pliers have serrated or plain jaws. Surrogated jaws offer a better grip on the workpiece. Serrated jaws might, however, damage the surface of the workpiece. In this case protection sleeves or pliers with non-serrated jaws should be used.

Pliers are made from high quality steel. In many cases pliers are chromium plated to protect them against rust. In climates with a high degree of humidity it is advisable to use such pliers as they will last longer and need less maintenance.

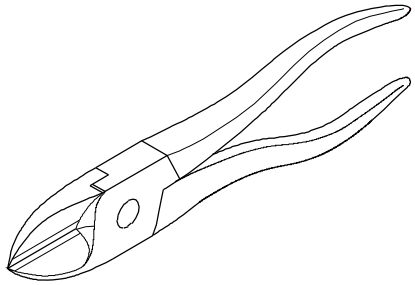
To keep pliers in good working condition, they should be kept clean, the metal parts should be wiped with an oily piece of cloth and, from time to time, a drop of oil should be applied to the pivots and joints.

Diagonal cutter plier

Fig 3 shows diagonal cuttng pliers or side cutting pliers.

They are used for cutting small diameter wires and cables, especially when they are close to terminals.

Fig 3



DIAGONAL CUTTING PLIERS

EMN110713

They are also used to remove the sheath and insulation from cables and cords.

They can also be used for other operations such as splitting and removing cotter pins.

Diagonal cutting pliers are made in the following overall lengths:

100, 125, 140, 160, 180 and 200 mm.

End cutting plier

Fig 4 shows end - cutting pliers or end nippers and their applications.

They are used to cut small diameter wires, pins, nails and to remove nails from wood.

End cutting pliers are made in the following overall lengths:

130, 160, 180, 200, 210 and 240 mm.

Fig 4

END CUTTING PLIERS

EMN110714

Flat nose pliers

Fig 5 shows a flat nose pliers and its applications.

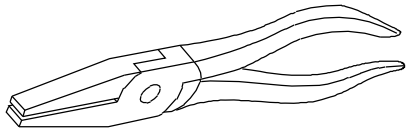
They are used to form and shape wires and small pieces of metal.

They are also used for other operations such as removing the metal sheath from cables, or gripping and holding small parts.

Flat nose pliers are made in the following overall lengths:

100, 120, 140, 160, 180 and 200 mm.

Fig 5



FLAT NOSE PLIERS

EMN110715

Round nose pliers

Fig 6 shows round nose pliers and its applications.

They are used to form curves in wires and light metal

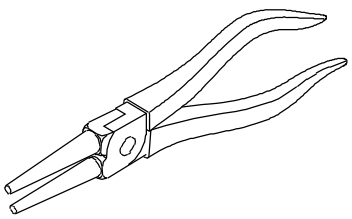
strips. The conical shape of the jaws makes it possible to form curves and circles of various dimensions.

They are also used to form eyelets in wires to fit terminal screws, and to hold small parts.

Round nose pliers are made to the following overall lengths:

100, 120, 140, 160, 180 and 200 mm.

Fig 6



ROUND NOSE PLIERS

EMN110716

Long nose pliers

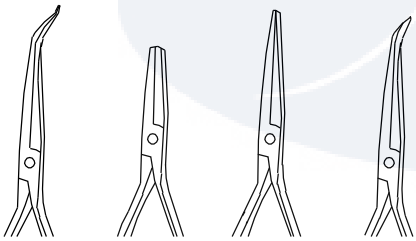
Long nose pliers and its applications. These pliers are made with straight and curved jaws.

They are used to hold small parts, especially in confined areas.

They are also used to adjust fine wires, contacts and other parts.

Long nose pliers are made with many differently shaped jaws as shown in Fig 7. Long nose pliers are available in the following overall lengths:160, 180, 200 and 220 mm.

Fig 7

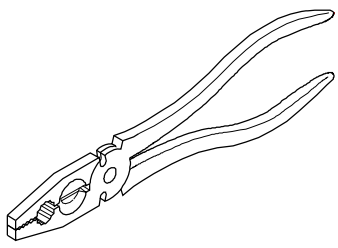


EMN110717

Combination pliers

Fig 8 shows a COMBINATION PLIERS and its application. A number of operations can be performed with these pliers.

Fig 8



COMBINATION PLIERS

EMN110718

The FLAT GRIP can be used to grip and hold parts and components and to twist wires.

Many combination pliers also have a PIPE GRIP which is used to grip and hold cylindrical objects.

They also have a pair of SIDE CUTTERS which are used to cut small diameter wires and cables.

A pair of JOINT CUTTERS are provided for shearing off steel wires.

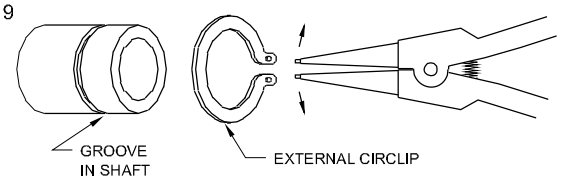
Combination pliers are available in the following overall lengths: 140, 160, 190, 210 and 250 mm.

Circlip pliers for external circlip

Fig 9 shows a CIRCLIP PLIER for EXTERNAL CIRCLIPS. The prongs of the jaws are inserted into the holes of the circlip. By applying pressure to the handles of the pliers, the jaws will expand the circlip which can then be removed or moved onto the workpiece.

These pliers are available with straight and curved jaws in the following dimensions.

Fig 9



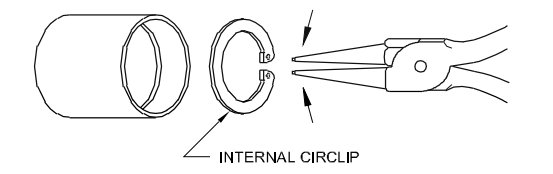
EMN110719

Size	Overall length	Used with circlips shaft diameter of
0	130 mm	3 - 10 mm
1	130 mm	8 - 25 mm
2	170 mm	19 - 60 mm
3	230 mm	40 - 100 mm
4	320 mm	85 - 165 mm

Circlip pliers for internal circlips

Fig 10 shows CIRCLIP PLIERS for INTERNAL CIRCLIPS. By applying pressure to the handles of the pliers, the jaws will compress the circlip which can then be removed from the workpiece.

Fig 10



EMN11071A

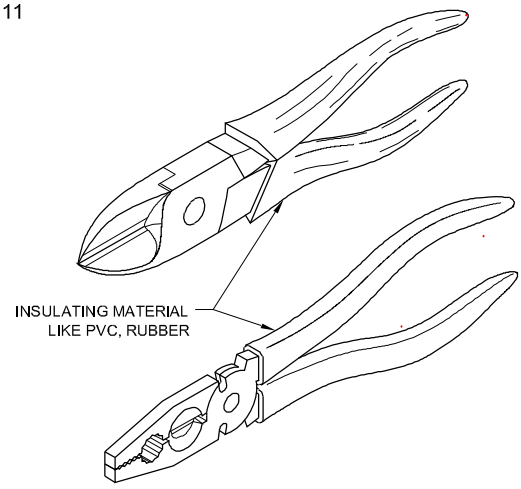
Size	Overall length	Used with circlips shaft diameter of
0	130 mm	3 - 10 mm
0	130 mm	3 - 10 mm
1	130 mm	8 - 25 mm
2	170 mm	19 - 60 mm
3	230 mm	40 - 100 mm
4	320 mm	85 - 165 mm

Pliers used by electrician

A number of pliers, especially diagonal cutting pliers, combination pliers, flat nose pliers, round nose pliers and long nose pliers, are frequently used by electricians.

As an additional safeguard against electric shock, these pliers are available with insulated handles made of high quality rubber or plastic as shown in Fig 11.

Fig 11

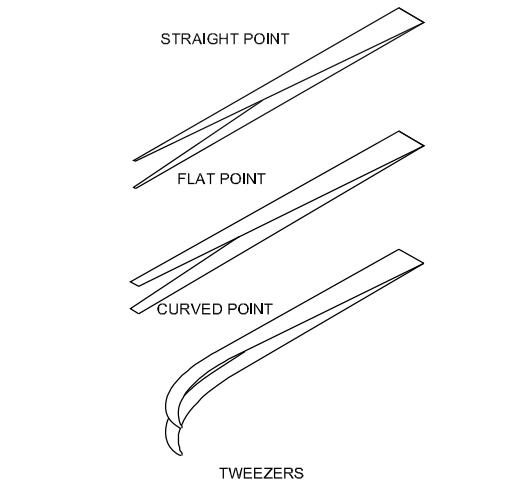


Before you work with electrical installations or electrical appliances, they have to be disconnected from the electrical supply. Working with live parts of an electrical installation or appliance can INJURE or KILL you, and it might seriously damage the installation and equipment.

Tweezers

Tweezers are used to hold light weight and very small components and very thin wires/strands. Tweezers are classified according to the shape of the tip and are specified by their length and shape. Fig 12 shows different types of tweezers.

Fig 12

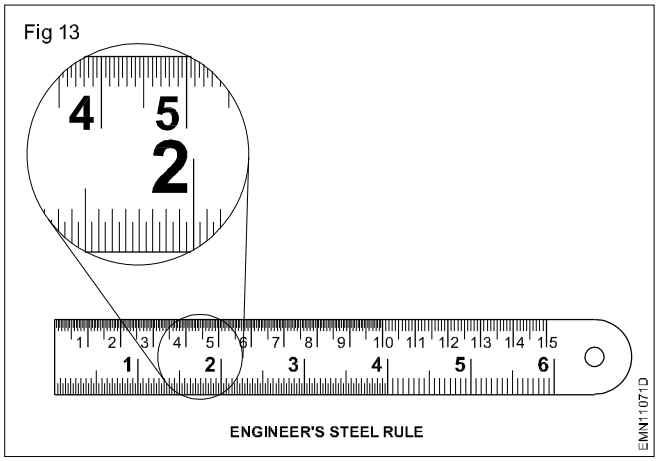


The thin structure of the tweezers permits easy access to places where fingers cannot reach. Tweezers are very useful during soldering of wires, components and placing of small screws in interior places.

Engineer's steel rule

An engineer's steel rule is the basic and most commonly used measuring tool for measuring and drawing the length of straight lines. A typical engineer's steel rule is shown in Fig 13.

Fig 13



Steel rules are made of spring steel or stainless steel. The edges are accurately ground to form a straight line.The surfaces of steel rules are satin-chrome finished to reduce glaring effect while reading, and also to prevent rusting.

Graduation on engineer's steel rule

The engineer's steel rules are generally graduated both in centimetres and inches as can be seen in Fig 13. In centimetre graduations, the smallest graduations are at intervals of 0.5 mm. In inch graduations the smallest graduation is of 1/16 of an inch. Thus the maximum reading accuracy of a steel rule is either 0.5 mm or 1/16 of an inch.

Standard sizes

Steel rules are available in different lengths. The common sizes are 150 mm/6inches, 300 mm/12 inches and 600 mm/24 inches.

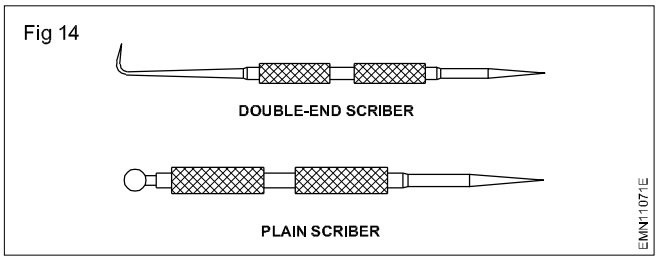
Scriber

A scriber is a pointed, sharp tool made of steel or carbon steel as shown in Fig 14. There are two types of scribers, namely,

– Plain scribers

– Double end scribers

Fig 14

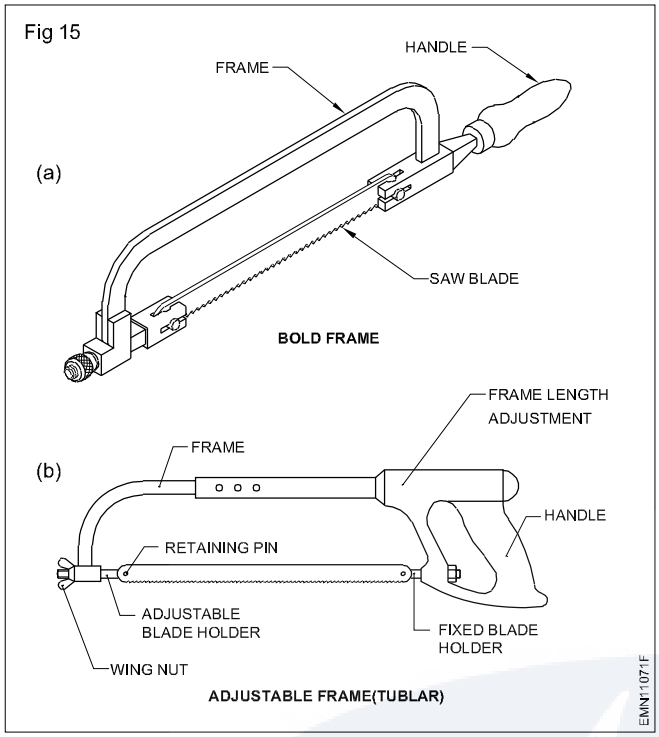


Uses of scribers

Scribers are used for scribing(marking) lines on surfaces prior to cutting. Scribers are generally used for marking on such surfaces on which pencil marking cannot be made or pencil marking is not clearly visible or pencil marking gets erased while handling or pencil marking is too thick. For example pencil marking is not suitable on Hylam or Bakelite sheets. Hence, line markings are done on these boards using scribers.

Hacksaw frame and blade

Fig 15 shows a typical hacksaw frame fitted with a blade. A hacksaw is used to cut metallic sheets or sections. It is also used to cut slots and contours.



Types of hacksaw frames

Bold frame: In this, the frame width is fixed and cannot be altered. Because of this only a particular standard length of hacksaw blade can be fitted with these frames.

Adjustable frame (Flat): In this, the frame is made of flat metal with provision for adjusting the width of the frame. Hence, different standard lengths of blades can be fitted with this frame.

Adjustable frame tubular type: In this, the frame is made of tubular metal with provision for adjusting the width of the frame. Hence, different standard lengths of blades can be fitted with this frame. This is the most commonly used type of hacksaw frame because this frame gives better grip and control while sawing.

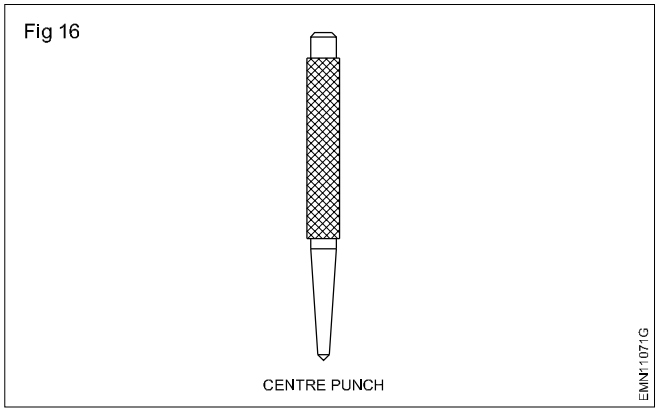
Hacksaw blades

A hacksaw blade is a thin, narrow, steel band with teeth and two pin holes at the ends. These blades are made of either low alloy steel (la) or high speed steel (hs). Hacksaw blades are available in standard lengths of 250 mm and 300 mm.

Punch

A punch is a tool used to make punch marks or light depressions at locations to be drilled or to position dividers or for making permanent dimensional features. A typical punch is shown in Fig 16. Punches are made of hardened steel with a narrow tip on one side.

Centre punch: These punches have an angle of 90^0 at the punch point. The punch mark made by this angle will be wide but not very deep. These punch marks give a good seating for the drill bit at the start of drilling. If one tries to drill at a point without a punch mark, the drill bit will slip away from the point to be drilled and may drill a hole at unwanted points, making the job a waste.



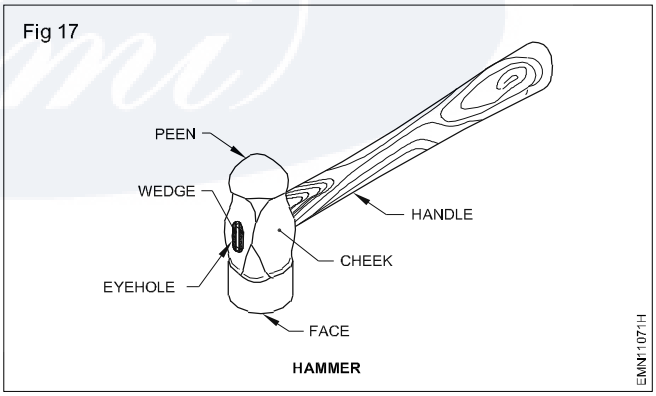
Prick punch: The angle of the prick punch is 30^0 or 60^0. The 30^0 point prick punch is used for marking light punch marks needed to position dividers. The divider leg will get proper seating in this punch mark. The 60^0 punch is used for witness marks.

Hammer

An engineer's hammer is a hand tool used for striking purposes like punching, bending, straightening, chipping, forging, riveting etc.,

Parts of a hammer

Fig 17 shows a typical hammer with the parts labeled.



The head is made of drop-forged carbon steel. The handle is generally made of such materials which can absorb the shock while striking. Wood is most popularly used as the material for the handle.

Face: The face of the hammer is that which strikes the objects. Hence, this portion is hardened. Slight convexity is given to the face to avoid digging of the face edges.

Pein: The pein is the other end of the head. It is used for shaping and forming work like riveting and bending. The pein can be of different shapes like ball pein, cross pein and straight pein. The pein of a hammer is also hardened is the face.

Cheek: The cheek is the middle portion of the hammer-head. The weight of the hammer is stamped here. This portion of the hammer head will be soft.

Eyehole: The eyehole is meant for fixing the handle. It is shaped to fit the handle rigidly. Wedges are used to fix the handle in the eyehole.

Specification of engineers hammer

Engineer's hammers are specified by their weight and the shape of the pein. Their weight varies from 125 gms to several kilo grams.

Generally, the weight of an engineer's hammer, used for marking purposes is 250 gms.

Using hammers

Before using a hammer,

– select a hammer with the correct weight suitable for the job

– make sure the handle is properly fitted

– check the head and handle for any cracks

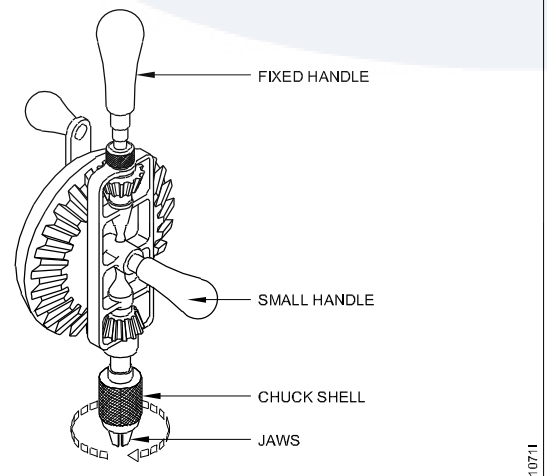
– ensure that the face of the hammer is free from oil or grease.

Drilling and drilling machines

Drilling is a process of making straight holes in materials. To drill holes, a machine tool known as drilling machine is used. Drilling machines are used with twist drill bits.

These drill bits rotate and penetrate into the material making holes. The drilling machines can be manually driven or electrically driven. A drilling machine can be portable/hand held or mounted on a stand. A typical manually driven, hand held drilling machine most commonly used in small electronics work is shown in Fig 18. Fig 19 illustrates a portable power drilling machine.

Fig 18

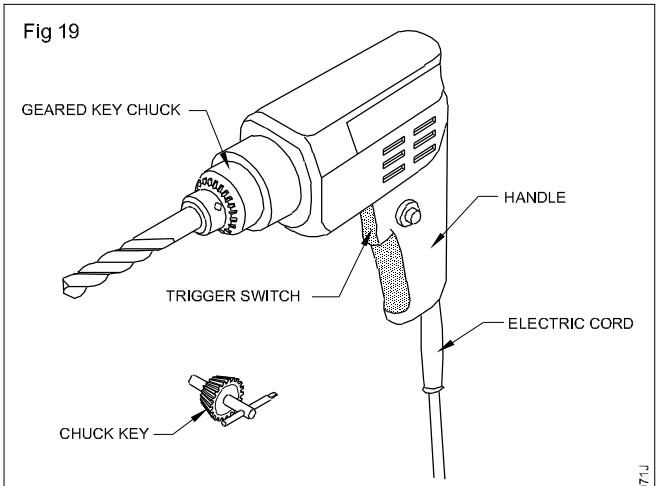


HAND DRILLING MACHINE

The hand drill is used for drilling holes up to 6.5 mm diameter.

Electric drilling machines are used where higher drilling speed and fairly constant speed is required. Holes can be drilled faster and with higher accuracy using electric drilling machines. Portable electric drilling machines are available in 6 mm and 12 mm capacity. These drilling machines generally operate on 230 V, 50 Hz AC mains supply.

Fig 19



ELECTRIC DRILLING MACHINE

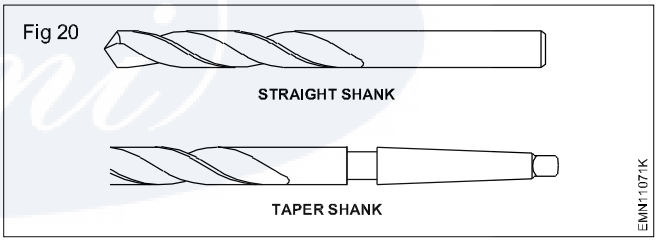
Twist drill/drill bit

Twist drills are used in drilling processes to form round holes in solid materials. When a drill is rotated and the rotating drill is pressed against the material, the drill penetrates and cuts away the material. The rate at which the drill is pressed through the material is called the 'feed'.

Parts of a drill

Shank: Shank is that portion of the drill by which it is held and driven by the drilling machine. Many different types of shanks are available, but two of the most common types of shanks are shown in Fig 20.

Fig 20



Taper shank drills: These are available in sizes from 12 mm to 52 mm in diameter. The shank has a self-holding taper which fits into a sleever or the taper bore of the drilling machine.

Straight shank drills: These types of drills are more commonly used than taper shank drills. The shank has the same diameter as the body of the drill. These drills are available in sizes from 0.35 mm to 16 mm in diameter.

Body: The body extends from the shank to the cutting end(point). Generally, the body shape of most drills is the same, but some special shapes may be necessary for special tasks. It has two helical grooves called flutes which run along its sides. The flutes help:

– to form the cutting edges

– to curl the chips and allow them to come out

– to allow the coolant to flow to the cutting edge.

Drill point: The conical shape of the cutting edge is ground to suit the material to be cut. This is the sharpened end of the drill and has a number of different parts.

Speeds of drills

The outer corner of a drill bit is the most hard-worked part of the cutting lip. For example, in one revolution the outer corner cuts through twice as much metal as the mid-point of the cutting lip.

The cutting speed for a particular material is expressed in feet per minute or in metres per minute.

The recommended speed for a drill is the ideal cutting speed for the outer corners of its lips. Select the revolutions per minute of the drilling machine that will give this cutting speed at the circumference of the drill.

General Rules

If do not have tables of speeds and feeds to guide remember these general rules.

– The smaller the drill, the higher the r.p.m.

– The softer the metal, the greater the feed.

– The harder the metal, the smaller the feed.

– The harder the metal, the lower the r.p.m.

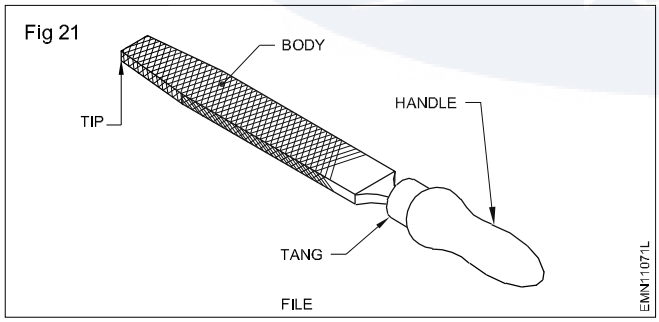
– Soluble oil is a suitable cutting fluid for cooling the drill while drilling for most common metals-other than cast iron, which is best drilled dry.

Files

A file is a cutting tool with multiple cutting edges used for filing different materials. Filing in one of the processes used to cut/remove small quantities of materials.

Parts of a file

Fig 21 illustrates the main parts of a typical file.



File specification

Files are specified according to their:

– length

– grade

– cut

– shape.

Length is the distance from the tip to the heel. It varies form 100mm to 300mm.

Grade: Different grades of files are Rough, bastard, second cut, smooth and dead smooth.

Rough file is used for removing more quantity of metal quickly.

Bastard file is used for ordinary filing purposes.

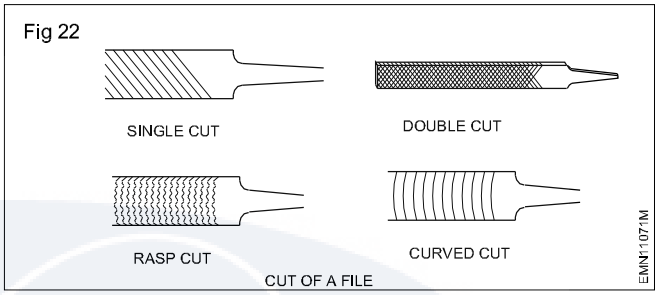
Second cut file is used for good finishing purposes.

Smooth file is used for removing less metal and for giving good surface finish.

Dead smooth file is used for high degree finishing.

Cut of file

The rows of teeth on the file surface indicate the cut of a file. For example, if there is single row of teeth on the file surface as shown in Fig 22, it is called 'single cut file.'



Types of cut

The different types of cut of files are:-

– Single cut,

– Double cut,

– Rasp cut, and

– Curved cut.

Single cut: A single cut file has a single row of teeth in one direction on the face of the file at an angle of 60°. These files are used for filing soft materials such as lead, tin, aluminum etc.

Double cut: A double cut file has rows of teeth in two directions across each other at an angle of 50° to 60°, another row at 75°. These files are used to file hard materials such as steel, brass, bronze, etc.