LABORATORY MANUAL

SEMESTER - FIRST

B.TECH

WORKSHOP PRACTICE LAB

Name of the Student _____

Registration No. _____ **Batch No.** _____ **Branch** _____

School of Aeronautics (Neemrana)

I-04, RIICO Industrial Area, Neemrana, Dist. Alwar, Rajasthan

(ApprovedbyDirectorGeneralofCivilAviation,Govt.ofIndia,AllIndiaCouncilforTechnicalEducation, Ministry of HRD, Govtof India & Affiliated to Rajasthan Technical University. Kota,Rajasthan)

School of Aeronautics (Neemrana)

CERTIFICATE

This is to certify thatMr./Ms._____

RegistrationNumber_____

ofB.Tech( ) hassatisfactorily completed the term of the subject, Workshop Practice Lab, prescribed by Rajasthan Technical University, Kota.

Dated:_____ **Signature ofFaculty**

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SCHOOL OF AERONAUTICS

NEEMRANA, ALWAR(RAJ.)

WORKSHOP PRACTICE LAB MANUAL

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Experiment No. 1

AIM:
Care and maintenance of tools and materials.

APPARATUS:
Vice, hammer, chisel, files, hacksaw, taps, dies, spanner, reamers, pliers, scrappers, screw driver, workshop forging shop tool.

INTRODUCTION:
Tools are designed to make a job easier and enable you to work more efficiently. If they are not properly used and cared for, their advantages are lost to you. Regardless of the type of work to be done, you must have, choose, and use the correct tools in order to do your work quickly, accurately, and safely. Without the proper tools and the knowledge of how to use them, you waste time, reduce your efficiency, and may even injure yourself.

PRINCIPLE:

PRECAUTIONS:
Care of vices:
1. Vices must be properly secured with bolts on work bench. In case of use of vice, the bolts must be checked and if found loose should be tightened with wrench orspanner.
2. Vice should be cleaned with cotton before and afteruse.
3. After six months of use, the main screw should be dismantled and lubricantproperly.
4. The handle of vice should be such that while using it, It should not come out. Case should be taken that it does not bend by hammering it for properly, Securing the work piece between jaws andvice.
5. Work piece must be secured in the centre of vice between thejaws.

Care of Hammers:
1. The face of hammer must be checked to be uniform and not bulged out due to prolonged use. Normally, it doesn‟t happen but sometimes manufactures used poor quality of material causing thisdefect.
2. The hammer should be properly cleaned and wiped out by cotton before and afteruse.
3. The shaft or handle of hammer must be secured properly with the hammer block and normally no additional wedge should be put into, to make it from. In case the handle is loosened, it should be replaced with freshone.
4. Hammer must be placed either in C tool box or woodenshelf.

Care of Chisel:
1. It must be kept clean and free from any oil or greasymaterial.
2. It should be properly cleaned and wiped out before and afteruse.
3. Once the cutting edge gets blunt it must be properly grounded and checking the cutting edge with a checkinggauge.
4. After long use, the length of chisel gets shortened then 150mm, however in case of fine chisel this is notapplicable.
5. Chisel should be kept in a wooden shelf, when not in use and should not be kept in bundles or with cuttingtools.

Care of files:

1. The files should not be used without handle or loose fittinghandle.
2. A file should never be used on hardened steel , hard surface scale or allowed to strike against the hardened vice jaws.
3. The new file should be used first on copper, brass and then on wrought iron and mildsteel.
4. File should be cleaned with thin hard wire brush or file card. After cleaning the file, chalk should be rubbed in to the file teeth to prevent the clogging ofpins.
5. The file should not be allowed to rust and to prevent it, the file is coated with machine oil. The oil should be removed before the file is put to use by carbon tetra chloride (CCl_4) or caustic soda(NaOH).
6. The worn out files may be re-used by dipping it in hydrochloric acid (HCl). The worn out files are best suited for making scrapper, punches, chiseletc.

Care of Hacksaw:

1. These may be two different types of hacksaws frame, one of fixed size and other is adjustable. In case of adjustable type, the frame is firmly made of steel pipe with loading holes of telescopicarrangement.
2. In this after long use, the frame cannot be held firmly and therefore it is not generally used However if the frame is adjustable, then it should be carefully used, so that it doesn‟t get loosened.
4. The blade with the hacksaw frame must be properly held and the wing nut must be replaced after long use, when it becomes too loose withscrew.
4. The hacksaw blade and the frame must be kept separately when not inuse.
5. The blade and frame must be clean and free from greasymaterial.

Care of Taps:

1. Taps must be kept clean before and afteruse.
2. It must be kept separately according to making or identification in sequence of operations so that when used it gives a rightthread.
3. Handle of tap must be of sufficient length and square slot made at the centre of the handle should be maintained so that it properly fits into the tap wrenchhandle.
4. Handle should be kept clean and free from any greasy material and it should be kept separately free fromtap.

Care of Dies:

1. Dies and handle should be kept clean before and afteruse.
2. The use of dies must be in sequence number or could be seen by visual observation so that dies could be prevented fromdamage.
3. Dies should be kept in a wooden box in sequence or as it is marked. Handle also should be kept separately in woodenshelf.
4. After certain intervals dies handle must be cleaned and wiped out by applying same lubricant to avoid atmospheric action. The handle should be repainted with red colour or any specified colours, specified by organisation after every threeyears.

Care of Spanner or Wrenches:

1. These are the tools available in different sizes ranging from 5mm to 75mm bolt or nut head size.
2. The spanner should be kept clean before and after use and free from greasy inparticular.
3. If the face of spanner is widened or damaged do not reworks on it by biting or marking it correct. Use of such spanners may be case of fatalaccident.

4. It should be used by holding the bolt at proper position and application of face must be at the extreme end of spanner or wrench and it should be turned at right angle to the length of the bolt. Always use the right size of spanner to avoid any damage to bolt head or screw. The spanner must be kept in a cloth jacket withflaps.

Care of Reamers:
1. They must be kept clean before and after use and must be kept on a wooden performed pack and kept in verticalpositions.
2. After certain use, cutting edges must be checked and if found blunt must be grounded properly and checked with appropriate gauge and in cause of reamer itsdiameter.

Care of Pliers:
1. Pliers are used to hold work piece, while normally cannot be hold by another devices, therefore more case is required in maintenance ofpliers.
2. It should be kept clean and free from greasy material and it must be wiped out with same cloth or cotton waste to prevent rusting offaces.
3. For the purpose cutting wires, it should not be used for hard steel materials; some other cutting tools or process must be used for thatpurpose.

Care of scrapper:
Since the scrapper has a very sharp cutting edge, therefore when these are not in use it is advisable to keep them lightly oiled and individually wrapped in a piece of cloth or felt or similar material, to protect the extremely hard cutting edge.

Care of Screw driver:
1. They must be kept clean and kept in cotton case to size andlength.
2. All the screw driver holders either fixed or detachable must be used in such a manner that it does not getdamaged.
3. The screw driver handle should be made of either wood or plastic and should not be hammered or used, otherwise except opening or cleaning or screw of specified size and shape.

Forging shop tools (Hand Tools):
(a). Anvil.
(b). Swage block.
(c).Hammers.
(d). Tongs.
(e). Chisels.
(f). Swages.
(g). Fullers.
(h). Flatters.
(i). Set hammer.
(j). Punches.
(k). Drift.

Care and Maintenance of workshop materials:
Workshop materials may be grouped in the following categories:
(a). Raw materials.
(b). Components.
(c). Fasteners.

(d). Work in process.
(e). Consumable.
(f). Lubricants.
(g). Paints.

1. All materials should be kept in proper position and are marked and displayed by writing or colouring.
2. Different types of raw materials should be stock separately.
3. Small components should be kept in container, rake or seals separately withlabels.
4. Shop floor must be kept clean anddry.

Care and Maintenance of forging tools:
1. All tools must be kept clean and free from greasy material, and placed in proper position.
2.In the case of anvil and swage block, it must be installed on a wooden foundation properly set in a horizontal position with the help of spirit level and it should be checked after three or six months.
3. The surface and the edges of anvils and swage block should not be heat with hammer. This will damage the face which will not produce the desireshop.
4. The hammer shaft should be properly fixed and check the length and after use to avoid any accident.
5. The hammer shaft should be properly secured with the help of metallic or wooden wedge ornails.
6. All the tools such as tongs, dies, swage blocks, set hammers, fullers, must be kept clean and put in a wooden self properly, make for specificpurpose.
7. Tongs used to hold such tools should be proper and of reasonablelength.

DIAGRAM:

Fig 1.2 Bench vice

Fig 1.2 Hammer

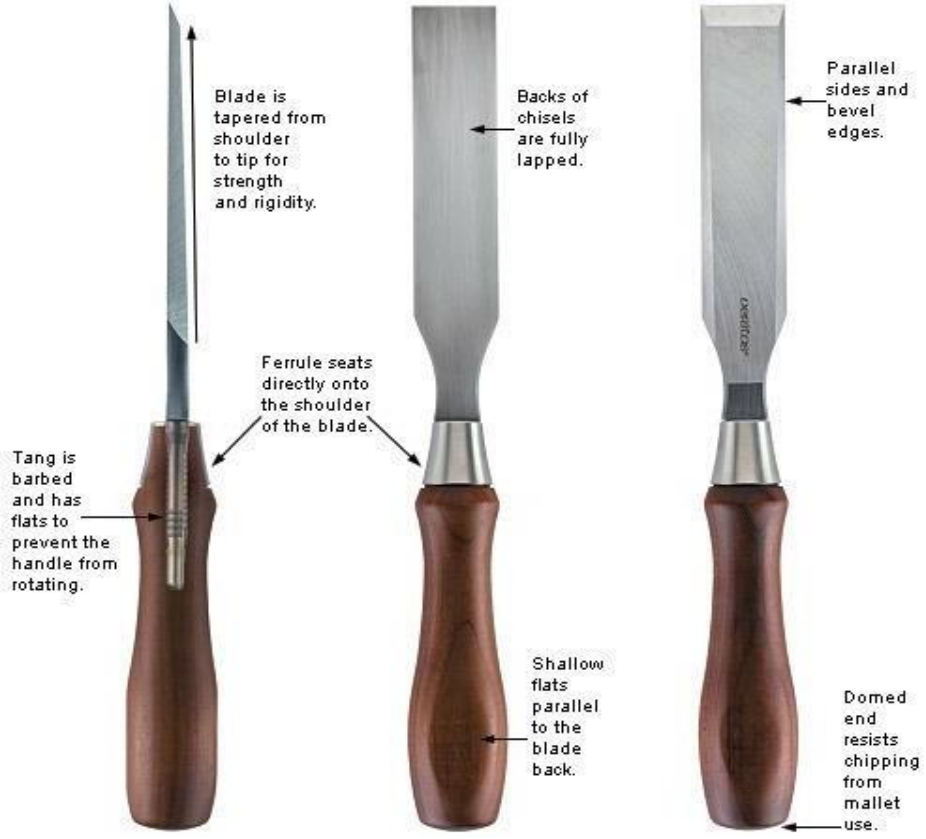

Fig 1.3 Chisel

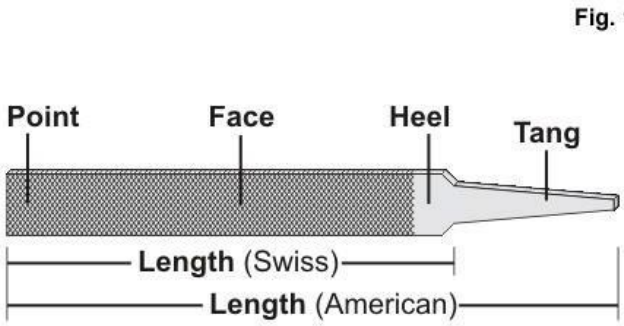

Fig 1.4 File

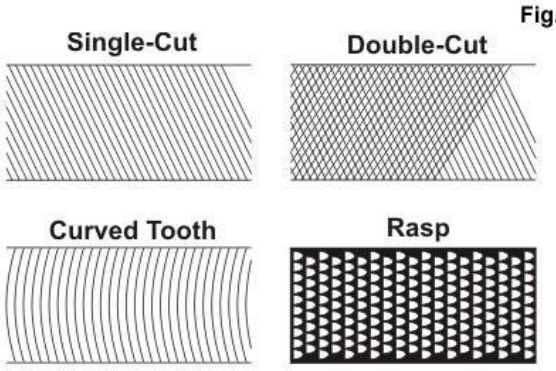

Fig 1.5 DifferentStyles

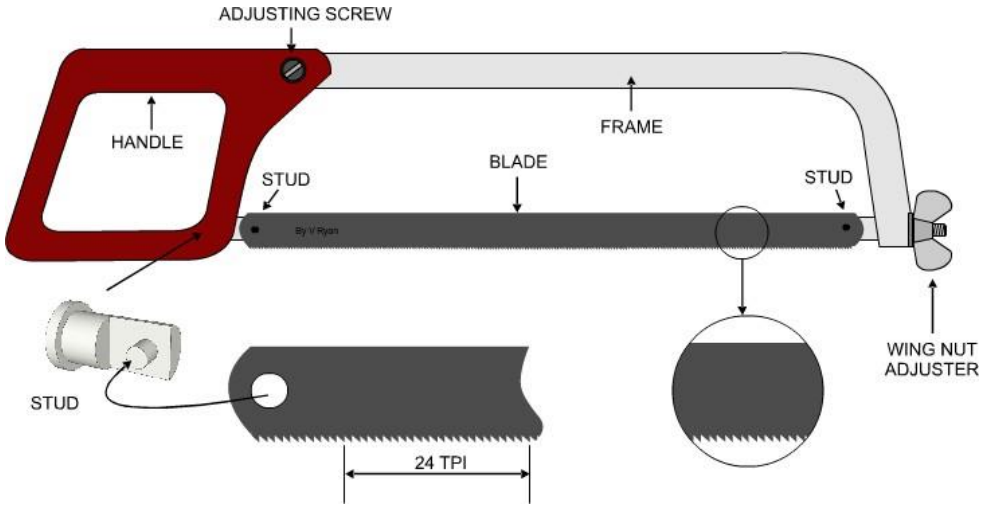

Fig 1.6 Hack saw

Fig 1.7 Different Taps

Fig 1.8 Dies

Fig 1.9 Different Spanners

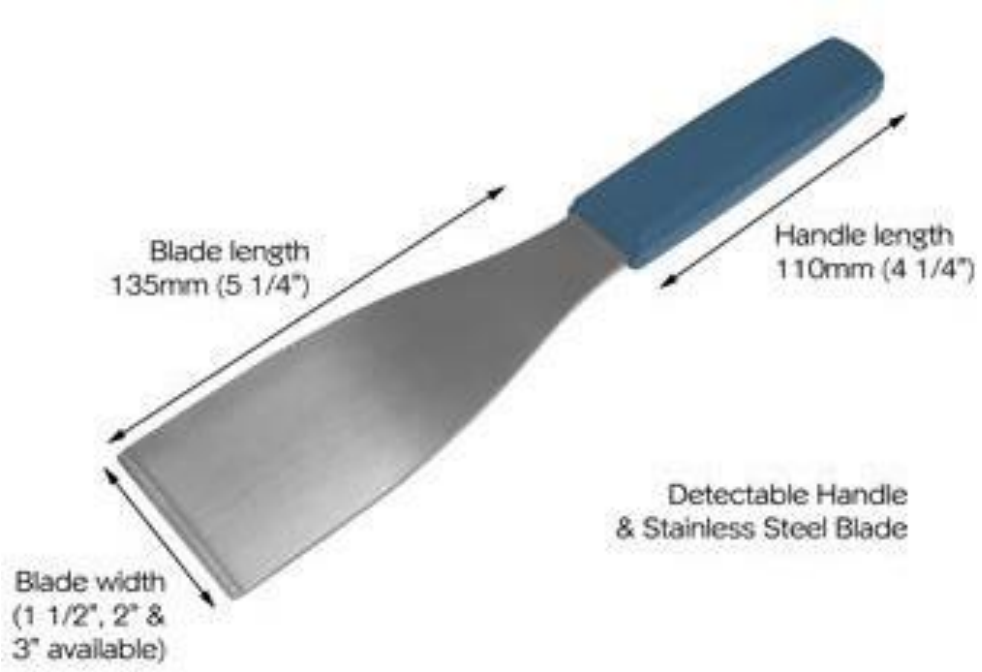

Fig 1.10 Scrapper

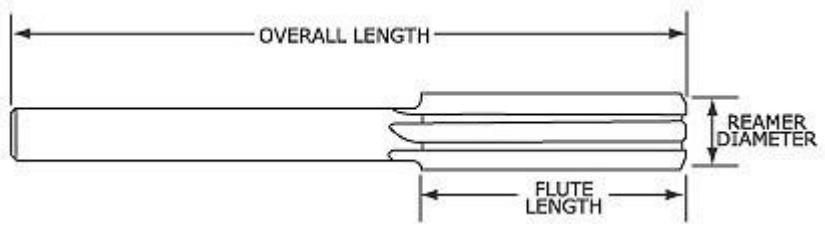

Fig 1.11 Reamer

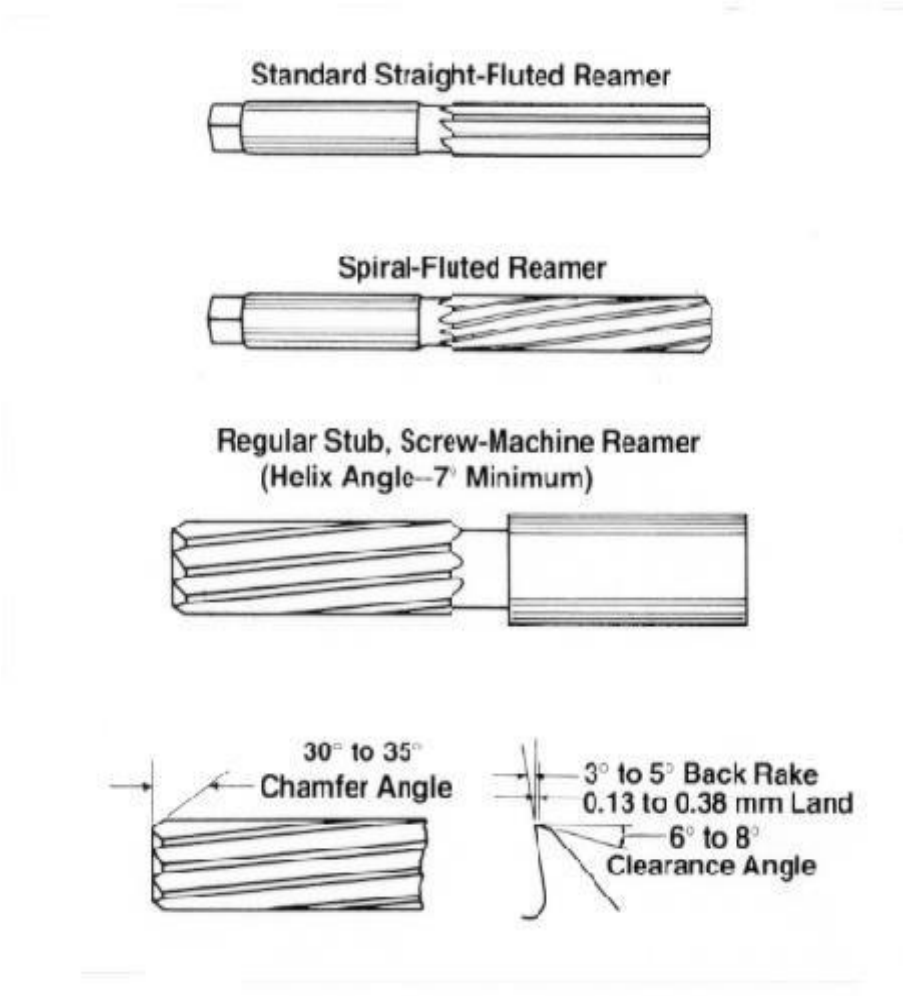

Fig 1.12 Different Reamers

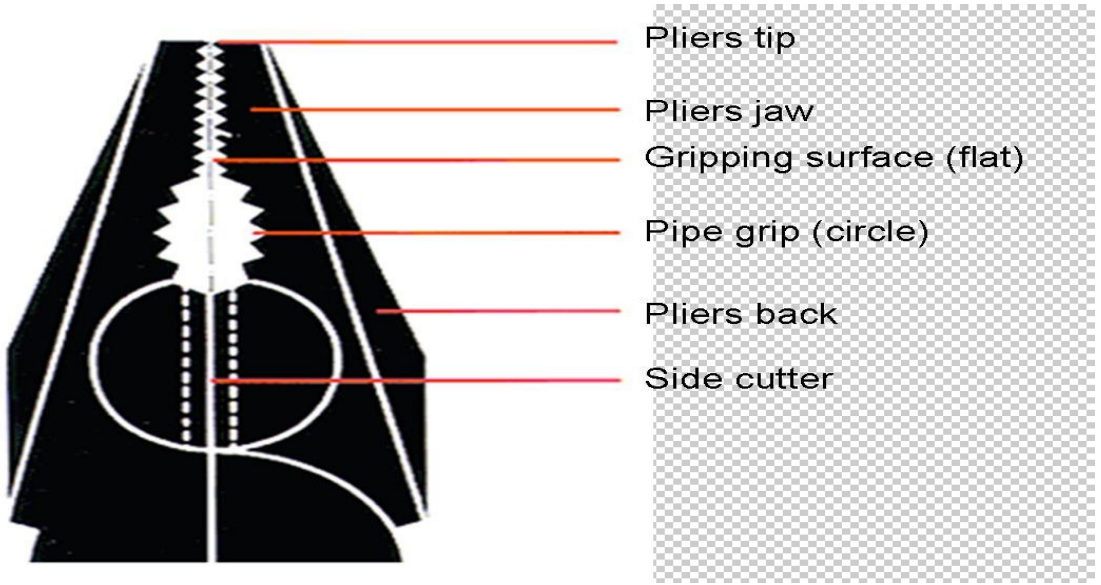

Fig 1.13 Pliers

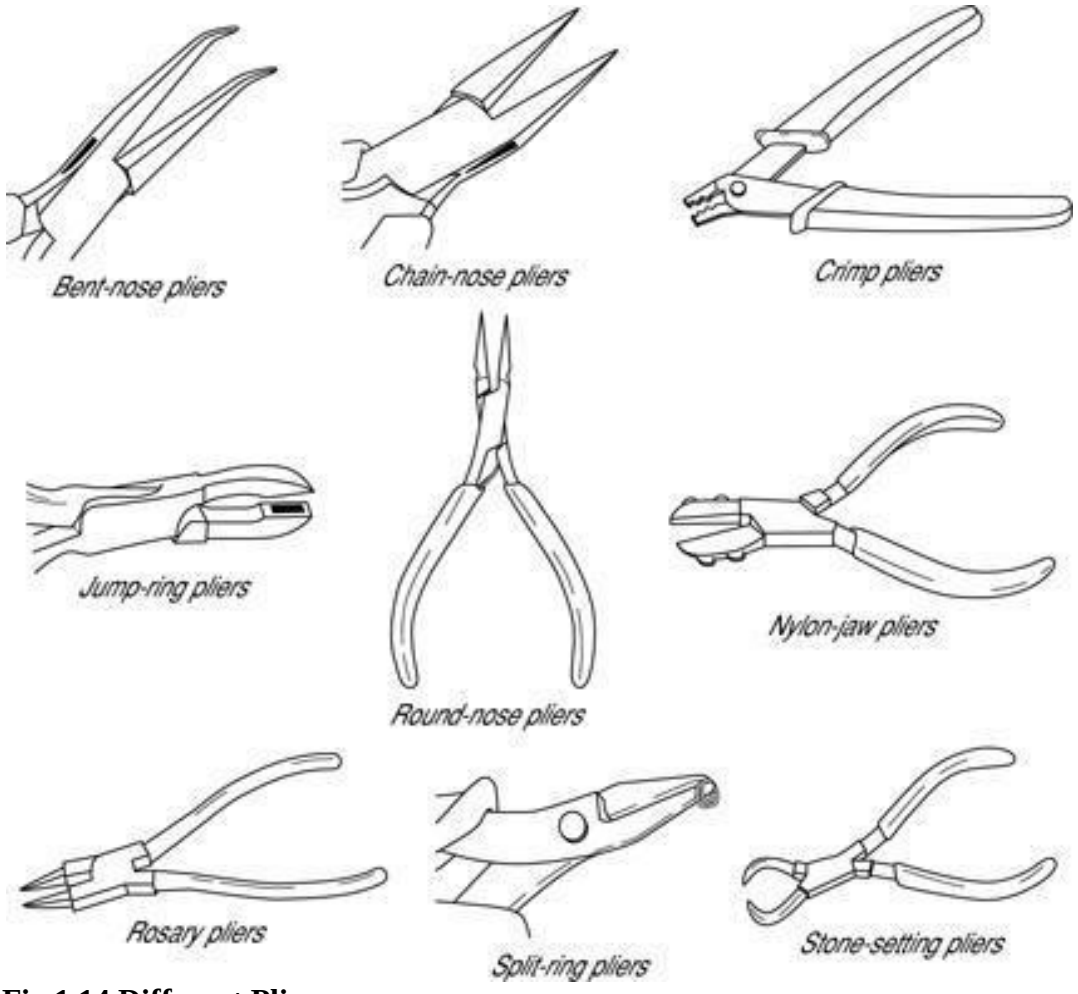

Fig 1.14 Different Pliers

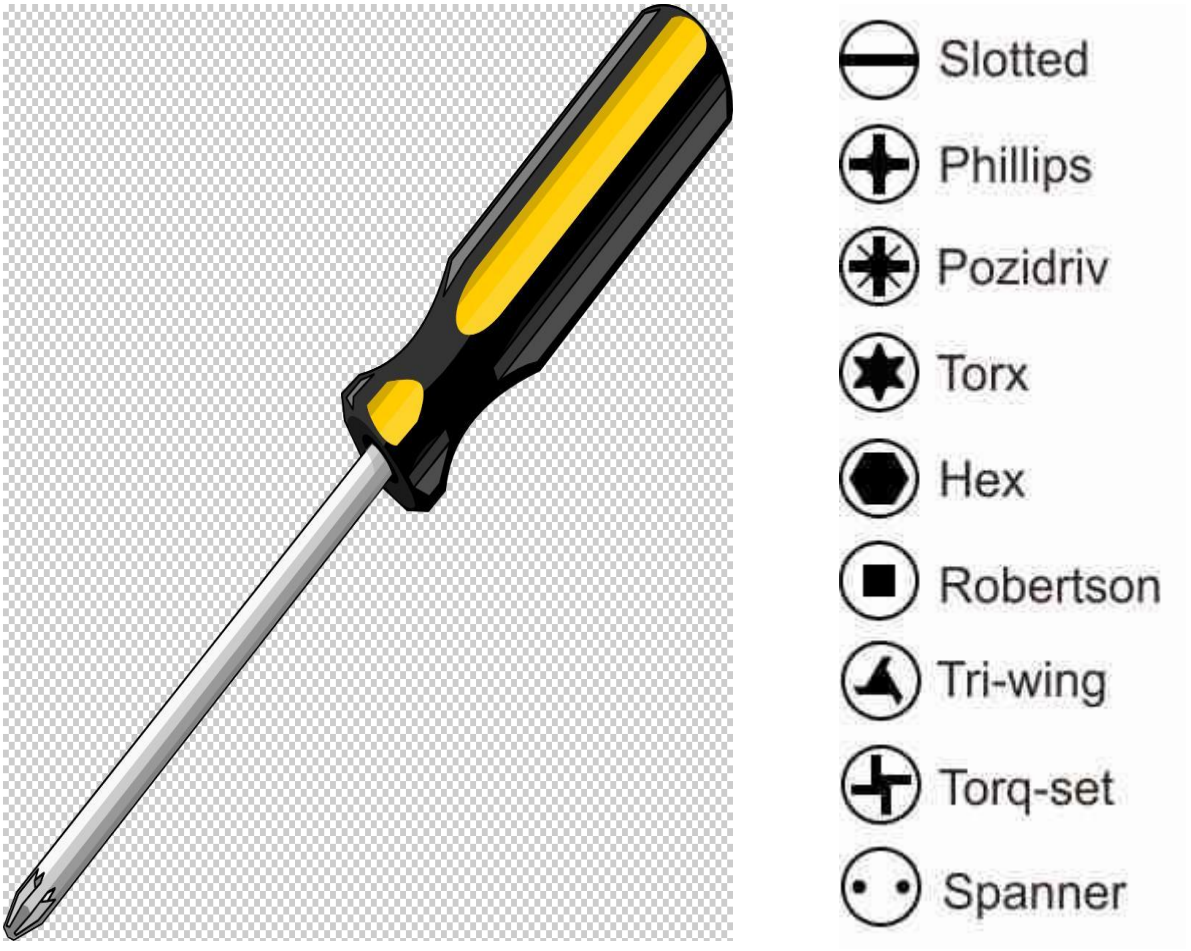

Fig 1.15 Screw Driver & Screw heads

Questions:

1. Why the care of tools is important?

2. How to take care of vices?

3. How to take care ofhammers?

4. How to take care ofchisels?

5. Explain, how to take care of files?

6. Explain, how to take care of hack saw?

7. How to take care of taps explain?

8. What points we should kept in mind while working with
   (a) Dies.
   (b) Reamers.

9. How to take care of spanners?

10. Explain the points to take care of spanners?

11. How to points to take care of screwdriver?

12. What do you understand by workshop material?

13. Give some points to explain, how to take care of workshop materials?

14. What is forging, what are the different forging tools?

15. Explain how to take care of forging tool?

16. What is bench vice?

17. What is hammer?

18. What is reamer?

19.What is the use of scraper?

20.What is file?

Sig. of C.I./Principal **Sig. ofTeacher**

EXPERIMENT NO. 2

AIM:

To measure the diameter of given circular hollow iron bar with the help of steel rule and caliper(inside & outside).

APPARATUS:

Iron circular bar, outside calliper, inside caliper, steel rule.

INTRODUCTION:

Caliper, measuring instrument that consist of two adjustable legs or jaws for measuring dimension of material parts. There are two types of caliper inside caliper and outside caliper. Outside caliper measure thickness and outside diameter of objects and inside caliper measure the inner diameter of a hollow bar.

PRINCIPLE:

Reading of outside& inside caliper can be read with the help of steel rule which works on the basic measuring technique of comparing an unknown length to the one previously calibrated.

PROCEDURE: Outside caliper

1. Properly clean the given bar with the help of sandpaper.

2. Hold the given bar in the measuring legs of outsidecaliper.

3. Properly adjust the legs of caliper with adjusting screw, so that it will properly hold work piece.

4. Now, slowly remove the work piece without moving the legs ofcaliper.

5. Transfer this reading or measurement, on a steel rule placed on a surface platesurface.

6. Take the reading from the steelrule.

7. Repeat the procedure for second and thirdreadings.

OBSERVATION TABLE:

Reading	**Average Reading = (R1+R2+R3) / 3**
1.	
2.	
3.	

DIAGRAM: Outside caliper

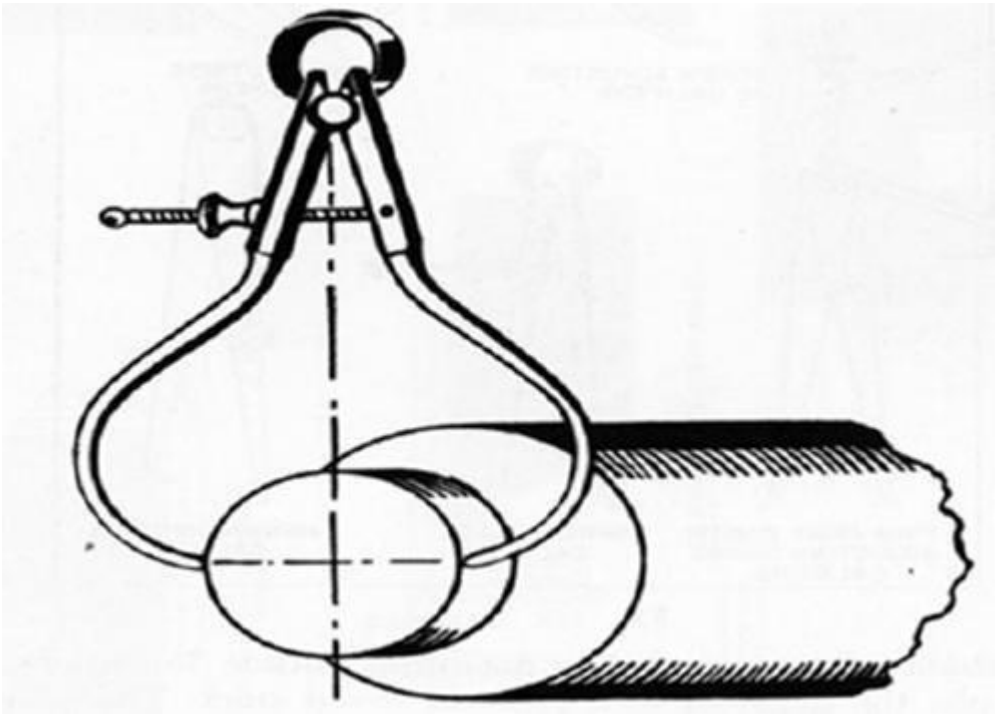

Fig.2.1: Measurement of circular bar

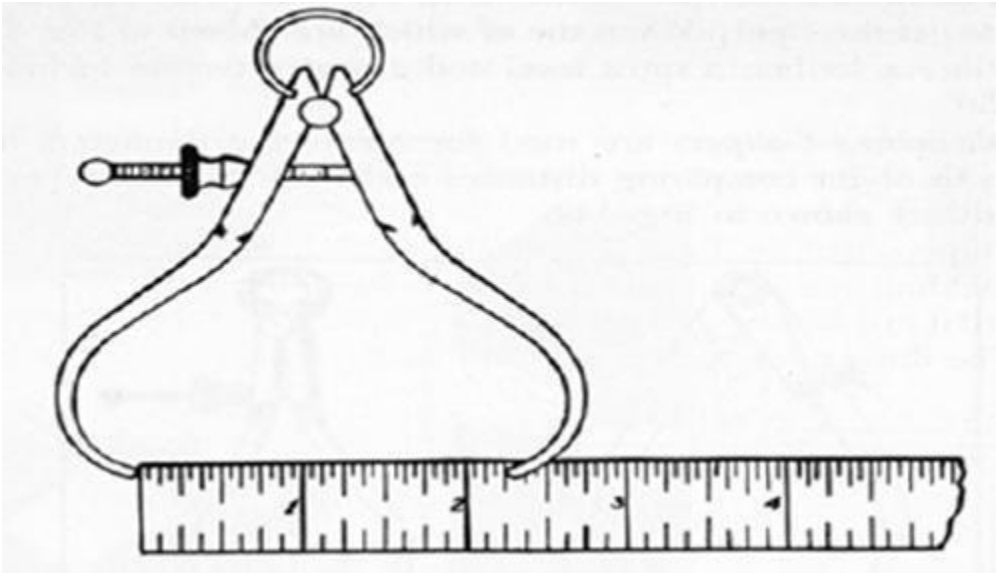

Fig.2.2: Readings help of steel rule

PROCEDURE: Inside calipe r

1. Properly clean the given bar with the help of sandpaper.

2. Hold the given hollow bar in the measuring legs of insidecaliper.

3. Properly adjust the legs of caliper with adjusting screw, so that it will properly hold work piece.

4. Now, slowly remove the work piece without moving the legs ofcaliper.

5. Transfer this reading or measurement, on a steel rule placed on a surface platesurface.

6. Take the reading from the steelrule.

7. Repeat the procedure for second and thirdreadings.

OBSERVATION TABLE: Inside caliper

Reading	**Average Reading = (R1+R2+R3) / 3**
1.	
2.	
3.	

DIAGRAM: Inside caliper

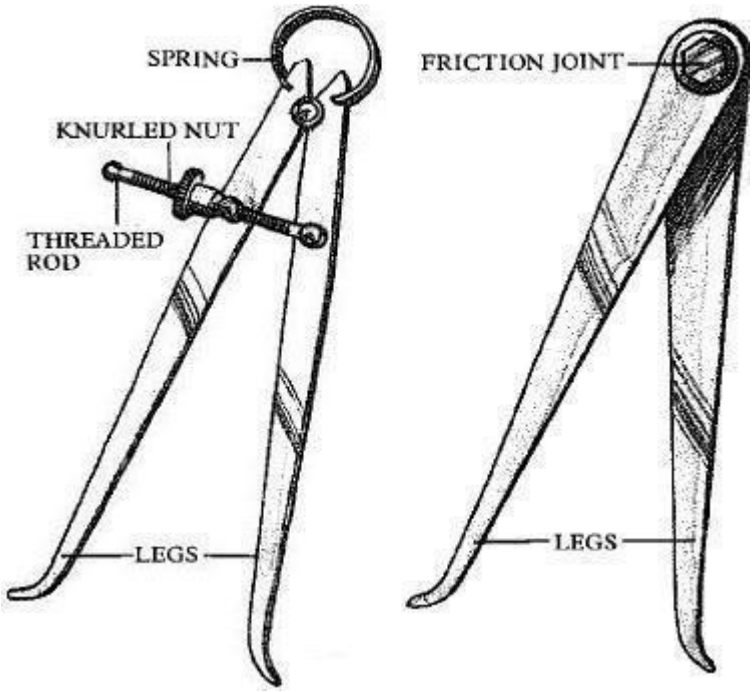

Fig 2.3: Inside Caliper

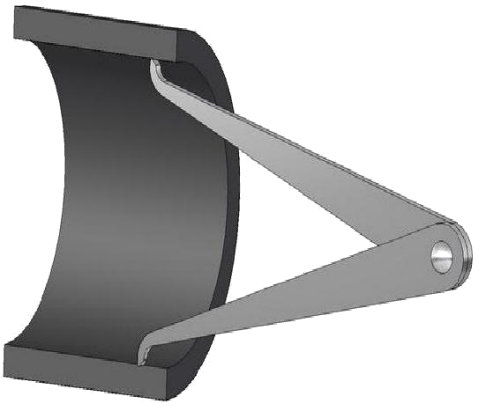

Fig 2.4: Measurement ofhollowbar

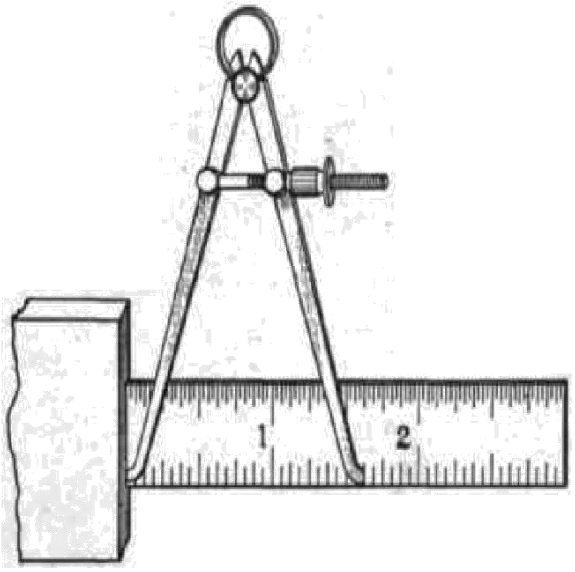

Fig 2.5: Readings help of steel rule

CONCLUSION:

PRECAUTIONS:

1. Surface of work piece should beclean.
2. Properly hold the bar duringmeasurement.
3. Readings must be taken very carefully without moving the caliperlegs.
4. Scale should be placed on surface plate duringmeasurement.
5. Take safety precaution during labexperiments.

QUESTIONS:

1. What are the Two Types ofcalipers?

2. What is the Purpose of outside Caliper?

3. How the average reading iscalculated?

4. On what principle steel ruleworks?

5. What are the tools required for measuring the diameter of circular steelbar?

6. What are the precautions to be followed during thepractical?

7. What is the procedure for measuring the diameter of circularbar?

8. What is caliper?

.

9. What is steel rule?

10. Which material is used for making steel rule?

11. Name the three types of steel rule?

12. What is odd leg caliper?

13. What is a shrink rule?

14. What is the use of odd leg caliper?

15. What is the use of inside caliper?

16. What is divider?

17.What do you know about hook rule?

18. How many types of steel rule?

19. What is divider?

20.State the difference between steel rule and hook rule?

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EXPERIMENT NO. 3

AIM:
To learn and practice the use of precision tools & measuring instruments.

APPARATUS:
1. Micrometers,
   a. inside and outsidemicrometer
   b. depthmicrometer
   c. screw threadmicrometer
2. Bevelprotector

INTRODUCTION:
1. Micrometers: Micrometers are used to make precise measurement of small objects. It has a thimble and barrel. The thimble is rotated till the spindle touches the work piece. Then the final adjustment is made by using Ratchet. The lock nut is then tightened and the dimension is measured on main scale and thimble scale.

Least count of micrometer
Least count of measuring instrument is the ratio of smallest division on main scale and total number of divisions on thimble scale.

Calculation of least count
Least Count (L. C) = Pitch/no. Of divisions on micrometer barrel(thimble)
where,
Pitch = distance travelled by thimble on linear scale in one rotation.

Calculation of final reading
Total reading of micrometer = main scale reading + least count x thimble scale reading.

a. INSIDE & OUTSIDEMICROMETER:

PRINCIPLE:

It works on the principle of screw and nut. We know that when a screw is rotated through one revolution it advances by one pitch distance i.e. one rotation of screw corresponding to a linear movement of a distance equal to pitch of the screw thread.

If the circumference of the screw is divided into number of equal parts say n its rotation through one division will cause the screw to advance through (pitch/n) length.

PROCEDURE:

1. Clean the workpiece and instrument .
2. Check the micrometer for errors like play in the jaw, zero error ifany.
3. Calculate the least count of theinstrument.
4. Hold the workpiece in the measuringanvils.
5. Note down the reading on main scale and thimblescale.
6. Take the measurement by micrometer for at least 3components.
7. Calculate the total reading ofmicrometer.

OBSERVATION TABLE:

S.NO.	Main scale reading	Thimble scale coincidence	Thimble scale reading	Zero error	Total length
a.1					
a.2					
a.3					
b.1					
b.2					
b.3					

DIAGRAM:

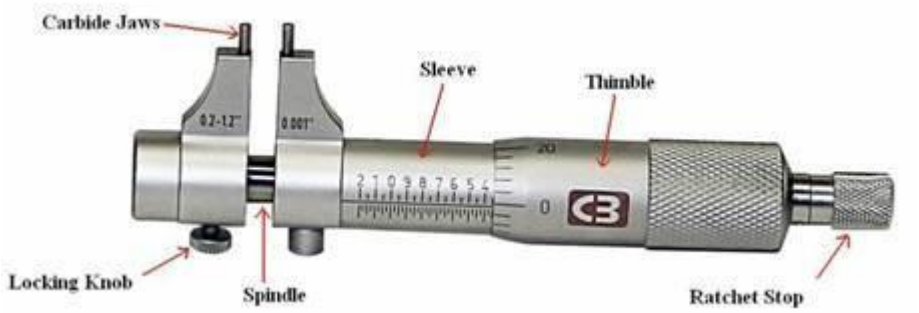

FIG.3.1 Inside Micrometer

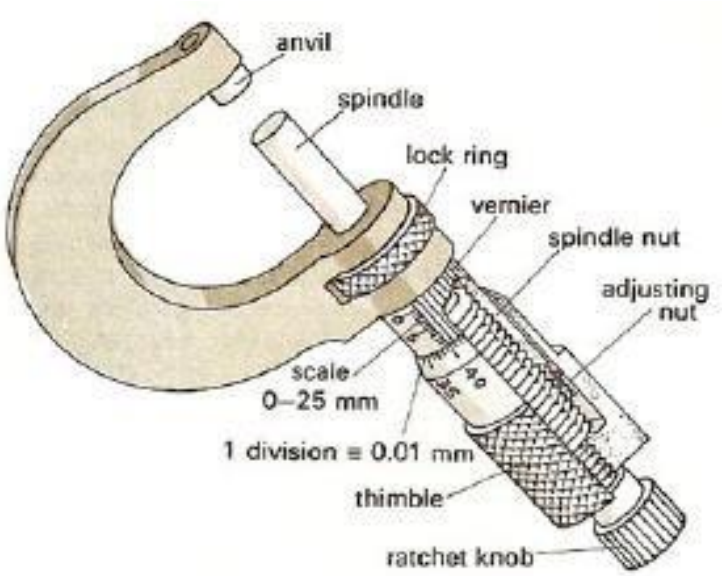

FIG. 3.2 Outside Micrometer

b. DEPTHMICROMETER:

PRINCIPLE:
Depth micrometer as the name indicates is used for measuring the depth of holes, slots and recesses. It has a shoulder, which acts as a reference surface. The shoulder is held firmly and perpendicular to the centreli8ne of hole. Extension rods are in steps of 25mm used for longer range of measurement. The extension rod can easily be inserted by removing the spindle cap. When the cap is replaced, the rod is held firmly against the reference surface. The extension rods are marked with their respective capacity and are square with the base in any position. The measuring faces of the base and rods are hardened**.**

PROCEDURE:
1. First choose the measurement rod suitable for the depth to be measured.

2. Clean the mounting surfaces of the measurement rod and the rod-receiving shaft using sandpaper.

3. Insert and rotate the measurement rod into the rod-receiving shaft to seat itcompletely.

4. Turn the thimble counter clockwise so that when the base is flush on the top (reference) surface, the measurement rod does not touch the surface to bemeasured.

5. Holding the base firmly on the reference surface, rotate the thimble ratchet clockwise until it “clicks” three times (as the measurement rod stops on the measurementsurface).

6. Read the depthmeasurement.

OBSERVATION TABLE:

S.No.	Main scale readingA	No. of circular section divisionB	Circular scale readings division X least countC	Extension rod selected	Total reading A+B+C

DIAGRAM:

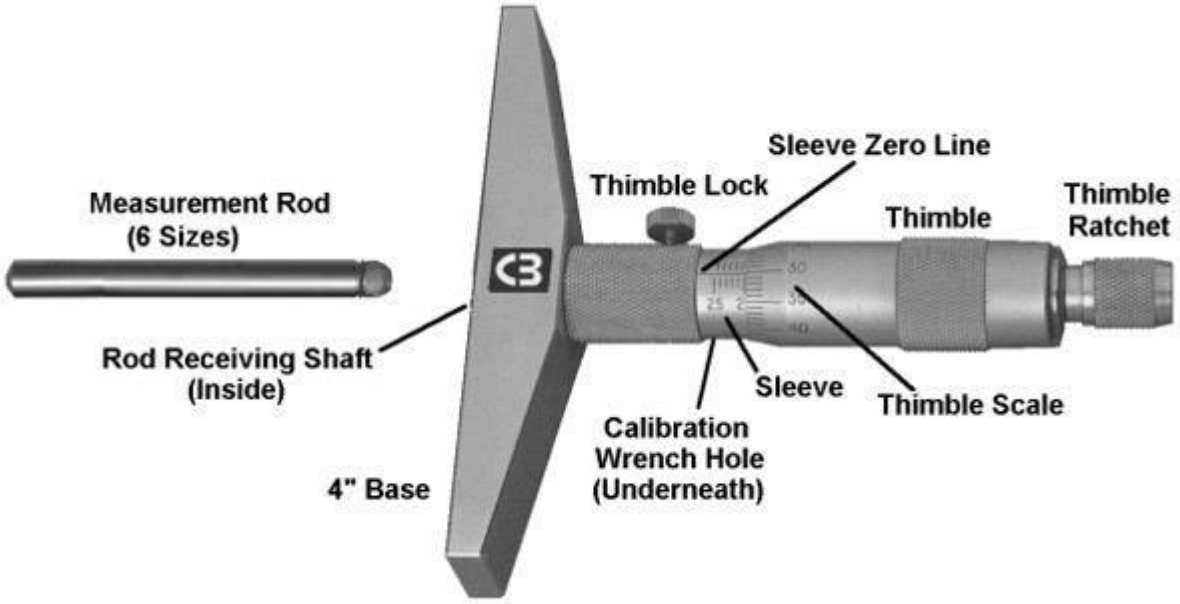

FIG. 3.3 Depth Micrometer

c. SCREW THREADMICROMETER:

INTRODUCTION:

It is designed to measure the pitch diameter of screw threads to an accuracy of 0.01mm in construction the screw thread micrometer is similar to outside micrometer with the following differences.

1. The movable spindle is pointed,and
2. The end of the anvil is of the same form of the screw thread to be measured the different pairs of interchangeable vee-envil and spindle points are used with this micrometer. In order to measure the pitch diameter the pointed end of the spindle and the sides of the vee-anvil should contact the surfaces of the thread. The reading on the micrometer is read in the similar way as in outsidemicrometer.

PRINCIPLE:
The principle of the thread micrometer same as outside micrometer.

PROCEDURE:
1. Clean the work piece and instrument.
2. Check the error of the thread micrometer by the use of given test piece with micrometer.
3. Calculate the least count of theinstrument.
4. Measure the screw thread pitch diameter the pointed end of the spindle and the sides of the vee-envil should contact the surface of thethread.
5. Note down the reading on the sleeve scale and the thimblescale.
6. Calculate the total reading of threadmicrometer.
7. Complete the observationtable.

OBSERVATION TABLE:

S.No.	Sleeve reading (A)	Thimblereading (B)	Total reading(A+B)

DIAGRAM:

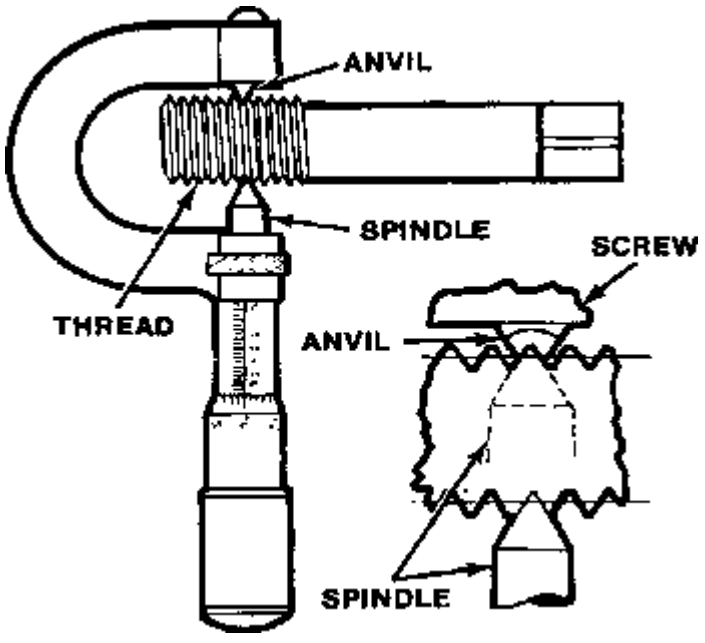

FIG.3.4 Screw Thread Micrometer

CONCLUSION/RESULT:

PRECAUTIONS:

1. it‟s essential to ensure the anvil is clean before you try to measureanything.
2. Hold the item you want to measure so that it's squarely between anvil and spindle -- if it's at an angle, you will not make an accuratemeasurement.
3. Use the ratchet to tighten the micrometer and cease turning the screw once the appropriate torque has beenreached
4. If you are right-handed, it's best to hold the micrometer in your right hand and the partyou want to measure in your left; if you are left-handed, reverse thisorientation.

2. BEVEL PROTECTOR:

INTRODUCTION:

It is used to lay out, measure, or check angles. The universal bevel protractor is capable of measuring obtuse angles as well as acute angles when accompanied with the correct attachments.

LEAST COUNT:-

Each space on the vernier scale is, therefore, one-twelfth of a degree. One-twelfth of a degree is equal to 5 minutes.

PRINCIPLE:

The micrometer works on the principle of screw and nut, when a screw is rotated through a nut by one revolution, it will move forward equal to a distance of one pitch.

MAIN COMPONENTS:-

The main component of the bevel protractor is the main scale The main scale is graduated into four 90-degree components. The main scale is numbered to read from 0 to 0 degrees and then back from 90 degrees to 0.As with other vernier measuring devices, the vernier scale of the bevel protractor allows the tool to divide each degree into smaller increments. The vernier scale is divided into 24 spaces, 12 spaces on either side of thezero.

TYPES OF BEVEL PROTRACTOR:-

- A
- B
- C
- D

In types A, B the Vernier is graduated to read 5min arcs whereas in case C the scale is graduated to read in degrees and the bevel protractor is without vernier or fine adjustment. the

difference between type A and B is that a is provided with fine adjustment devices or acute angle attachment whereas type is not the scale of all types are graduated either as a full circle marked 0-90-0-90 with one vernier as semi-circle marked 0-90-0 with two vernier 180 apart .Type D is graduated in degrees and is not provided with either vernier or fine adjustment devices or acute angle attachment.

OBSERVATION TABLE:

S.No.	Angle of Plate	Angle Measured

DIAGRAM:

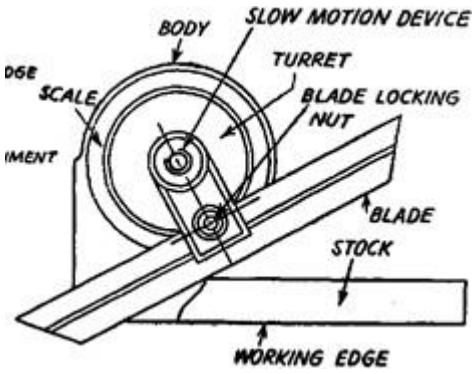

FIG. 3.5 Bevel Protector

CONCLUSION:

PRECAUTIONS:

1. The sine bar should not be used for angle greater than 60^0 because any possible error in construction is accentuated at thislimit.

2. A compound angle should not be formed by mis-aligning of work piece with the sine bar. This can be avoided by attaching the sine bar and work against an angle plate.

3. As far as possible longer sine bar should be used since using longer sine bars reduces manyerrors.

QUESTIONS:

1. What is Pitch?

2. What is Least Count?

3. What is the principle of a Micrometer?

4. How to calculate the least count of given micrometer?

5. How to calculate the final reading from main scale reading and thimble scalereading?

6. What are the various precations to be observed during measurement?

7. What is zero error?

8. How many types of micrometer?

9. Name the three types of micrometer?

10 What do you know about ratchet stop?

11 How to calculate the final reading?

12. How many types of error?

13. What is positive error?

14. What is negative error?

15. Name the parts of micrometer?

16. What is Vernier bevel protractor?

17. What is the least count of vernier bevel protractor?

18. Name the parts of vernier bevel protractor?

19. Which material is used for making bevel protractor?

20. How to calculate the least count of vernier bevel protractor?

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Experiment No. 4

AIM: To acquaint with the different types of Drill.

APPRATUS: twist bit, screwdriver bit,
masonry,spur point,bullet pilot, countersink tile,flat wood,hole saw,Forstner,wood auger.

INTRODUCTION:

To drill a satisfactory hole in any material, the correct type of **drill bit** must be used; it must be used correctly and be sharpened as appropriate. Many jobs around the house require a hole of some kind to be drilled - whether it is putting up a shelf, building a cabinet or hanging a light fitting.

For basic requirements, a set of high-speed steel twist drills and some masonry bits will probably be sufficient for the average handyman. But for more sophisticated jobs/material, others bits will be required - perhaps larger, or designed for a specific material/purpose. Good quality drill bits can be expensive, so take care of them, keep them in a case or box if possible, rather than allowing them to roll around loose in a toolbox where the cutting edges may bedamaged.

Learning how to sharpen drill bits is cost effective, it better to keep a bit sharp by occasional sharpening rather than waiting until it becomes really blunt. A sharp bit cuts better with less effort whether used in a power or hand drill. A sharp bit will also give a cleaner hole.

Types of Drill Bits:

1. TWISTBITS

Usually preferred to as twist drills, twist bits are probably the most common drilling tools used by the handyman with either a hand or electric drill. The front edges cut the material and the spirals along the length remove the debris from the hole and tend to keep the bit straight.

They can be used on timber, metal, plastics and similar materials. Most twist bits are made from either:

- **'high speed steel'** (HSS), these are suitable for drilling most types of material, when drilling metal the HSS stands up to the hightemperatures.
- **'carbon steel'**, these bits are specially ground for drilling wood and should not be used for drilling metals, they tend to be more brittle, less flexible than HSSbits.

Twist bits are also available coated with Titanium nitride (TiN), these are easily identified by the gold like color. This coating increases the hardness of the bit and adds a self-lubricating property. The coating is only really effective when metal is being drilled, it has little effect when working with other materials.

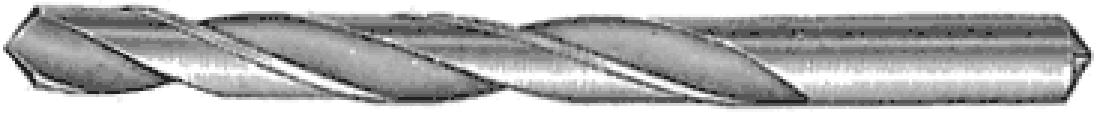
Twist drills are usually available in sizes 0.8-12 mm plus. They are designed for drilling relatively small holes, they sometimes tend to clog quickly especially when the wood is 'green' so when drilling deep holes (especially in hardwood) the bits should be withdrawn regularly to remove thewaste.

Special care is required when using the smallest sizes since these bits are thin and brittle. Always hold the drill square to the work and apply only light pressure when drilling.

Sharpening - use a drill sharpener, a grindstone jig or an oilstone.

Titanium nitride bits cannot be sharpened without destroying the coating (although if the drill needs sharpening, the coating will probably have already been destroyed). Forming the correct angle at the tip is important for efficientcutting.

DIAGRAM:



2. SCREWDRIVER BITDRILLS

Designed to fit in rechargeable screwdriver these bits have a hexagonal shank. They are ideal for drilling pilot holes but are limited by the low power of these type of screwdrivers and the limited size of small bits available.

Sharpening - as for twist drills.

DIAGRAM:

3. MASONRY BIT:

As the name suggests, these are designed for drilling into brick, block, stone, quarry tiles or concrete. The cutting tip is often made from tungsten carbide bonded to a spiralled steel shaft. Some masonry drills are described as 'durium tipped', this term refers to a highly durable silicon bronze alloy used instead of tungsten as the cutting point.

Masonry drills are usually used in a power drill; although they can be used with a lot of effort in a hand brace. Most masonry bits can be used with a hammer action power drill, but always check as the action is quite punishing on the bit and cheaper bits have been known to shatter

when subjected to the pounding. Always use a slow rotational speed for drilling into harder materials to avoid overheating the tip, and frequently withdraw the bit to remove dust.

Long Masonry bits (300 to 400mm) are available for drilling through masonry walls.

Bit sizes range from 4 to 16mm.

Sharpening - use a drill sharpener or grindstone to sharpen the tungsten carbide tip.

DIAGRAM:

4. SPUR POINTBIT

Also known as a wood or dowel bit, they have a central point and two raised spurs that help keep the bit drilling straight. The bit cuts timber very fast when used in a power drill and leaves a clean sided hole. They are ideal for drilling holes for dowels as the sides of the holes are clean and parallel. Sizes range from 3 to 10mm. Spur point bits should only be used for drilling wood or someplastics.

Sharpening - a bit fiddly as it has to be done by hand. Sharpen the point and spurs with a fine file or edge of a fine grindstone; the angle between the point and spurs should be 90°.

DIAGRAM:

5. BULLET PILOTPOINT:

With their central point and two spurs, Bullet drills resemble spur point bits, but can be used in metal, wood and plastics. Unlike normal twist drills, the twisted flutes are ground away; making a truer, more accurate bit than normal twist bits. They cut a clean hole and cause little damage when they break through the back of the workpiece.

Bit sizes range from 1.5 to 13 mm.

Sharpening - cannot be carried out satisfactorily.

DIAGRAM:

6. COUNTERSINK:

Although not a true 'drill', it is used in a power or hand drill to form the conical recess for the heads of countersunk screws. These bits tend to be designed for use on soft materials such as timber and plastics, not metals. When used with a power drill to counter sink an existing hole, the bit tends to 'chatter', leaving a rough surface. Better results be will obtained if the countersink bit is used before the hole is drilled, then take care to ensure that the hole is in the centre of the countersunk depression.

Countersinks are available with fitted handles so that they can be used by hand twisting, often easier than changing the bit in the drill when only a relatively few holes need countersinking.

Sharpening: difficult, but can be done with a fine triangular file.

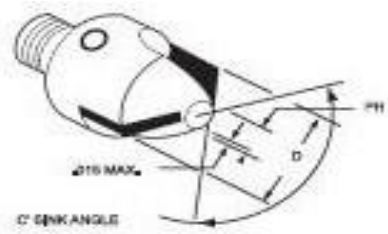
DIAGRAM:

7. COUNTERSINK WITH CLEARANCEDRILL:

These combination bits are quite clever, they drill the clearance hole and countersinks it all in one stroke. Can be used in a power drill or some routers. Different bits are required for different size of clearance holes and they are probably not cost effective unless a large number of a given hole size need to be drilled andcountersunk.

Sharpening - difficult, due to shape of spur points.

DIAGRAM:



8. TILEBIT:

A bit for drilling ceramic tiles and glass, it has a ground tungsten carbide tip. They can be used with a hand drill, but are best used in a variable speed power drill on a slow speed. When drilling glass, some form of lubricant (i.e. turpentine or white spirit) should be used to keep the tipcool.

Ceramic tiles can also be drilled using a masonry bitif it is used at slow speed and without hammer action.

Sharpening - difficult because of the hard tungsten carbide and curved cutting edge. With care and patience, a blunt edge can be made good using anoilstone.

DIAGRAM:

9. FLAT WOODBIT:

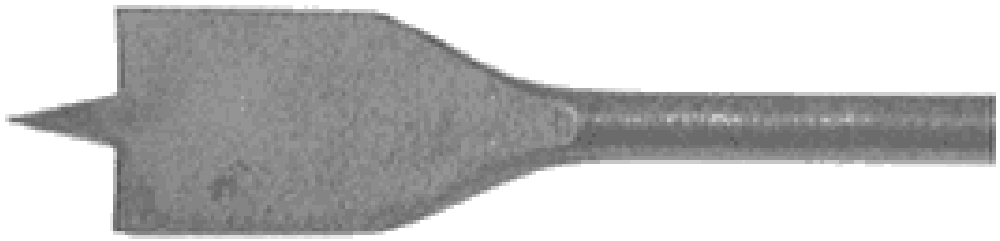
Intended for power drill use only, the centre point locates the bit and the flat steel on either side cuts away the timber. These bits are used to drill fairly large holes and they give a flat bottomed hole (with a central point) so are ideal where the head of a screw/bolt needs to be recessed into the timber - always use this bit before drilling the clearance hole for the bolt.

The larger bits require a fairly powerful drill to bore deep holes. The bits cause a lot of splintering as they break out the back of the workpiece - using a sacrificial backing board will reduce this. Flat wood bits are not really suitable for enlarging an existing hole.

Sizes range between 8 and 32mm.

Sharpening - use a fine file, oilstone or grindstone.

DIAGRAM:



10. HOLE SAW:

Used for cutting large, fixed, diameter holes in wood or plastic. They will usually cut up to a depth of 18mm - deeper versions are available. Best used in a power drill at low speed as the blade saws it's way through the material.

Sharpening - could be done with a fine triangular file - as for an ordinary saw.

DIAGRAM:

11. COMBINATION HOLESAW:

Like the Hole Saw above, these combination saws can cut large holes but they consist of a number of different sized round saw blades, usually ranging from about 25 to 62mm in diameter. Normally the blade are secures by a radial screw in the 'head', all blades other than the desired sized being removed before the screw is inserted to secure the required diameter blade. Best used in a power drill at low speed as the blade saws it's way through the material.

Sharpening - could be done with a fine triangular file and 'setter' as for an ordinary saw.

DIAGRAM:

12. FORSTNERBIT:

Used to form holes with a flat bottom, such as for kitchen cupboard hinges. Best used in a power drill held in a drill stand as there's little in the way of a central point. If used freehand, the positioning is difficult to control as there is no central pilot bit.

Sharpening - on an oilstone or with a fine file.

DIAGRAM:

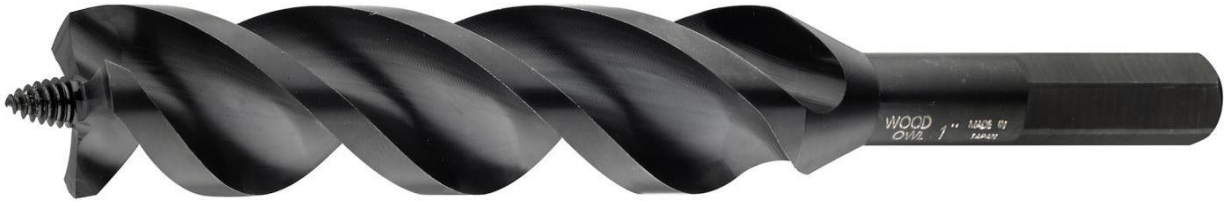
13. WOOD AUGERBIT

This is ideal when drilling large-diameter, deep holes in wood or thick man-made boards. Generally an Auger bit should only be used in a hand brace. The bit will cut a clean and deep,

flat bottomed holes. The single spur cuts and defines the edge of the hole while the chisel-like cutting edge removes the waste within the previously cut circle. The threaded centre bites into the wood and pulls the bit into the timber. This 'pulling' action means that the bit is really unsuitable for use in a powerdrill.

Sharpening - use a fine file or oilstone to keep the spur and main cutting edges sharp.

DIAGRAM:



CONCLUSION:

_____

_____

_____

_____

_____

_____

PRECAUTIONS:

1. Wear Safety Goggles.
2. Wear protectiveclothing.
3. Turn off the drill during changing drillbit.
4. Ensure that the Chuck is Tight before Using theDrill.
5. Use the Correct Drill Bit for EveryJob.
6. Avoid Clogging or Binding of the DrillBit.

DIAGRAM:

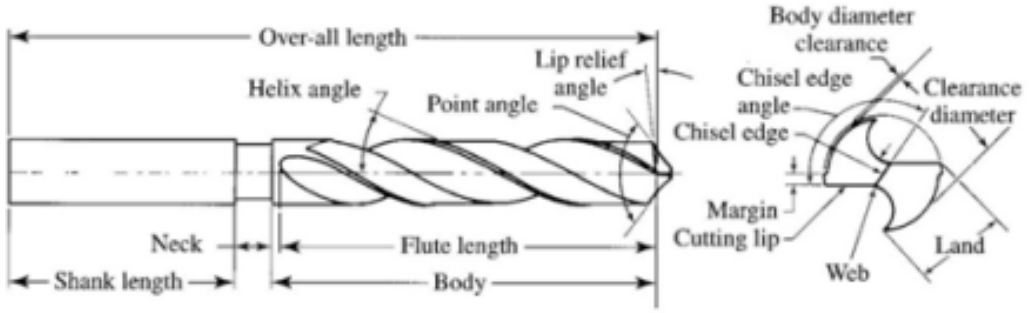


FIG. Nomenclature of Drill Bit

FIG. Different types of Drill Bits

QUESTIONS:

1.What is the use of drill bit?

2. Which materials use to make Twist drill?

3. Use of screw driver drillbit?

4. Which Drill bits use for making hole inwood?

5. How to sharpen the drillbits?

6. What is drill?

7. How many types of drill?

8. What is a twist drill?

9. Which material is used for making drill?

10.What do you know about 18-4-1drills?

11.What is a metric series drills?

12.What is a number series drill bit?

13.What is a letter series drill bit?

14.What is a screw driver bit?

15.How many types of drill series?

16.Name the five types of drill bit?

17.What is a fraction series drill bit?

18.What it masonry drill bit?

19.What is a hole saw bit?

20.What is a combination hole saw bit?

SIGN of TEACHER **SIGN of PRINCIPAL**

EXPERIMENT – 5

OBJECTIVE: To learn and practice the use of drills and reamers.

APPARATUS USED: Drilling M/C, Twist Drill, Reamer, Work Piece.

Twist Drill:

Twist drills are the most common cutting tools used with drilling machines. Twist drills are designed to make round holes quickly and accurately in all materials. They are called twist drills mainly because of the helical flutes or grooves that wind around the body from the point to the neck of the drill and appear to be twisted. Twist drills are simply constructed but designed very tough to withstand the high torque of turning, the downward pressure on the drill, and the high heat generated by friction. There are two common types of twist drills, high-speed steel drills, and carbide tipped drills. The most common type used for field and maintenance shop work is the high-speed steel twist drill because of its low cost. Carbide-tipped metal drills are used in production work where the drill must remain sharp for extended periods, such as in a numerically controlled drillingmachine.

INTRODUCTION:

Drilling: It is a cutting process that uses a **drill** bit to cut or enlarge a hole of circular cross-section in solid materials. The **drill** bit is a rotary cutting tool, often multipoint. The bit is pressed against the workpiece and rotated at rates from hundreds to thousands of revolutions per minute.

Reaming: A **reamer** is a type of rotary cutting tool used in metalworking. Precision **reamers** are designed to enlarge the size of a previously formed hole by a small amount but with a high degree of accuracy to leave smoothsides.

PRINCIPLE:

Drilling machines use a drilling tool that has cutting edges at its point. This cutting tool is held in the drill press by a chuck or Morse taper and is rotated and fed into the work at variable speeds. The removal of metal in a drilling operation is by shearing andextrusion.

PROCEDURE:

i) Run the machine at low speed and observe the motions, which control the shapes of the surfaces produced.

ji) Learn the names of the major units and the components of each machine. Record these details (Table 1).

(Please ensure that the main isolator switch is off and check that the machine cannot be inadvertently Started. Do not remove guards). Use the manufacture's handbook for details that cannot beinspected.

iii) Record the obtainable speed and feed values (Table 2).

iv) Note down the special features of the speed and feed control on eachmachine,

v) Pay attention to thefollowing:

a, Size specification of various machine tools,

b, Machine tool structures and guide ways I slide ways.

c. Drive mechanism for primary (cutting)motion,

d. Drive mechanism for secondary (feed)motion.

e. Drill geometry - check forangles

OBSERVATION:

Table1: Machine Tool Specification

Machine	**Types & Make**	**Size**	**Speed Given To**		**Feed Given To**		**Types of surface produced**
			Tool	**Work**	**Tool**	**Work**	
Drilling M/C							

Table2: Speed and Feed data

S.No.	**Drilling Machine**	
	Speed	**Feed**

1		
2		
3		
4		

GENERAL DRILLING OPERATIONS:

DRILLING DEEP HOLES:

If the depth of the hole being drilled is greater than four times the diameter of the drill, remove the drill from the workpiece at frequent intervals to clean the chips from the flutes of the drill and the hole being drilled. A slight increasing speed and decrease in feed is often used to give the chips a greater freedom of movement. In deep hole drilling, the flutes of the smaller drills will clog up very quickly and cause the drill to drag in the hole, causing the diameter of the hole to become larger than the drill diameter. The larger drills have larger flutes which carry away chips easier. The depth of the hole being drilled is four times the diameter of the drill itself, remove the drill at frequent intervals and clean the chips from the flutes of the drill and from the hole beingdrilled.

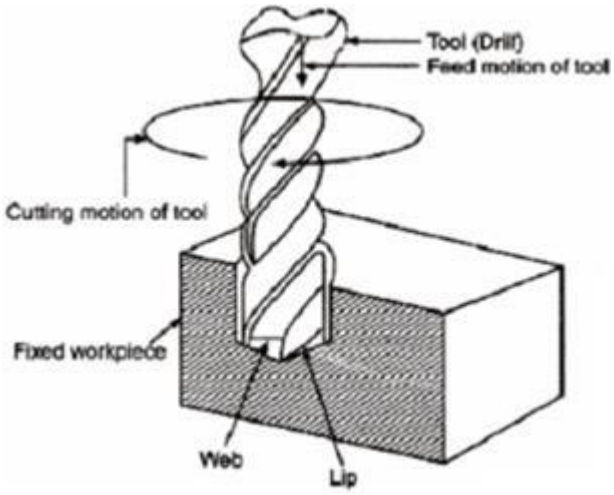


FIG.1 Drilling Deep Hole

SPECIAL OPERATIONS ON DRILLING MACHINES

COUNTERSINKING:

Countersinking is the tapering or beveling of the end of a hole with a conical cutter called a machine countersink. Often a hole is slightly countersunk to guide pins which are to be

driven into the workpiece; but more commonly, countersinking is used to form recesses for flathead screws and is similar to counterboring.

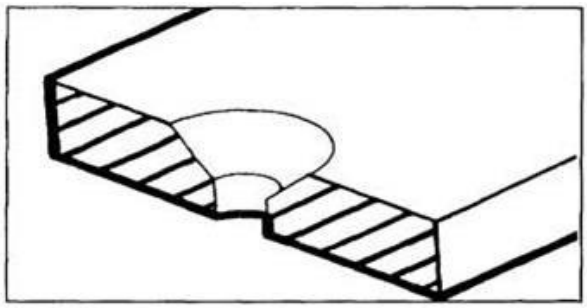


FIG.2 Countersinking

COUNTERBORING AND SPOT FACING:

Counterboring is the process of using a counterbore to enlarge the upper end of a hole to a predetermined depth and machine a square shoulder at that depth. Spot facing is the smoothing off and squaring of a rough or curved surface around a hole to permit level seating of washers, nuts, or bolt heads. Counterbored holes are primarily used to recess socket head cap screws and similar bolt heads slightly below the surface. Both counterboring and spot facing can be accomplished with standard counterbore cutters. Counterbore cutters have a pilot to guide the counterbore accurately into the hole to be enlarged. If a counterbore is used without a pilot, then the counterbore flutes will not stay in one spot, but will wander away from the desired hole. The shank of counterbores can be straight or tapered. The pilots of counterbores can be interchangeable with one another so that many hole combinations can be accomplished.

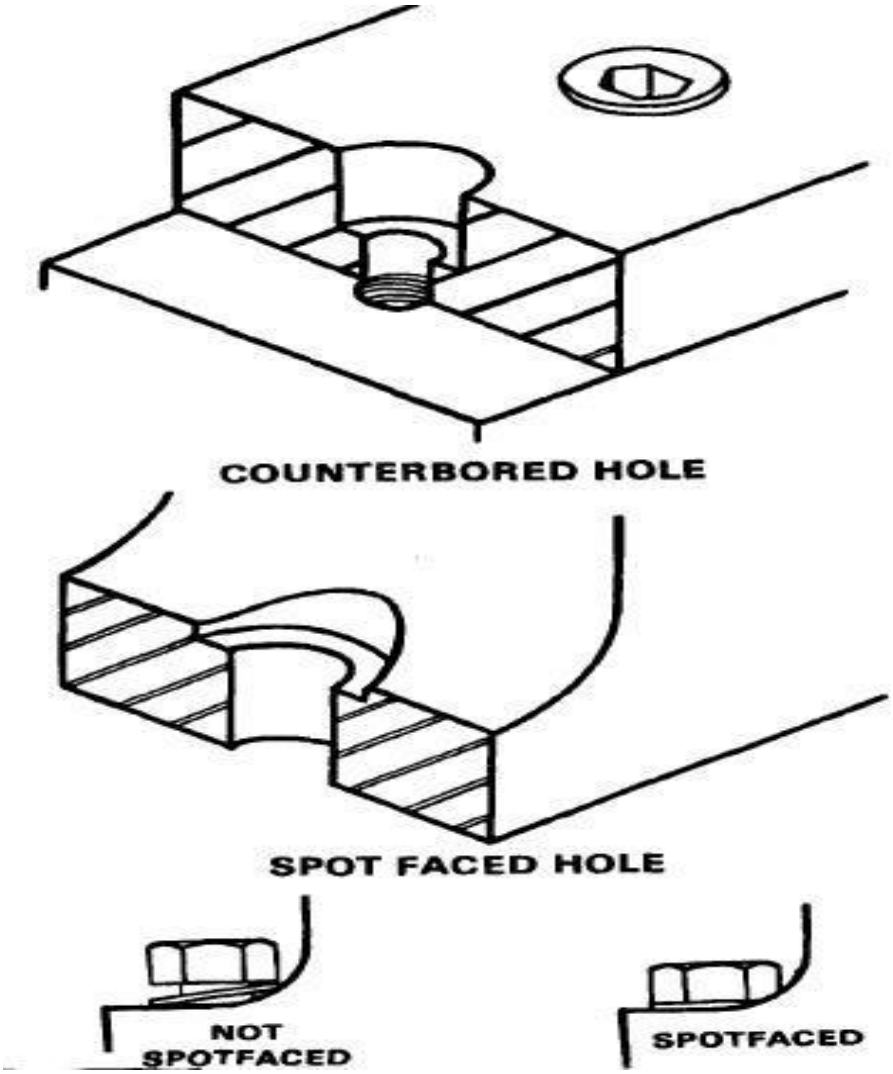


FIG. 3 Counter Boring and Spot Facing

TAPPING:

Tapping is cutting a thread in a drilled hole. Tapping is accomplished on the drilling machine by selecting and drilling the tap drill size, then using the drilling machine chuck to hold and align the tap while it is turned by hand. The drilling machine is not a tapping machine, so it should not be used to power tap. To avoid breaking taps, ensure the tap aligns with the center axis of the hole, keep tap flutes clean to avoid jamming, and clean chips out of the bottom of the hole before attempting to tap.

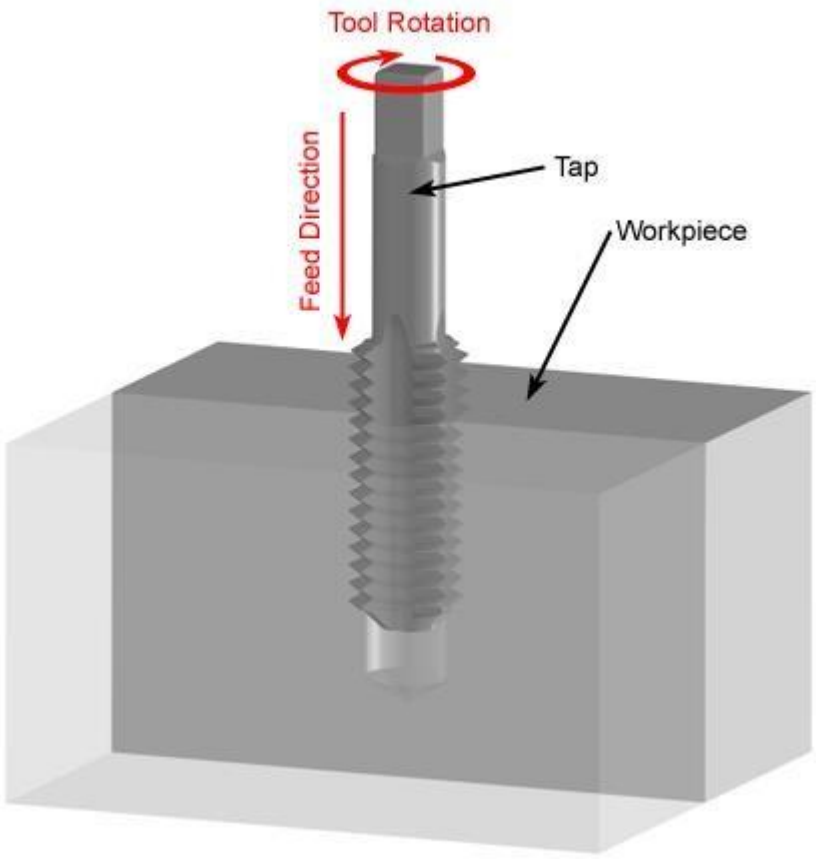


FIG. 4 Tapping Operation

REAMING:

When great accuracy is required, the holes are first drilled slightly undersized and then reamed to size. Reaming can be done on a drilling machine by using a hand reamer or using a machine reamer. When you must drill and ream a hole, it is best if the setup is not changed. For example, drill the hole (slightly undersized) and then ream the hole before moving to another hole. This method will ensure that the reamer is accurately aligned over the hole. If a previously drilled hole must be reamed, it must be accurately realigned under the machine spindle. Most hand and machine reamers have a slight chamfer at the tip to aid in alignment and starting.

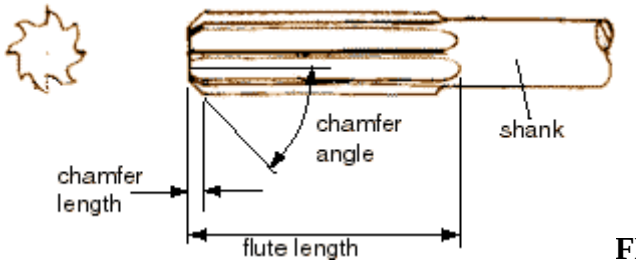


FIG. 5 Reamer

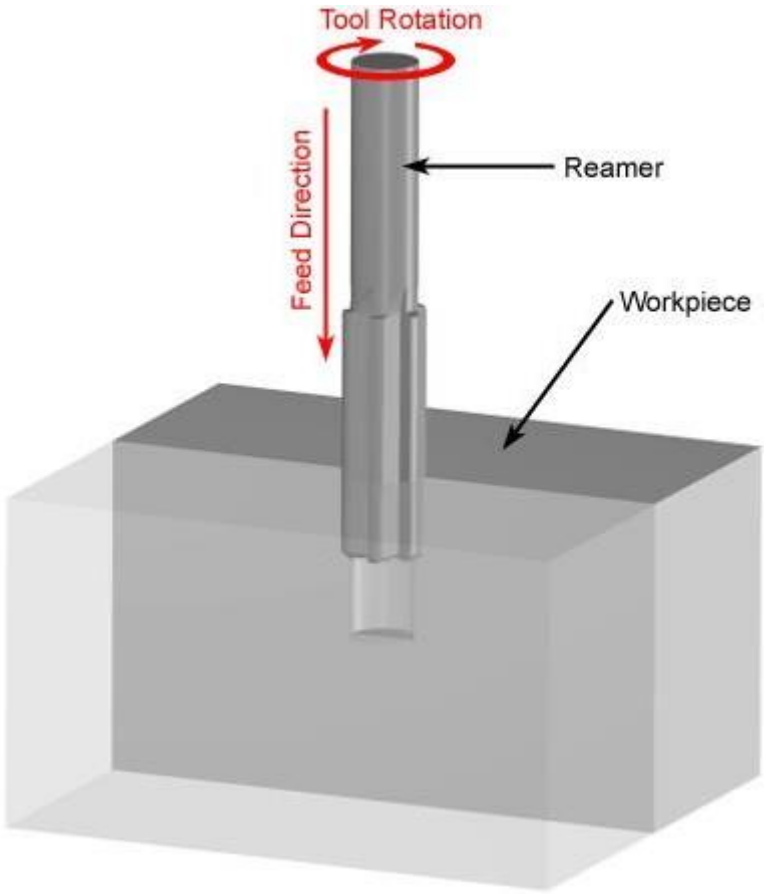


FIG. 6 Reaming Operation

DIAGRAMS:

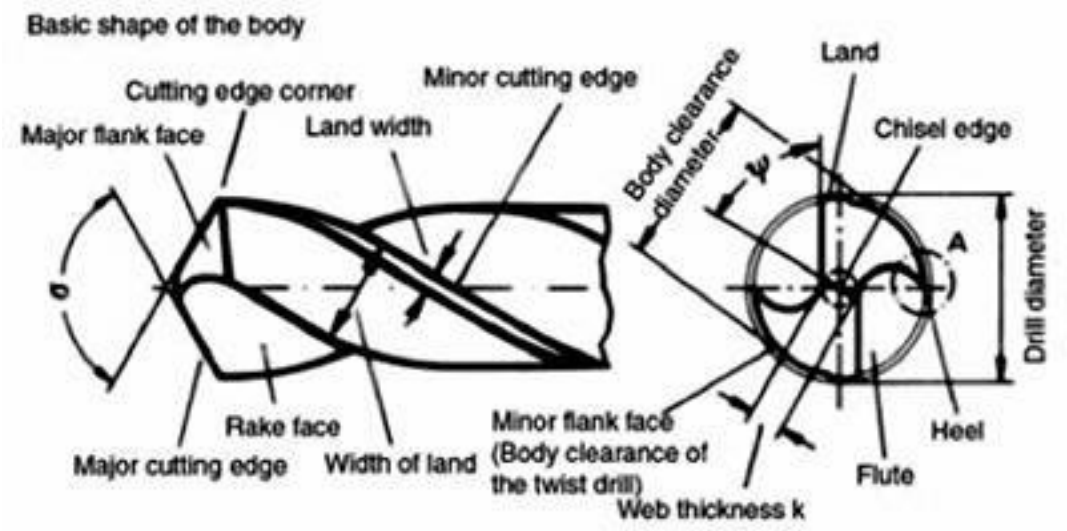


FIG. 7 Twist Drill

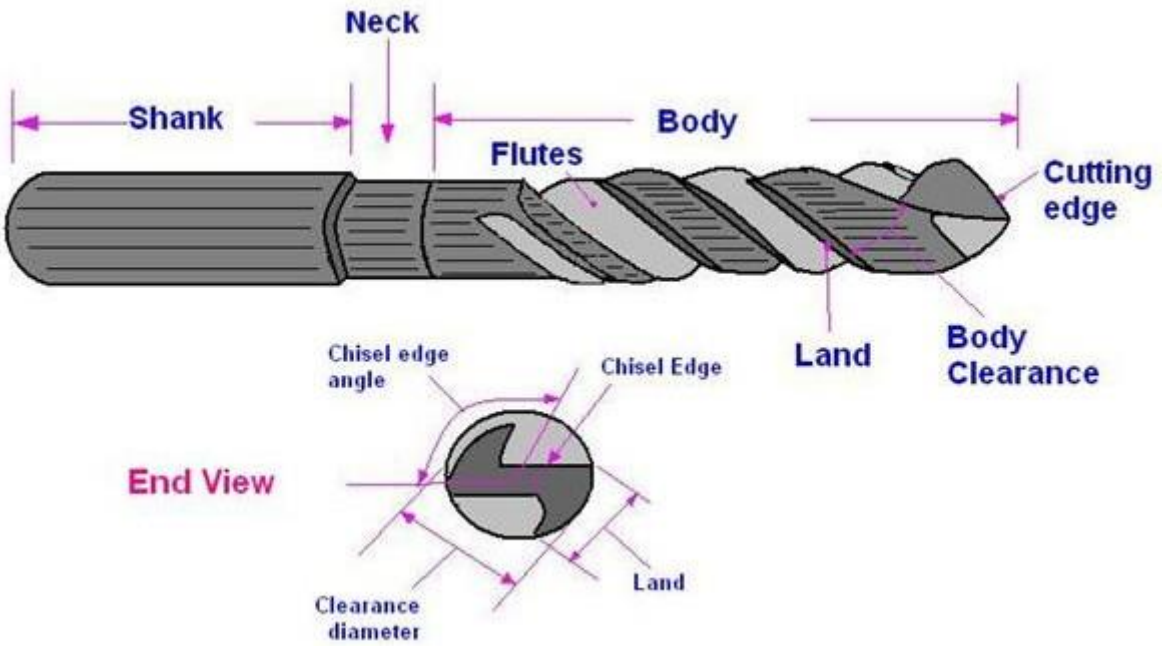


FIG. 8 Parts of Twist Drill

PRECAUTIONS:

- Never make any adjustments while the machine isoperating.
- Never clean away chips with your hand. Use abrush.
- Keep all loose clothing away from turningtools.
- Make sure that the cutting tools are running straight before starting theoperation.
- Never place tools or equipment on the drillingtables.
- Keep all guards in place whileoperating.
- Ease up on the feed as the drill breaks through the work to avoid damaged tools or workplaces.
- Remove all chuck keys and wrenches beforeoperating.
- Always wear eye protection while operating any drillingmachines.

QUESTIONS:

1.Why are drilled holes generally slightly larger than drilldiameter?

2. What are the functions of flutes on a twistdrill?

3. What will happen when the drilling is done with dulldrill?

4. How is the diameter of a drilled holemeasured?

5. What operation other than hole drilling can be performed on drillingmachine?

6. How is the drill held inspindle?

7.What is the use of drill?

8.What is the use of reamer?

9.State the difference between reamer and drill?

10.Name the various operations on drilling machine?

11.What is reaming?

12.What is working principle of drilling machine?

13.What is the main function of reamer?

14.How many types of reamer?

15.How many types of drill?

16.Name the three types of reamer?

17.Name the five types of drill?

18.What is drill vice?

19.What is drill drift?

20.What is drill sleeve?

SIGN of Principal/HOD SIGN of Faculty

Experiment 6

AIM: To mark the centre and to check the taper angle of given circular workpiece by the use of marking and measuring tool, combination set.

APPARATUS: Circular bar, combination set, sand paper.

INTRODUCTION:
The combination set consist of scale, squaring-head, protractor and centre-head. It consists of a heavy scale, which is grooved all along its length. It is on this groove that sliding squaring head is fitted. One surface of the squaring head is always perpendicular to the scale and it can be adjusted at any place by a locking blot and nut. The squaring head also contains a spirit level which is used to test the surface for parallelism. For laying out dovetails an included angle is also mounted on the scale. It can also slide to any position and be locked there.

PRINCIPLE:
The principle behind steel rule is of comparing an unknown length to the one previously calibrated. The principle of protractor is of comparing an unknown angle to the one previously calibrated.

PROCEDURE:

1. Take the circular bar and clean it with the sand paperthoroughly.

2. Now first to locate the centre of circular bar , adjust the centre head on slotted steel rule with the help of lockingnut.

3. Place the circular bar in the centre head (V-shape) such that steel sale will be on its circumferentialface.

4. Make the line on its surface with the help of a chalk or sharppencil.

5. Place the circular bar similarly at 90° to firstposition.

6. We get a point in the centre point at which both lines are intersecting each other. This is the centre of given circularbar.

7. Now, to check the angle b/w the two edges of circular bar, adjust square head with the slotted steelscale.

8. Check the piece as it is shown in figure for90°.

9. Hold the work piece b/w sq. head & steel if it is perfect 90° there will be no gap b/w given job piece and the steel scale & squarehead.

10. Now for checking the angle of longer edge (length) of workpiece, make the adjustment in combination set, adjust the protractor head over slotted steel scale. Now, place the protractor head on face of circular bar & adjust steel rule along its length, now lock the tool in thisposition

11. Check the angle and protector head against the arrow position.

OBSERVATION TABLE:

S.NO.	**Angle of Edge**	**Avg. Reading**

CONCLUSION:

_____
_____
_____
_____
_____
_____

PRECAUTIONS:

1. The workpiece should be clean.

2. Reading must be takenappropriately

3. when not in use kept in thecases.

4. Every care should betaken.

DIAGRAMS:

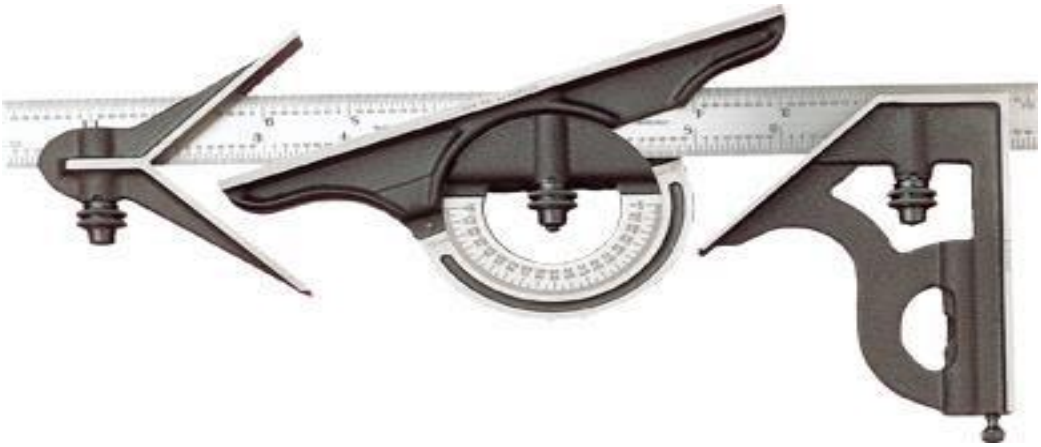


Fig. 6.1 Combination set

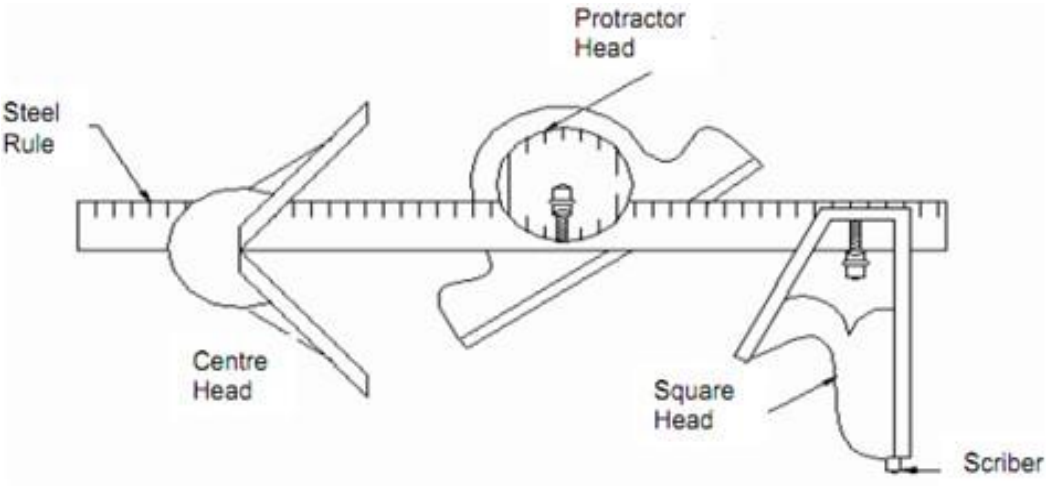


Fig 6.2 Combination set diagram

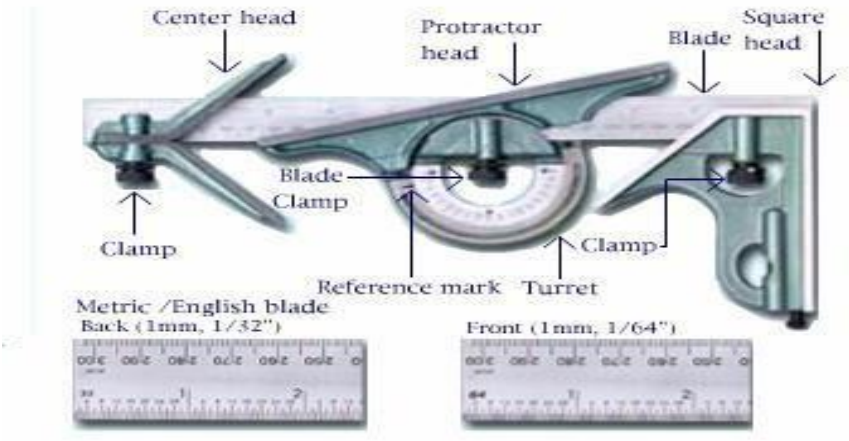


Fig 6.3 Different parts of Combination set

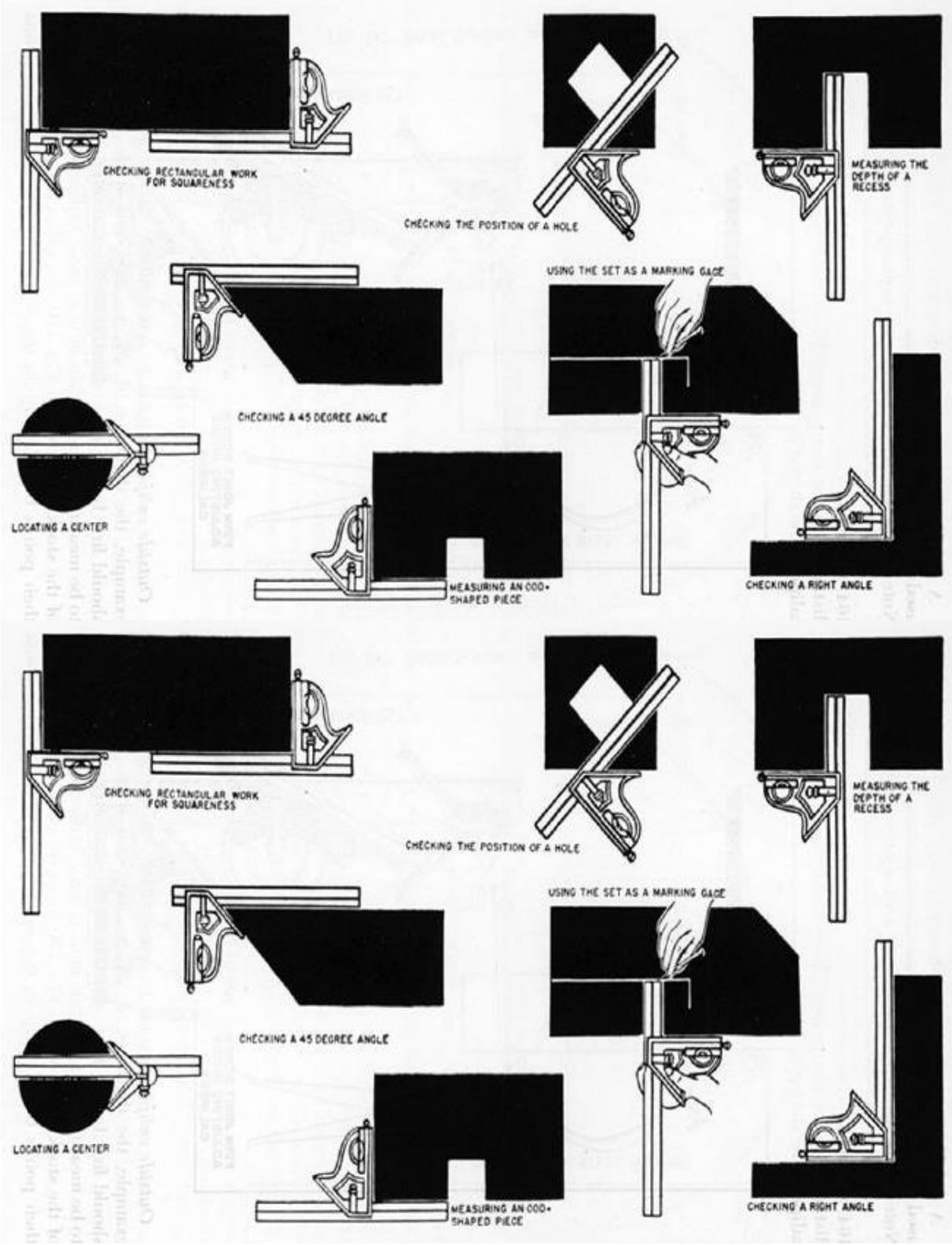


Fig.6.4 Using Combination set.

QUESTIONS:

Q 1.Why combination set is called by thisname?

2.What is the different tools in combination set and For What purpose they areused?

3.Explain the procedure of checking a job piece with the help of combination set for it squareness.

4.The protractor head in combination set can measure minimum degree of?

5.Why the spirit level is given in particular head of combinationset?

6.What is the purpose of sequence head in combinationset?

7. What is the purpose of centrehead?

8.What is combination set?

9.Name the parts of combination set?

10.What is the use of heavy-duty rule?

12.What do you know about combination set?

13.What is scriber?

14.Which material is used for scriber?

15.Which material is used for heavy-duty rule?

16.The center head made of which material?

17.The square head made by?

18.The protractor head made by?

19.What is the least count of heavy-duty rule?

20.What degree can measure by protractor head?

SIGN.of Principal/HOD SIGN. of Teacher

Experiment no. 7

AIM: To learn and practice the use of marking and measuring, cutting and fitting tools.

APPARATUS:

- **Marking and Measuringtools:**
  i. Scribers
  ii. Divider
  iii. Punches
  iv. Trysquare
- **Cutting and Fittingtools:**
  i. Saws
  ii. Chisel
  iii. Files
  iv. Hammers
  v. Taps

INTRODUCTION:

Machine tools are capable of producing work at a faster rate, but, there are occasions when components are processed at the bench. Sometimes, it becomes necessary to replace or repair component which must be fit accurately with another component on reassembly. This involves a certain amount of hand fitting. The assembly of machine tools, jigs, gauges, etc, involves certain amount of bench work. The accuracy of work done depends upon the experience and skill of the fitter. The term „bench work" refers to the production of components by hand on the bench, whereas fitting deals which the assembly of mating parts, through removal of metal, to obtain the required fit. Both the bench work and fitting requires the use of number of simple hand tools and considerable manual efforts. The operations in the above works consist of filing, chipping, scraping, sawing drilling, and tapping.

Marking and measuring tools:

Scribers: A Scriber is a slender steel tool, used to scribe or mark lines on metal work pieces. It is made of hardened and tempered High Carbon Steel. The Tip of the scriber is generally ground at 12oto 15o. It is generally available in lengths, ranging from 125mm to 250mm .It has two pointed ends the bent end is used for marking lines where the straight end cannot reach.

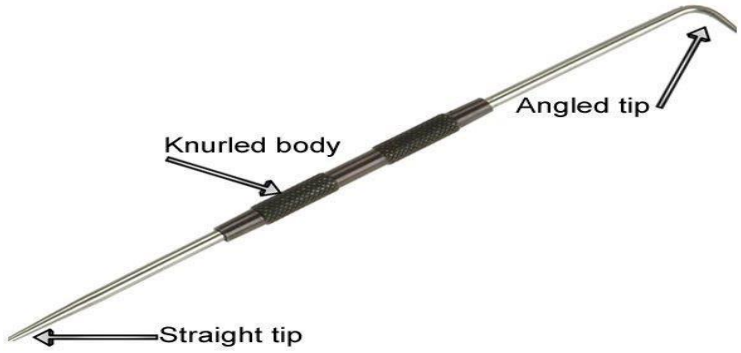


Fig. 7.1 Scriber

Divider: It is basically similar to the calipers except that its legs are kept straight and pointed at the measuring edge. This is used for marking circles, arcs laying out perpendicular lines, by setting lines. It is made of case hardened mild steel or hardened and tempered low carbon steel. Its size is specified by the length of theleg.

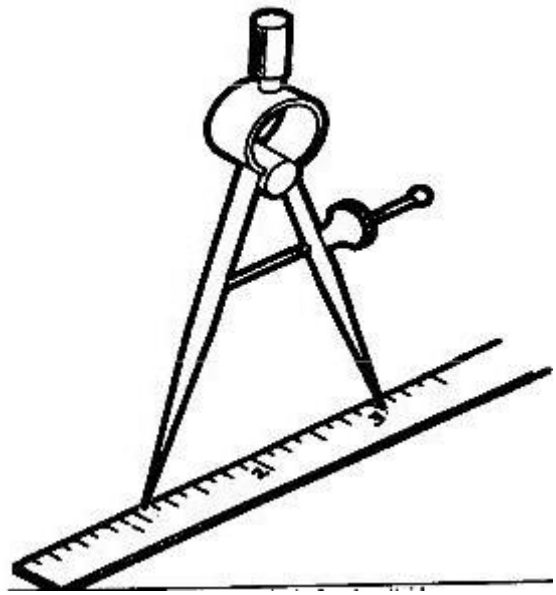


Fig.7.2 Divider

Punches: These are used for making indentations on the scribed lines, to make them visible clearly. These are made of high carbon steel. A punch is specified by its length and diameter (say as 150‟ 12.5mm). It consists of a cylindrical knurled body, which is plain for some length at the top of it. At the other end, it is ground to a point. The tapered point of the punch is hardened over a length of 20 to 30mm. Dot punch is used to lightly indent along the layout lines, to locate center of holes and to provide a small center mark for divider point, etc. for this purpose, the punch is ground to a conical point having 60° included angle. Center punch is similar to the dot punch, except that it is ground to a conical point having 90° included angle. It is used to mark the location of the holes to bedrilled.

Fig. 7.3 Punches

Try Square: It is measuring and marking tool for 90 angle .In practice, it is used for checking the squareness of many types of small works when extreme accuracy is notrequired .The blade of the Try square is made of hardened steel and the stock of cast Iron or steel. The size of the Try square is specified by the length of the blade.

Fig.7.4 try square

Cutting and Fitting tools:

Saws: The Hack Saw is used for cutting metal by hand. It consists of a frame, which holds a thin blade, firmly in position. Hacksaw blade is specified by the number of teeth for centimeter. Hacksaw blades have a number of teeth ranging from 5 to 15 per centimeter (cm). Blades having lesser number of teeth per cm are used for cutting soft materials like aluminum, brass and bronze. Blades having larger number of teeth per centimeter are used for cuttinghardmaterialslikesteelandcastIron.Hacksawbladesareclassifiedas**(i)Allhard**

and (**ii) flexible type**. The all hard blades are made of H.S.S, hardened and tempered throughout to retain their cutting edges longer. These are used to cut hard metals. These blades are hard and brittle and can break easily by twisting and forcing them into the work while sawing. Flexible blades are made of H.S.S or low alloy steel but only the teeth are hardened and the rest of the blade is soft and flexible. These are suitable for use by un-skilled or semi-skilled persons.

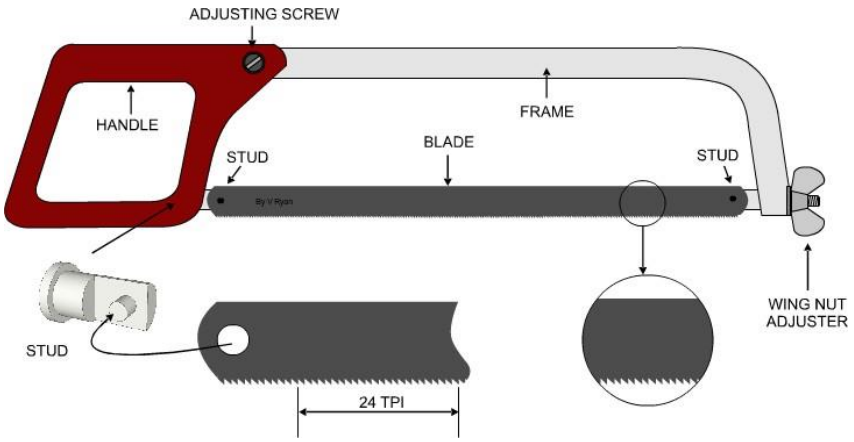


Fig.7.5 Saw

Fig.7.6 Tenon Saw

Chisels: Chisels are used for removing surplus metal or for cutting thin sheets. These tools are made from 0.9% to 1.0% carbon steel of octagonal or hexagonal section. Chisels are annealed, hardened and tempered to produce a tough shank and hard cutting edge. Annealing relieves the internal stresses in a metal. The cutting angle of the chisel for general purpose is about 60°.

Fig.7.7 Chisel

Files: Filing is one of the methods of removing small amounts of material from the surface of a metal part. A file is hardened steel too, having small parallel rows of cutting edges or teeth on its surfaces. On the faces, the teeth are usually diagonal to the edge. One end of the file is shaped to fit into a wooden handle. The figure shows various parts of a hand file. The hand file is parallel in width and tapering slightly in thickness, towards the tip. It is provided with double cut teeth. On the faces, single cut on one edge and no teeth on the other edge, this is known as a safe edge.

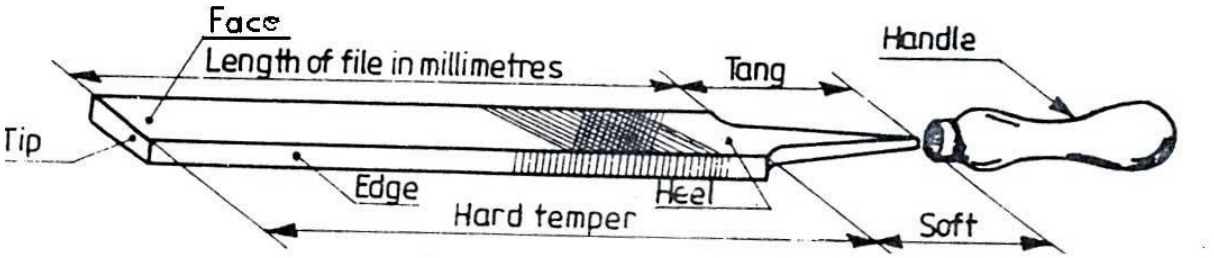


Fig.7.8 File

Hammers:

Ball Peen Hammer: Ball- Peen Hammers are named, depending upon their shape and material and specified by their weight. A ball peen hammer has a flat face which is used for general work and a ball end, particularly used for riveting.

Fig.7.9 Ball-Peen hammer

Cross-Peen Hammer: It is similar to ball peen hammer, except the shape of the peen. This is used for chipping, riveting, bending and stretching metals and hammering inside the curves and shoulders.

Fig.7.10 Cross-Peen Hammer

Straight-Peen Hammer: This is similar to cross peen hammer, but its peen is in-line with the hammer handle. It is used for swaging, riveting in restricted places and stretching metals.

Fig.7.11 Straight Peen Hammer

Taps and Tap wrenches

A tap is a hardened and steel tool, used for cutting internal thread in a drill hole. Hand Taps are usually supplied in sets of three in each diameter and thread size. Each set consists of a

tapper tap, intermediate tap and plug or bottoming tap. Taps are made of high carbon steel or high speed steel.

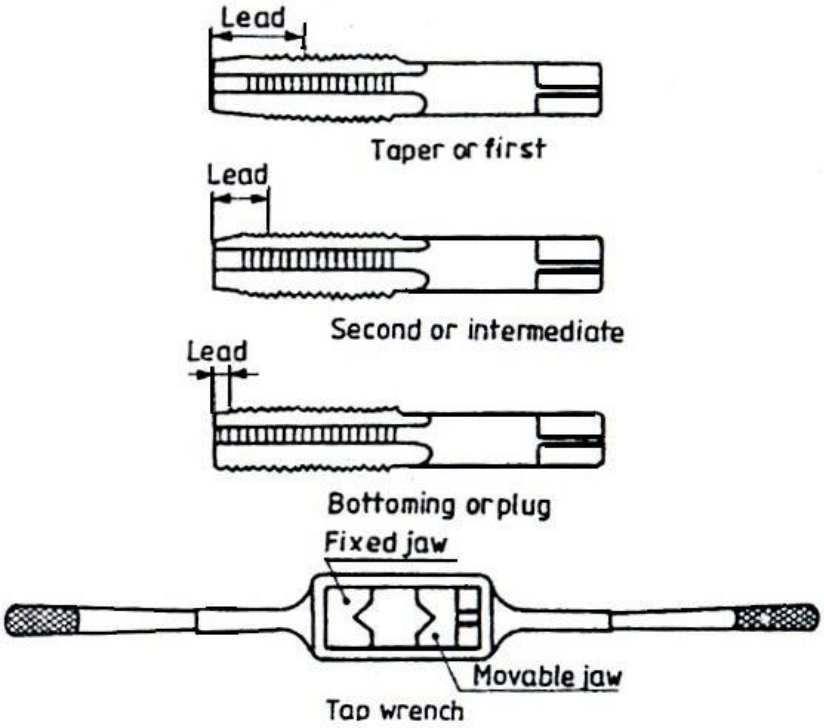


Fig.7.12 Taps and tap wrenches

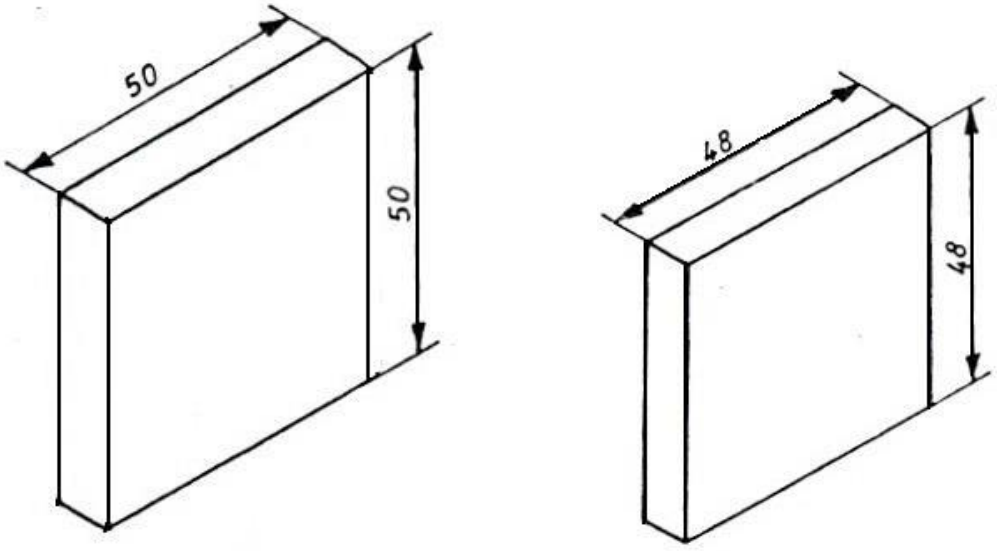
Practices:

1. Square filing: To file the given two Mild Steel pieces in to a square shape of 48 mm side as shown in Figure.

Tools required:
Bench vice, set of Files, Steel rule, Try-square, Vernier caliper, Vernier height gauge, Ball-peen hammer,
Scriber, Dot punch, Surface plate, Angle plate and Anvil.

Sequence of operations:
1. The dimensions of the given piece are checked with the steelrule.
2. The job is fixed rigidly in a bench vice and the two adjacent sides are filed, using the rough flat file first and then the smooth flat file such that, the two sides are at rightangle.
3. The right angle of the two adjacent sides is checked with thetry-square.
4. Chalk is then applied on the surface of the workpiece.
5. The given dimensions are marked by scribing two lines, with reference to the above two datum sides by using Vernier height gauge, Angle plate and Surfaceplate.
6. Using the dot punch, dots are punched along the above scribedlines.

7. The two sides are then filed, by fitting the job in the bench vice; followed by checking the flatness of the surfaces. As the material removal through filing is relatively less, filing is done instead ofsawing.



(a) RawMaterial (b) FinishedJob

Fig7.13 Filing Operation

Conclusion:

_____

_____

_____

_____

2. V-Fitting: To make V- fit from the given two MS plates and drilling and Tapping as shown inFigure.

Toolsrequired:

Bench vice, set of Files, Try-square, Scriber, Steel rule, Ball-peen hammer, Dot punch, Hacksaw, Vernier caliper, Surface plate, Angle plate, Vernier height gauge, 5mm drill bit, 3mm drill bit, M6 tap set with wrench, Anvil and Drilling machine.

Sequence of operations:

1. The burrs in the pieces are removed and the dimensions are checked with steelrule.
2. Make both pieces surface levels and right angles by fixing in the Vice, use Files for removing material to get level.
3. With the help of Try square check the right angles and surfacelevels.
4. Using Surface plate and Angle plate mark the given two metal pieces as per drawing with Vernier heightgauge.

5. Punch the scribed lines with dot punch and hammer keeping on the Anvil. Punch to punch give 5 mmgap.
6. Cut excess material wherever necessary with Hacksaw frame with blade, Drill bits and Taps.
7. The corners and flat surfaces are filed by using square/flat and triangular file to get the sharpcorners.
8. Dimensions are checked by vernier caliper and match the two pieces. Any defect noticed, are rectified by filing with a smoothfile.
9. Care is taken to see that the punched dots are not crossed, which is indicated by the half of the punch dots left on the pieces.

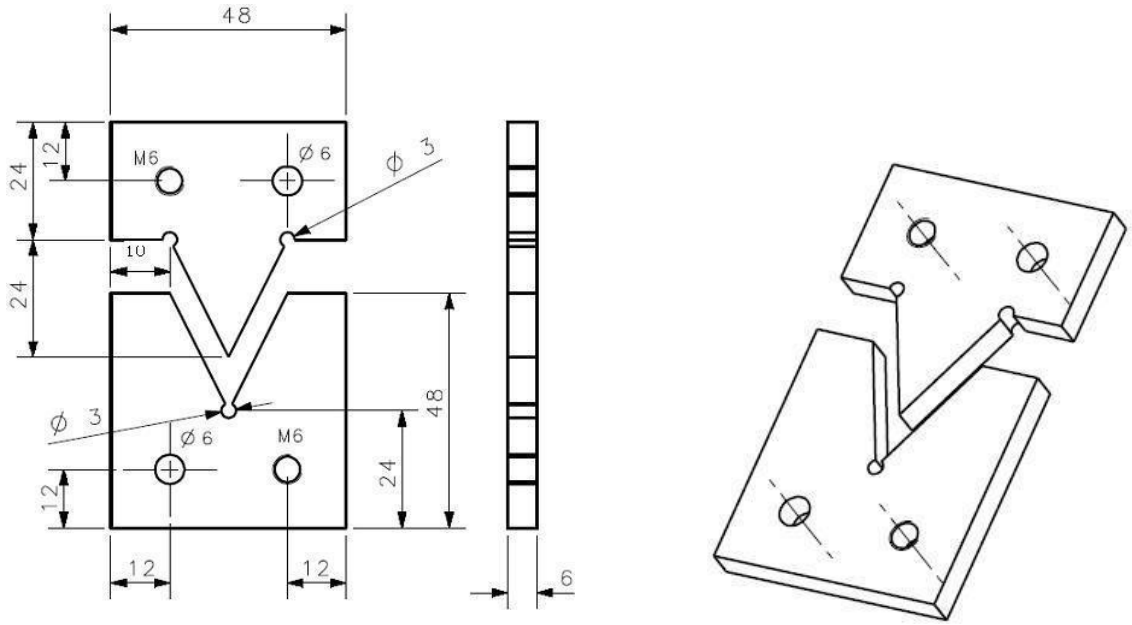


Fig.7.14 V-Fitting

Conclusion:

_____
_____
_____
_____

3. T-Lap Joint: To make a T-lap joint as shown in Figure from the given reaper of size 50 x 35 x 250 mm.

Tools required:
vice, steel rule, jack plane, try-square, marking gauge, 25 mm firmer chisel, cross-cut saw, tenon saw, scriber and mallet.

Sequence of operations:
1. The given reaper is checked to ensure its correctsize.

2. The reaper is firmly clamped in the carpenter's vice and any two adjacent faces are planed by the jack plane and the two faces are checked for squareness with the trysquare.
3. Marking gauge is set and lines are drawn at 30 and 45 mm, to mark the thickness and width of the modelrespectively.
4. The excess material is first chiseled out with firmer chisel and then planed to correctsize.
5. The mating dimensions of the parts X and Yare then marked using scale and marking gauge
6. Using the cross-cut saw, the portions to be removed are cut in both the pieces, followed by chiseling and also the parts X and Y are separated by cross-cutting, using the tenonsaw
7. The ends of both the parts are chiseled to the exactlengths.
8. A fine finishing is given to the parts, if required so that, proper fitting isobtained.
9. The parts are fitted to obtain a slightly tightjoint.

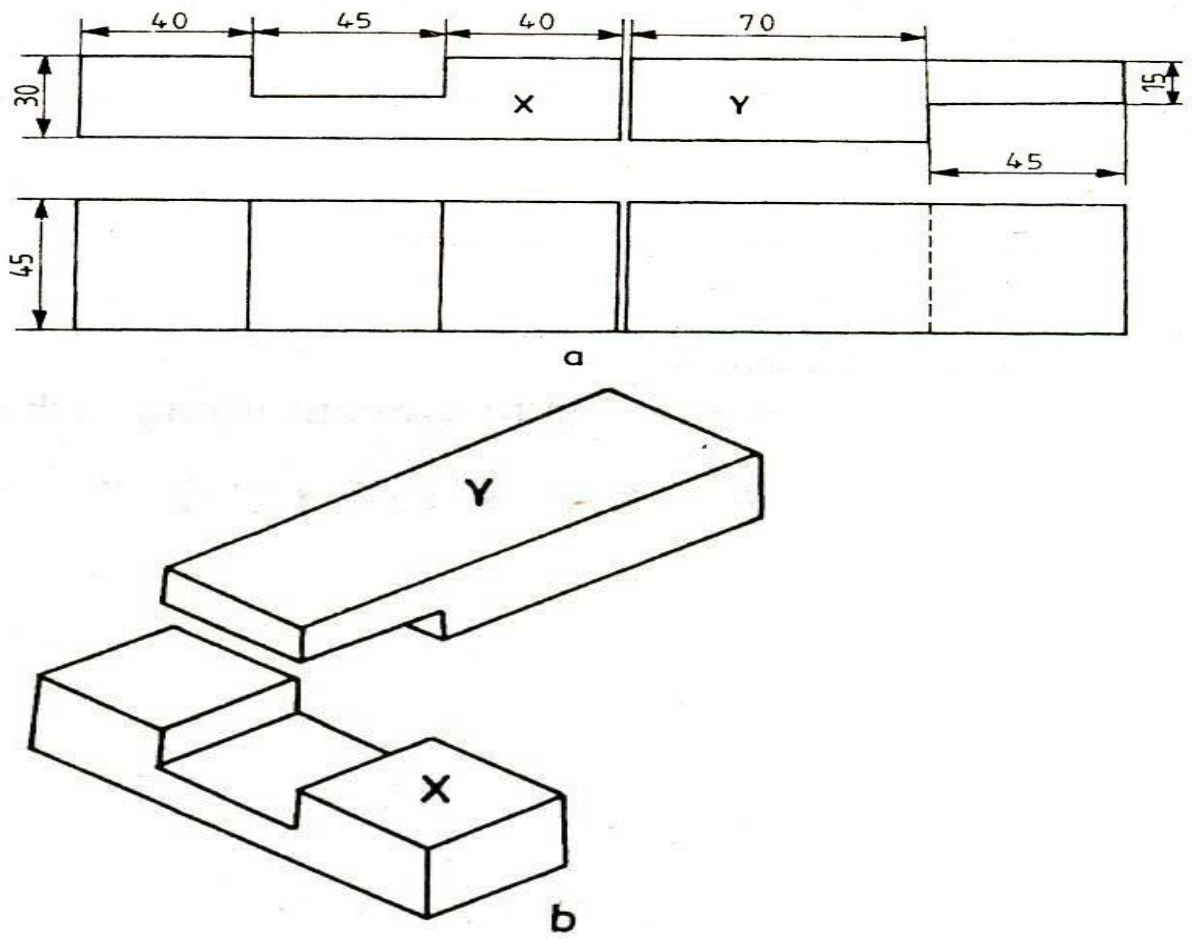


FIG.7.15 T-Lap Joint

Conclusion:

PRECAUTIONS:

1. Always wear eye protection - preferably industrial quality safety glasses with side-shields. The lathe can throw off sharp, hot metal chips at considerable speed as well as spin off spirals of metal that can be quite hazardous. Don't take chances with youreyes.
2. Wear short sleeve shirts, loose sleeves can catch on rotating work and quickly pull your hand or arm into harm's way.
3. Wear shoes - preferably leather work shoes - to protect your feet from sharp metal chips on the shop floor and from tools and chunks of metal that may getdropped.
4. Remove wrist watches, necklaces, chains and other jewelry. Tie back long hair so it can't get caught in the rotating work. Think about what happens to your face if your hair gets entangled.
5. Always double check to make sure your work is securely clamped in the chuck or between centers before starting the lathe. Start the lathe at low speed and increase the speedgradually.
6. Get in the habit of removing the chuck key immediately after use. Some users recommend never removing your hand from the chuck key when it is in the chuck. The chuck key can be a lethal projectile if the lathe is started with the chuck key in thechuck.
7. Keep your fingers clear of the rotating work and cutting tools. This sounds obvious, but I am often tempted to break away metal spirals as they form at the cuttingtool.
8. Avoid reaching over the spinning chuck. For filing operations, hold the tang end of the file in your left hand so that your hand and arm are not above the spinningchuck.
9. Never use a file with a bare tang - the tang could be forced back into your wrist orpalm.

QUESTIONS:

Q.1 What do you understand by marking and measuring tools?

_____
_____
_____
_____
_____
_____
_____

2.what do you understand by Cutting and fittingtools?

_____
_____
_____
_____
_____
_____
_____

Q 3.What is the use of Trysquare?

_____
_____

Q 4.How to use the divider show by making suitablediagram?

5. What do you understand bycarpentry?

6. Write the name of Different types of Hammers and Theiruses?

7.What is making tool?

8.What is measuring tools?

9.What is cutting tools?

10.What is fitting tools?

11.What is scriber?

12.What is divider?

13.What is punch?

14.What is try square?

15.What is hacksaw?

16.What is chisel?

17.What is file?

18.Name the three types of grad file?

19.Name the five types of shape of file?

20.What is taps?

SIGNofPrincipal/HOD SIGN of Faculty

Experiment – 8

AIM: to learn and practice the use of angle plate.

APPARATUS: Angle plate

INTRODUCTION: An angle plate is simply a piece of cast iron or steel that has two flat surfaces at right angles to each other. The two ends of the angle plate are also flat and at right angles to both of the two other surfaces. On some angle plates there can be webbing between the two surfaces to add to the rigidity of the surfaces. In this case inside surfaces are often just the rough surface of the original casting. Most angle plates have on the two main surfaces slots so either face can have a workpiece, other device or the milling table attached toit.

Some angle plates are made thicker so they are rigid enough without any stiffening and do not need webs at the ends. This means the internal surfaces can be machined accurately and flat. It will be seen that this is a very useful facility especially where space islimited.

If the angle plate does not have holes in it where they are needed then they can often be drilled in it. This is not a good idea to do this too often. But it is worth doing it to achieve a common set-up like fitting a rotary table to it. In this case it can be convenient to drill and tap these holes so that studs can be fitted into them. This is can be easier than trying to clamp the rotary table using loose bolts andnuts.

PRINCIPLE: An **angle plate** is a work holding device used as a fixturein metalworking. The angle plate is made from high quality material (generally spheroidal cast iron) that has been stabilized to prevent further movement or distortion. Slotted holes or *T* bolt slots are machined into the surfaces to enable the secure attachment or clamping of work pieces to the plate, and also of the plate to the worktable.

USE OF ANGLE PLATE:

1.To rotatesurfaces:

The main purpose of the angle plate is that it effectively rotates one surface, for example, a milling table, into another surface at right angles to the first.

If a workpiece is clamped to an angle plate, it effectively rotates it through 90º. When a flattish workpiece is clamped to the milling table it is usually with the large surface horizontal. In this position it is not always easy to machine the sides of the workpiece as might be required. But if we use an angle plate to turn it through 90º we can easily machine the sides.

Similarly it is possible to hold a long thin workpiece on end on an angle plate. It is then possible to machine the end of the workpiece.

Fig8.1 holding a workpiece on an angle plate to machine its sides

2. Use of angle plate onend:

Though it would be usual to use the two large surfaces on an angle plate the ends of the two sides are always flat and at right angles to the two sides. This end surface could be mounted on the milling table. It would have to be clamped to the table. The possible advantage of this is that very often the length of an angle plate is longer than the height of either of its sides.

Examples of the use of an **angle plate** on **end**

Ex.1 matching two V-blocks

It might seem that two V-blocks of apparently the same size from the same manufacturer would form a pair even if not matched. In practice they can differ so much as not to be useable as a pair. If they are going to be machined to make them match then it is easiest to match the two V surfaces and then machine the others to match. One way of doing this is to mountheV-blocksontheangleofanangleplateandthenclampthemtogether.Thismight

necessitate drilling holes in the webs so they can be bolted together. Then the other surfaces on the V-blocks can easily be machined to match each other.

3. Increasing the effective size of an angleplate:

An angle plate can be made larger by bolting a flat plate or rectangular tube onto the front of it. If some rectangular tube is used allowance has to be made for the tube bending slightly under pressure. One solution to this is the nut the bolt inside the tube on the side where something is being clamped to the tube.

Fig8.2 Rotary table mounted on angle plate using rectangular tube 404

4. Use of an angle plate foraligning

An angle plate can be seen as being equivalent to a square but of much greater thickness. Because of this it can be used to align two edges at right angles but where one is at a different height to the other. This can be used for aligning vices.

Fig8.3 aligning a vice using a parallel, angle plate and square

5. Use of an angle plate as astop

An angle plate bolted to the milling table to one side of a vice can be used as a stop when holding a workpiece in the vice. There is more on this under "Vices"

(a.)Angle plate used to mill accurate angles

One advantage of mounting a workpiece on an angle plate compared to using a tilting vice is that it can be used to mill one surface at an angle to another.

The workpiece can be mounted using clamps on the angle plate using a precision protractor. All of this can be done while the surface being used is horizontal.

Fig8.4 Machining an edge at an angle

Any method that could be used to align a workpiece clamped on the milling table, such a fences, could be used here.

(b.)Machining flutes on connecting and coupling rods

On many engines the connecting rods and coupling rods are fluted. It might seem that they could be clamped to the milling table and then milled out with an end mill.

This is not the best way to do this. Firstly the bottom of the flute has rounded corners. This can be done by grinding the required radius on the slot drill that is going to be used to mill the flutes. The ends of the flutes are not round such that the axis of the round corner is in the plane of the rod. It is "swept out", i.e., the axis of the round part is in the plane of the rod.

This means that most of the flute can be machined with the rod flat on the milling table. But the end of the flute has to be machined with the rod held vertically. The machining can be done with a fly cutter or a T-slot cutter modified for this job.

The connecting rod has to be held near the top of an angle plate since the length of the tool is limited. The workpiece is clamped to the angle plate.

Fig8.5 Machining a connecting rod with a Woodruff cutter

If a connecting rod is fluted at all then it is fluted on both sides.

6. Use of an angle plate with cylindricalsquares:

If the angle plate has two cylindrical squares mounted on it this can provide a horizontal surface at right angles to a vertical one. This is really useful for clamping flat thin workpieces in the vertical position with the bottom of the workpiece parallel to the table. Many parts are of this sort, one example is a parallel.

The squares can be set to the same height using a height gauge. The workpiece rests on the cylindrical squares and is clamped to the angle plate. It would also be possible to make two or even more parts at the same time like this. This is a situation where only one clamp might seem to be enough for light machining. It would be with a thick workpiece but it would not be enough to stop a thin workpiece vibrating. The top of the workpieces is machined with whatever will give the best finish. The part is removed and any burr removed from it. It is returned the other way up and milled to the widthrequired.

This would be more accurate than trying to make parallels in a vice because the parallels being made are resting on two, accurate points that could be wide apart compared to resting on a narrow, hopefully flat surface at the bottom of the vice.

The great advantage that the angle plate has over the cylindrical squares is that it is possible to mount a workpiece on it whilst it is in a convenient position, that is, the surface is horizontal when the angle plate is held in a bench vice. The plate can then be mounted so this face is now vertical with the workpiece still onit.

7. Use of angle plates – head horizontal – vertical mode

(a)Extending the area for verticalmilling:

But if the angle plate is the other way round, the distance in the y direction is much smaller but the space from the cutter downwards isgreater.

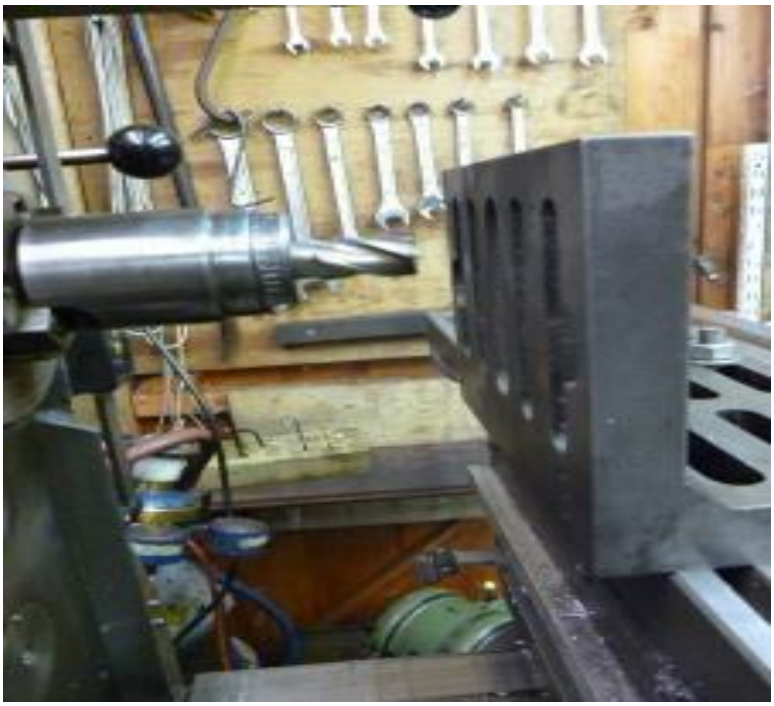


Fig8.6 Extending the milling area.

This configuration allows, in principle, for the user to use a horizontal milling machine as a vertical milling machine. But it is easy to see that it is very difficult for the user to see what is going on. It is also difficult to set up the workpiece, not only because it is inaccessible but because the surface is vertical. The only way to do this is to take the angle plate off the machine, fit it in a vice and mounted the workpiece with the surface horizontal.

This setup not only increases in the new "y" direction but since the angle could be turned round the depth in the "z" direction is also increased. But this does require an angle plate with flat internal surfaces.

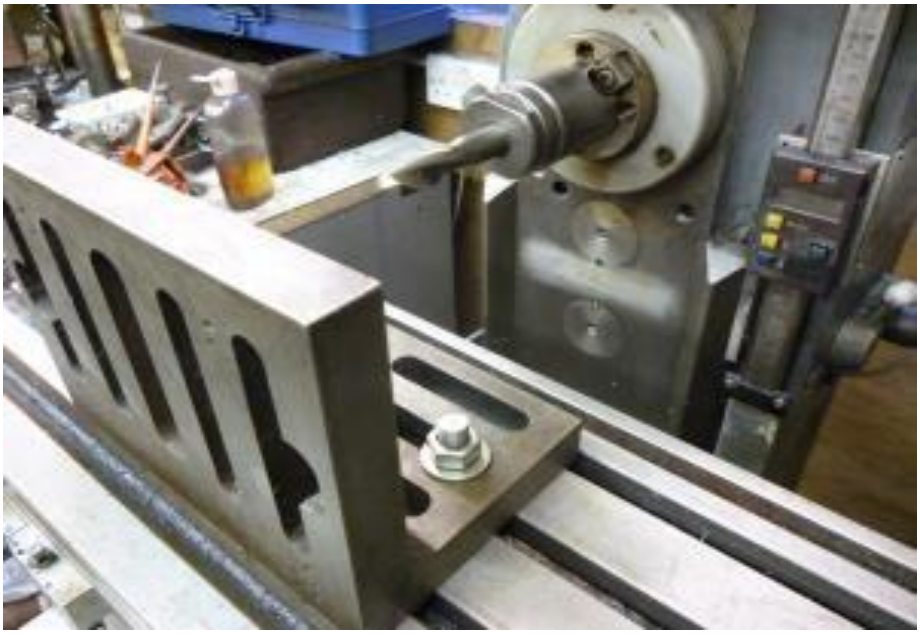


Fig8.7 Increasing the depth in the "z" direction.

PRECAUTIONS:

1. Care must be taken for the internal and external stresses develop duringmachining.

2. While using bolts, stops and clamps ensure that these have a firm seat on both the work and the clampingblock.

3. The clamps and stops should be placed as near the work aspossible.

4. Ensure that the clamping device does not hinder free movement of the worktable.

DIAGRAMS:

FIG.8.8 Webbed Angle Plate

FIG8.9 Precise Giant Angle Plates

QUESTIONS:

Q 1.what do you understand by Angleplate?

2.What is the principle of AnglePlate?

3.How we use angle plate forAligning?

4.How to increase the effective size of angleplate?

5.Write precautions using Angleplate

6.What is a angle plate?

7.What is the angle of angle plate?

8.Which material is used for making angle plate?

9.How many grades are of angle plate?

10.How many types of angle plate?

11.What do you know about plain angle plate?

12.What is the use of slotted angle plate?

13.What is the use of table angle plate?

14.Whst is the use of precision angle plate?

15.What is the purpose of grade-2 angle plate?

16.What do you know about solid angle plate?

17.What is the purpose of slote in the angle plate?

18.What is box angle plate?

19.What is the main aim of angle plate?

20.How many numbers are of angle plate?

SignofTeacher. **Sign ofPrincipal**

EXPERIMENT – 9

AIM: to learn and practice the use of scrapers.

APPARATUS: Scrapers.

INTRODUCTION:

a tool or device used for scraping, especially for removing dirt, paint, or other unwanted matter from a surface. A hand **scraper** is a single-edged **tool** used to scrape metal from a surface. This may be required where a surface needs to be trued, corrected for fit to a mating part, needs to retain oil (usually on a freshly ground surface), or even to give a decorative finish. Surface plates were traditionally made by scraping.

PRINCIPLE:

Metal scraping is a technique for removing, progressively and in a controlled way, very thin layers of metal from the high areas of a surface, making it increasingly even until it reaches a very high degree of flatness. Think of a metal surface as having high and low areas, like miniature hills and valleys of a terrain. With each scraping pass you remove some material from the peaks, and so make them lower. After a sufficient number of passes, you will have brought the peaks down to the level of the valleys, and the surface will have become flat.

IMPORTANCE OF SCRAPERS:

- Scraping can be done inexpensively. If you need to watch your finances, and have already a bench grinder with a cool grinding wheel, you can buy or make the essentials you will need to do a wide range ofscraping
- Recondition many worn out or even damaged measuring and layouttools
- You will also be able to make your own precision tools, as well as attachments, jigs, and accessories to extend the capabilities of your equipment, which could not be made satisfactorily without scraping some of the criticalsurfaces
- you will be able to conceive new projects with a greater degree of freedom, and enhance their designaccordingly,
- Scraping is also essential to bring lathes, milling machines, and machine tools in general to their bestperformance.
- With careful scraping and some TLC in other areas, even a very inexpensively built or worn out machine usually can be turned into a precision and high performancetool.

- A well scraped machine will have the smoothness and "velvet feel" that makes it a pleasure to use, and will give many years of accurate and trouble free service. And when it eventually wears out, you can scrape it again, and again make it work like new.

CARE OF SCRAPERS:

Since the scrapper has a very sharp cutting edge, therefore when these are not in use it is advisable to keep them lightly oiled and individually wrapped in a piece of cloth or felt or similar material, to protect the extremely hard cutting edge.

PRECAUTIONS:

1. Work in a Clear, Well LitArea.
2. Keep Scraper Away fromMoisture.
3. Wear AdequateProtection.
4. Store the Scraper when it is Not inUse.
5. Perform RequiredMaintenance.
6. Never Touch the scraper Immediately after Finishing aJob.
7. Carry the ToolCarefully.

DIAGRAMS:

FIG.1 Scraper

FI

G. 2 Different types of Scrapers

Questions

1.What is scraper?

2.How many types of scraper?

3.Which material is used for scraper?

4.Name the three types of scraper?

5.What is a bearing scraper?

6.What is the purpose of triangular scraper?

7.What is the use of flat scraper?

8.What is a hook scraper?

9.What is two handle scraper?

10.What is bull nose scraper?

11.What is the use of half round scraper?

12.What is the angle of hook scraper?

13.Name the one application for half round scraper?

14.Name the one application of triangular scraper?

15.Name the one application for flat scraper?

16.Which scraper is used for oil pocket in the bush bearing?

17.What is scraping?

18.What is the main aim of scraper?

19.Which cutting tool is used for making scraper?

20.Name the two method of scraping?

Sign of Teacher Sign. of Principal

Experiment no. 10

AIM: To learn and practice the use of Snipes.

APPARATUS: SNIPES.

INTRODUCTION:

Snips, also known as **shears**, are hand tools used to cut sheet metal and other tough webs. If the handles are in line with the blades is known as a straight snips; if the handles are at an angle then it is known as an offset configuration. This design allows for the material to flow away from the blades when making long cuts, which is easier and safer than straight cutting snips.

There are two broad categories: tinner's snips, which are similar to common scissors, and compound-action snips, which use a compound leverage handle system to increase the mechanicaladvantage.

Tinner snips:

Tinner's snips, also known as tin snips, are one of the most popular type of snips. They are defined by their long handles and short blades. They usually have extra wide jaws and are made of drop forged carbon steel. Depending on the size of the blade, tin snips can cut between 24 and 16 gauge cold rolled low-carbon tin. They can be ranged in length from 7 to 14 in (180 to 360 mm) long. There are two main types: straight-pattern and duckbill-pattern. Straight-pattern are best for straight cuts, but can handle gentle curves. Duckbill-pattern snips, also known as Trojan-pattern snips, have blades that taper down from the pivot to the tip of the blades. The blade edges are also bevelled to more easily cut curves and circles or shapes. They are a lighter duty snip that can only cut up to 25 gauge mild steel. Other common blade patterns include the circle pattern or curved pattern and the hawk's-bill pattern. Circle pattern snips have a curved blade and are used to cut circles. Hawk's-bill snips are used to cut small radii on the inside and outside of a circle. The shape of the blades allow for sharp turns without buckling the sheet metal. A common use is cutting holes inpipes.

Compound-action snips:

Compound-action snips are also known as aviation snips because they were developed to cut aluminum in the construction of aircraft. They can handle aluminium up to 18 gauges, mild steel up to 24 gauges or stainless steel up to 26 gauge. These types of snips have become the most popular because of the linkage that increases the mechanical advantage without increasing the length of the snips. There are three cutting styles: straight cutting, left cutting, and right cutting. Straight cutting snips (generally have yellow colored soft grips) cut in a

straight line and wide curves; left cutting snips (usually red) will cut straight and in a tight curve to the left; right cutting snips (usually green) will cut straight and in a tight curve to the right. These different cutting styles are necessary because metal is stiff and heavy and does not move out of the way readily when cutting around a curve. The respective styles move the material out of the way when cutting in the direction they are designed for. The blades are usually serrated to prevent material slippage.

In addition to the configurations outlined below, there are also upright and long cut configurations. The upright snip has the blades rotated 90° from the handles. This configuration is more ergonomic and commonly used in tight spaces. The long cut snip has long blades that make it easier to make long straight cuts. These snips are commonly used on vinyl or aluminumsiding

Standard compound-action snips are designed for cutting steel or softer materials, although the occasional use on stainless steel is not detrimental. For cutting through tougher materials, such as Inconel and titanium, special hard snips are available. They are similar in design to standard or offset aviation snips but have specially heat treated blades. These snips will have a different color handle to differentiate them from the other standardtypes.

Pipe and duct snips

Pipe and duct snips, also known as double cut snips, are a subtype of compound-action snip used to cut stove pipe and ducting lengthwise. The snips have a three-piece jaw that has two side blades that slide against a central blade. This creates in (4.4 mm) wide strip that curls up along the cut. A compound lever system is used to increase the mechanical advantage.

CARE OF SNIPES:

1. It should be kept clean and free from greasy material and it must be wiped out with same cloth or cotton waste to prevent rusting offaces.

2. When these are not in use it is advisable to keep them lightly oiled and individually wrapped in a piece of cloth or felt or similar material, to protect theedges.

3. after certain use, cutting edges must be checked and if found blunt must be grounded properly

CONCLUSION:

_____

_____

_____

DIAGRAMS:

Fig.10.1 Tinner Snipe tool

Fig.10.2 Compound action Snipe tool

Fig.10.3 Pipe and Duct Snipe

Fig.10.4 Nose Plier Snipe

Fig.10.5 Bent nose side cutting plier snipe.

Fig.10.6 jewelry snipe.

Questions

1.What is snipe?

2.How many types of snipe?

3.How to increase the mechanical advantage of snips?

4.What are the two broad categories of snips?

5.What is straight snips?

6.Which snips have longer handle and shot blades?

7.Which material is used for the tinners snips?

8.What gauge tin can cut by the used of tinners snips?

9.What is the size oftinnerssnips?

10.Name the two main types of snips?

11.What is the use of straight-pattern snips?

12.What is the use of duckwill-pattern snips?

13.What is Trojan-pattern snips?

14.What is compound-action snips?

15,What is the use of aviation snips?

16.What is the use of red color handle snips?

17.Which snips are used to cut upto 26 gauge stanless steel?

18.How many cutting style s of aviation snips?

19.What is the use of different color handle ?

20.Which snips is used to cut right curve?

Sign. Of teacher

Experiment No. 11

AIM:
To check and tight all the mounting bolts, screw, and moving parts of aircraft F-27 with the help of different types of screw drivers and spanners / wrenches.

APPARATUS:
Screw drivers, wrenches.

INTRODUCTION:
Screw drivers:
A screw driver is a hand tool that is designed to turn screws. The shank is made of steel set in to a wooden or plastic handle. The blade is shaped or flattened to fit recesses in the heads of screws or bolts. Screw drivers are made in many sizes. A stubby screw driver helps to start screws where space is limited.

SPANNERS/WRENCHES:
A wrench is a tool for turning nuts or bolts. It is usually made of steel. There are many kinds of wrenches. They may consists of a slot, socket, pins or movable jaws for grasping the nut, with the rest of the tool serving as a handle for applying pressure.

PRINCIPLE:
To turn nuts and bolts and screws for assembling and disassembling them from fittings.

PROCEDURE:
1. All the screw drivers and wrenches should be cleaned with cotton before and afteruse.
2. It should be used by holding the bolt at proper position and application of face must be at the extreme and of spanner or wrench and it should be turned at right angle to the length of the bolts.
3. Always use the right size of screw driver and wrench to avoid any damage to bolt head or screw.
4. The spanner or wrench must be kept in a cloth jacket withflaps.

OBSERVATION TABLE:

S.No.	Physical check	Observation

PRECAUTIONS:

1. Always match the screwdriver to the screw head, both in terms of size andtype.

2. Choose contoured handles that fit the shank tightly, with a flange to keep the hand from slipping off thetool.

3. Use a slot screwdriver with a blade tip width that is the same as the width of slotted screw head.

4. For cross head screws, use the correct size and type of screwdriver: a Phillips screwdriver may slip out of a screw head designed for use with the slightly, flatter-tipped Pozidrive screwdriver.

5. Use a vise or clamp to hold the stock if the piece is small or moveseasily.

6. Wear safety glasses or a face shield (with safety glasses or goggles) that is appropriate for the hazards of the work you aredoing.

7. Keep the screwdriver handle clean. A greasy handle could cause an injury or damage from unexpectedslippage.

DIAGRAMS:

FIG 11.1 Screw Driver

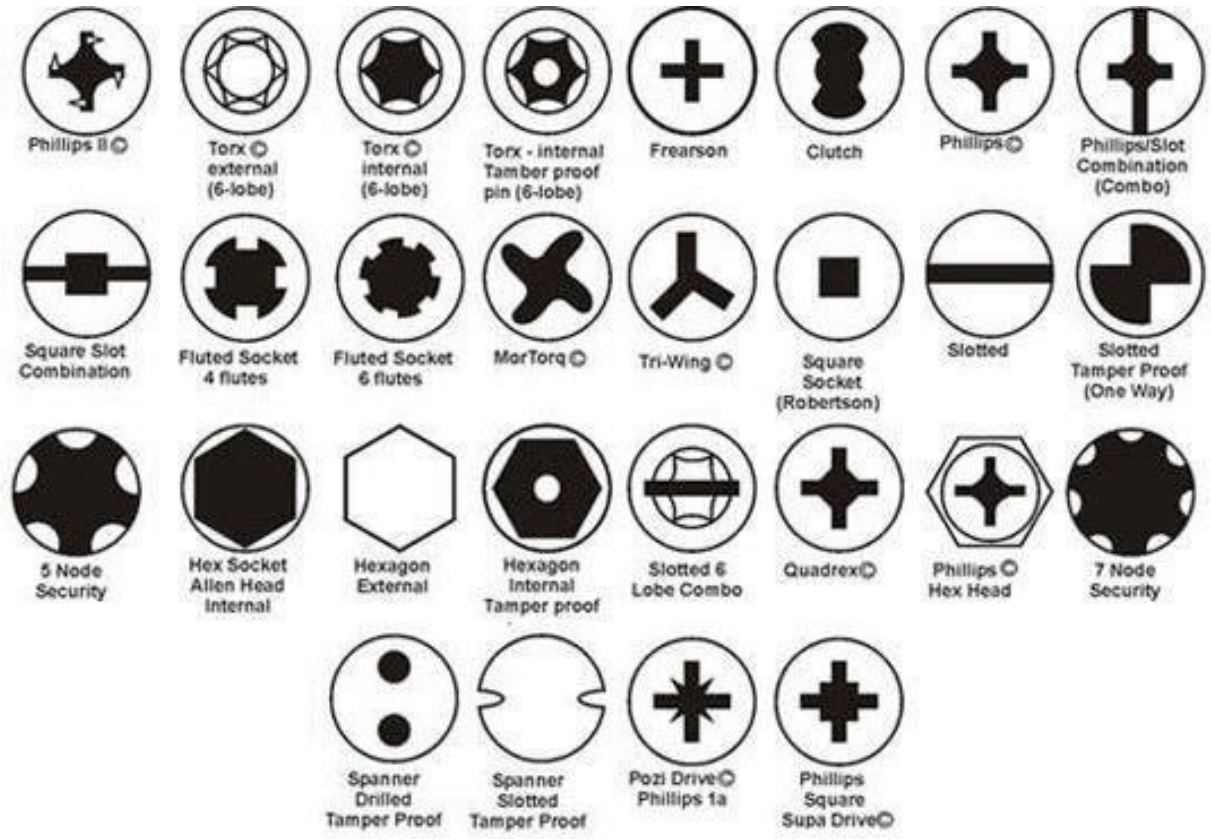


FIG 11.2 Different Screw Head

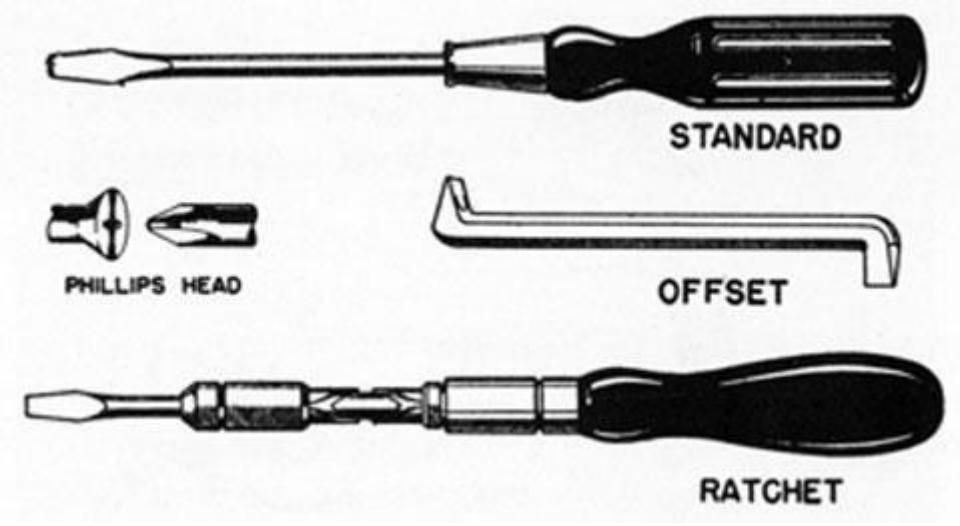


FIG. 11.3 Standard & Ratchet Screw Driver

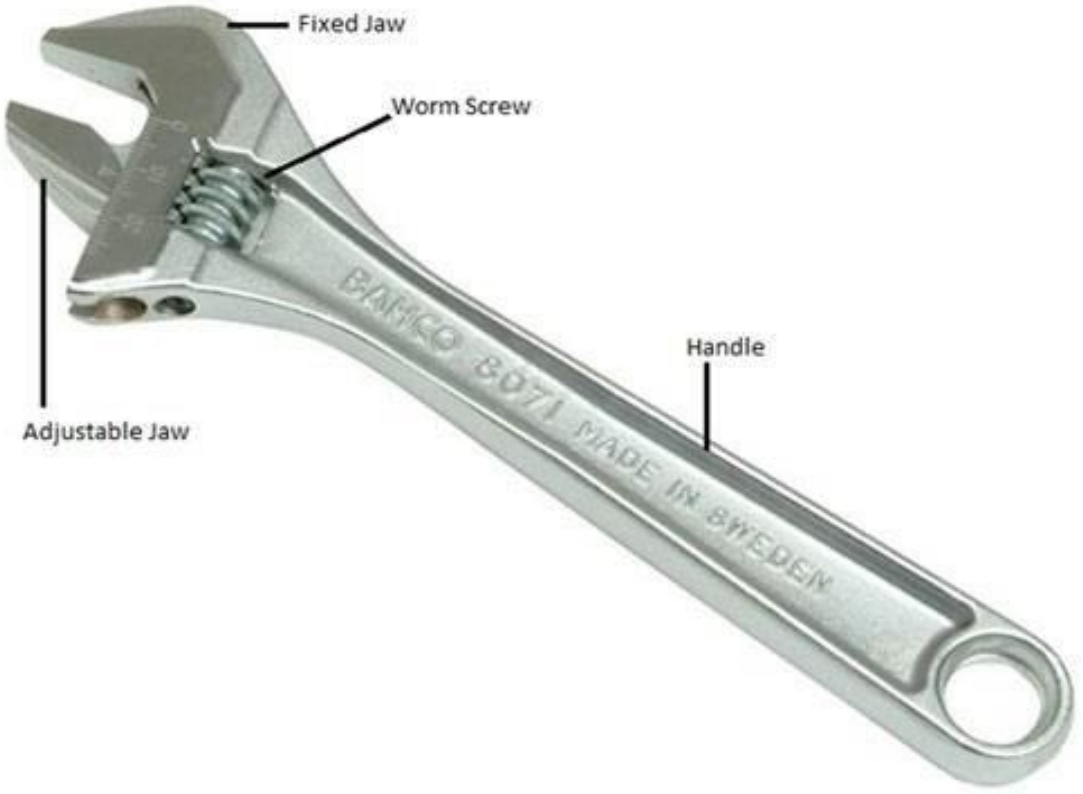


FIG. 11.4 Spanner

FIG. 11.5 Different Types Of sppaners

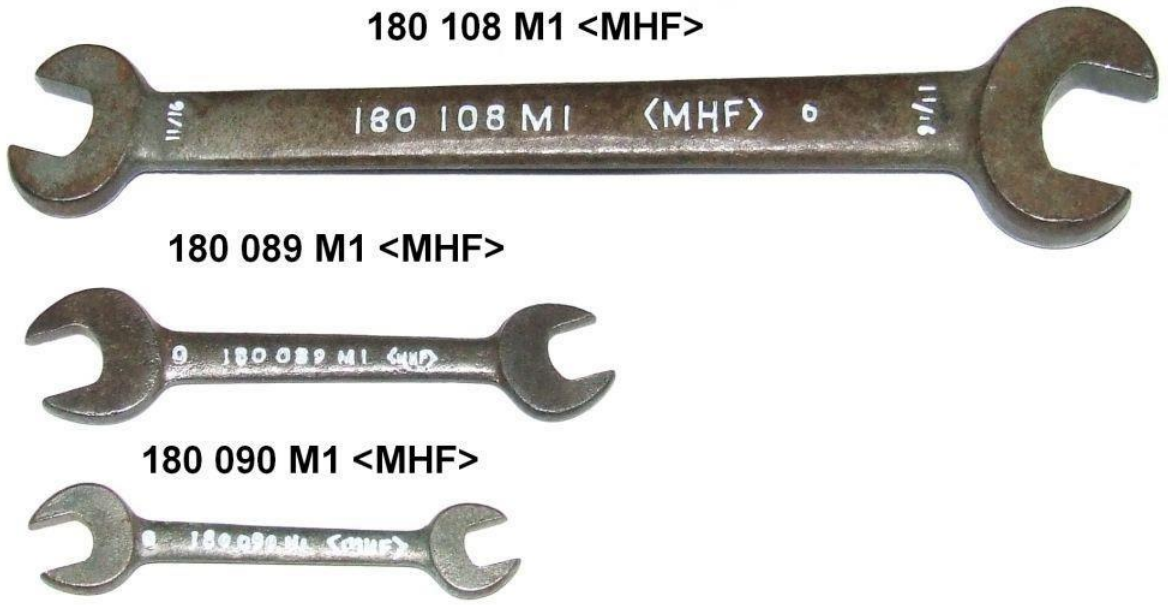


FIG. 11.6 Spanners Notation

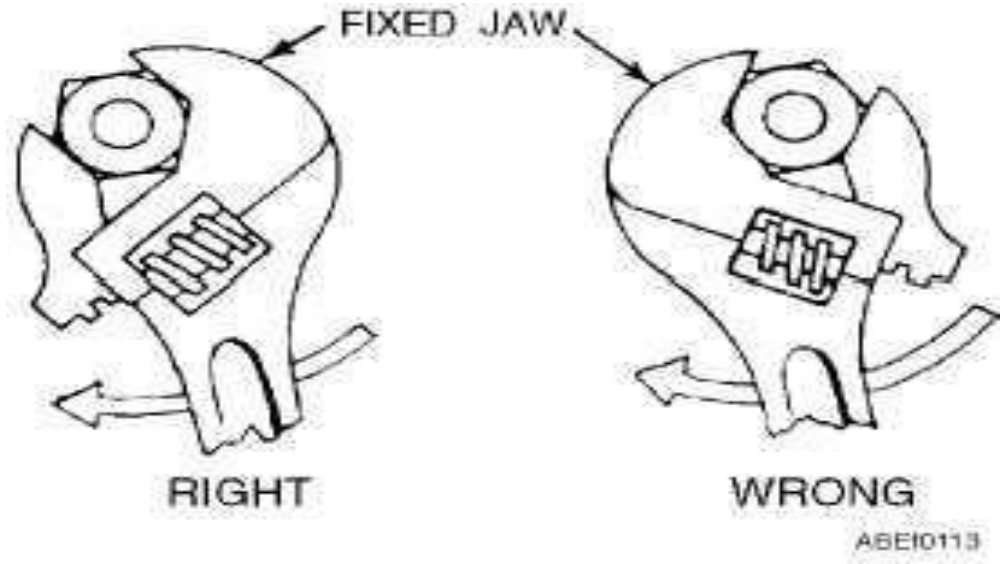


FIG. 11.7 Spanners using method

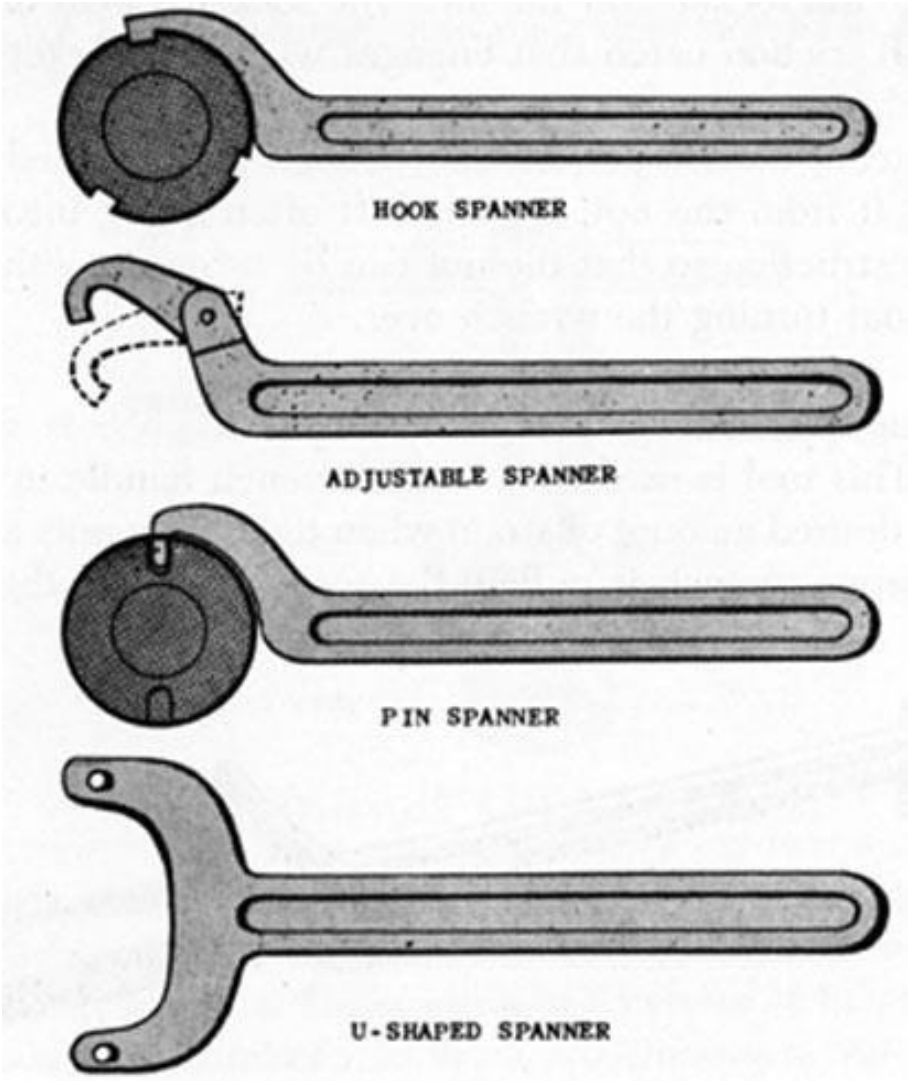


FIG. 11.8 Different Styles Of spanners

FIG. 11.9 Pipe Wrench

Questions:

1. What is ascrewdriver?

2. What is a heavy-duty screwdriver?

3. What is a phillipsscrewdriver?

4. What is the purpose of a double-ended offsetscrewdriver?

5. What is awrench?

6. What is an adjustmentwrench?

7. What is a T-handle topwrench?

8. What is a socket wrench and how it is used with aratchet?

9. Which tool is used to turn the screw ?

10.What is stubby screw driver?

11.What is a combination wrench?

12.Which wrench is used in plumbing work?

13.Which wrench is used in work shop?

14.What is the use of hook spanner?

15.What is the use of adjustable wrench?

16.Chain wrench use for?

17.What is the use of allen-key?

18.What is a torque wrench?

19.What is a liver-jaw wrench?

20.What is a pin face wrench?

Sig. of C.I./ Principal **Sig. of Instructor**

Experiment no. 12

AIM: to learn and practice the use of work holding tools.

APPARATUS: V- Blocks, 'C' Clamps, Workpiece.

INTRODUCTION:

V Block:V-Blocks are precision metalworkingjigstypically used to hold round metal rods or pipes for performing drilling or milling operations. They consist of a rectangular steel or cast iron block with a 90-degree channel rotated 45-degrees from the sides, forming a V- shaped channel in the top. A small groove is cut in the bottom of the "V". They often come with screw clamps to hold the work. There are also versions with internal magnets for magnetic work holding. When the handle is rotated there is movement in thescrew.

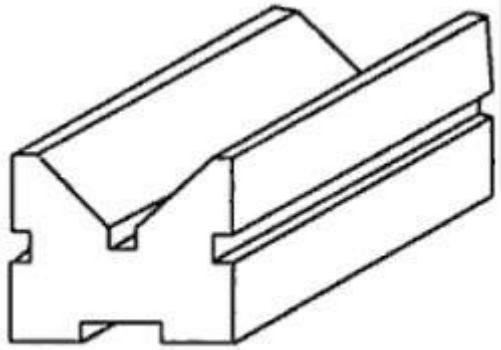


FIG.12.1V Block

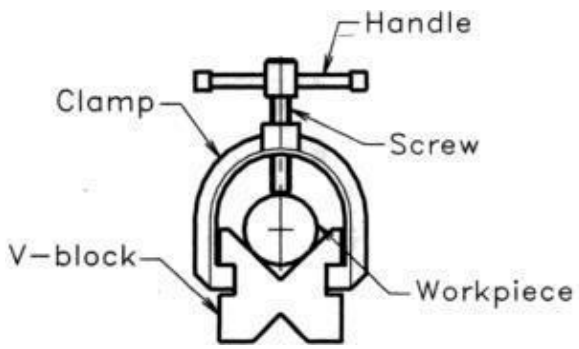


Fig.12.2 V BlockParts

C Clamp: A C-clamp or **G-clamp** is a type of clampdevice typically used to hold a woodor metalworkpiece, and often used in, but are not limited to, carpentry and welding. These clamps are called "C" clamps because of their C shaped frame, but are otherwise often called G-clamps or G-cramps because including the screw part they are shaped like an uppercase letter G. These clamps are available is sizes varying from 70 mm to 800 mm. it is used for holding the planks after gluing.

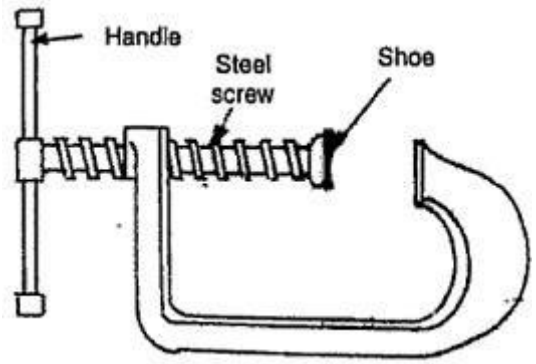


Fig.12.3 C-Clamp

CARE and MAINTENANCE:

1. Keep screw lubricated with small quantity of preventive lubricatingoil.
2. Keep metal surface free of rust orcorrosion
3. If you remove the clamp knob, clean the threads with a wire brush and place a small amount of silicone grease on the threads and thewasher.
4. Coat surfaces with preservative lubricatingoil.
5. Replace all part broken or damaged beyondrepair.

CONCLUSION:

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DIAGRAMS:

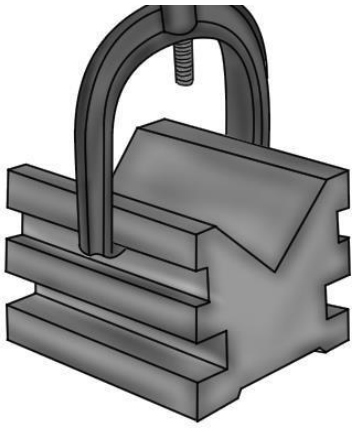

Fig.12.4 V- Block

Fig.12.5 C- Clamp

QUESTIONS:

Q 1.what is the use of v- block or vclamp?

Q.2how to use c- clamp to hold aworkpiece?

Q. 3 write precautions of usingclamps?

Q. 4 which materials are used in making ofclamps?

Q. 5 What is a V-block?

Q. 6 Which material is used for V-block?

Q. 7 What is the angle of V-block?

8.Which material is used for V-block?

9.What is the bearing area of V-block?

10.Which V-block is used for checking triangle effect?

11.The general purpose use V-block is?

12.Different angles V-blocks are?

13.According to accuracy grade V-block are?

14.How many types of V-block?

15.What is a magnetic V-block?

16.How many types of magnetic V-blocks?

17.What is a plain V-block?

18.Name the three types of V-blocks?

19.V-blocks are widely used in?

20.Steel V-blocks are made from?

SIGN.ofHOD/Principal **SIGN. of Faculty**

Experiment No. 13

AIM:
To measure the diameter and length of given machined circular work piece by using vernier caliper with British system.

APPARATUS:
Vernier caliper, circular work piece.

INTRODUCTION:
It is precision instrument which is used for measuring external as well as internal diameters of shafts, thickness of parts etc. to an accuracy of 0.001 inch and to an accuracy of 0.02mm. It can also be used to measure the depth of slots andholes.

PRINCIPLE:
The principle of vernier is that when two scales or divisions slightly different in size are used the difference between them can be utilised to determine the accuracy of measurement.

PROCEDURE:
Steps:
1. Note the no. of full inches markscrossed.
2. Note the no. of main divs.crossed.
3. Note the full sub divisions crossed by vernier zero beyond the 2ndreading.
4. Note the no. of divisions on vernier scale coinciding with any divisions on mainscale.

Example:

First reading	=	1.000 inch.
Second reading(6 min divs.)	=	0.600
Third reading (3 sub divs.)	=	0.075
Fourth reading (10 V. divs.)	=	0.010
Finalreadings	=	1.685

OBSERVATION TABLE:

S.No.	Range	Smallest Division Value on main Scale	No. of Division of Vernier	Least Count

DIAGRAM:

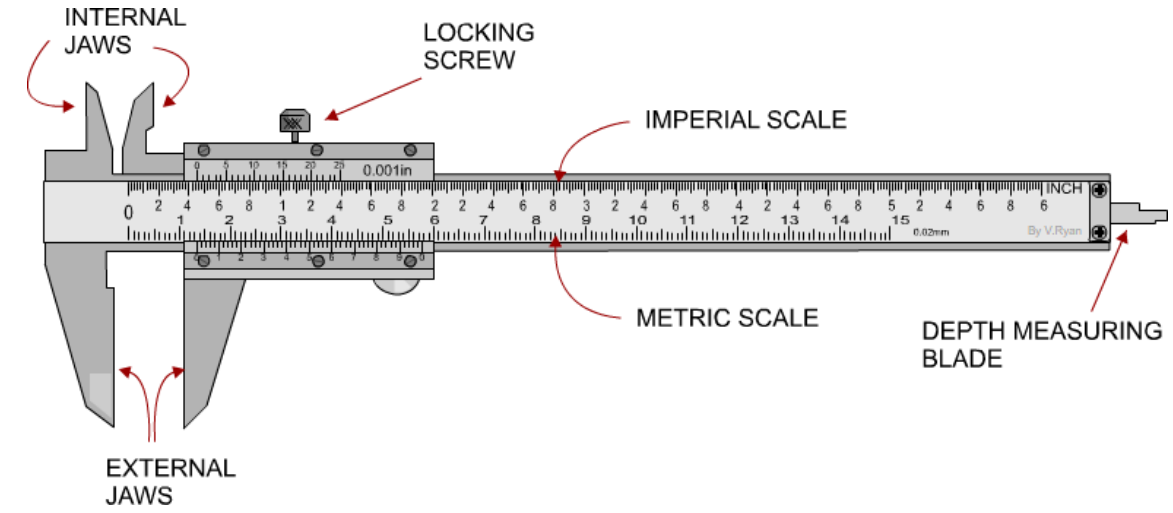

FIG. 13.1 Vernier Caliper

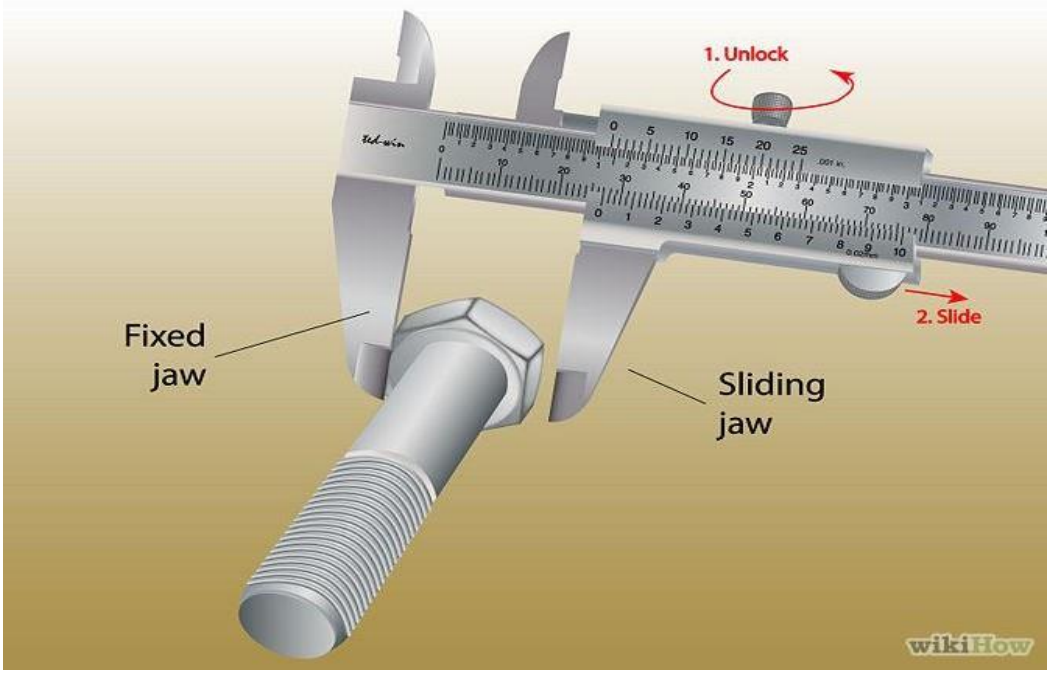

FIG. 13.2 Using in measuring Dia of Bolt Head

CONCLUSION:

PRECAUTIONS:

1. Line of measurement must coincide with line of scale i.e. following Abbe's principle correctly.

2. While measuring outside diameters with Vernier caliper, caliper should not be tilted or twisted.
3. Do not apply unnecessary extra pressure while takingmeasurements.
4. Handle and grip the instrument near or opposite to the jaws while taking the measurement.
5. Accuracy of measurement primarily depends on two senses – sense of sight (eyes) and sense of touch (feel). Imperfect vision and improper eyesight can cause error so use of proper magnifying glass should bedone.

QUESTIONS:

1. What is verniercaliper?

2. Which material is used for making verniercaliper?

3. How the least count of vernier caliper can bedetermined?

4. What are the uses of verniercaliper?

5. What do you understand by 25/49 verniercaliper?

6.How many types of vernier caliper?

7.What is the least count ofvernier caliper?

8.How many vernier divisions are in one inch?

9.How many vernier divisions are in one main division?

10.How many vernier divisions are in one sub division?

11.How many sub divisions are in one main division?

12.Name the parts of vernier caliper?

13.What is the use of nib of thevernier caliper?

14.What is the main purpose of vernier caliper?

15.What do you know about 25/49 vernier caliper?

16.What do you know about 49/50 vernier caliper?

17.What is the relationship between the metric &British system?

18.What is the decimal value of 3/8 inch?

19.What is fine adjusting screw?

20.What is a dial vernier caliper?

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Experiment No. 14

AIM:
To measure the height and scribe the lines on the desired dimension of given work piece by using vernier height gauge.

APPARATUS:
Vernier height gauge, work pieces.

INTRODUCTION:
It is mainly used for measuring heights of parts to an accuracy of 0.02 mm, and 0.001 inch also. It is also used for scribing lines in layout work.

PRINCIPLE:
The principle of vernier height gauge is that when two scales or divisions slightly different in size are used the difference between them can be utilised to determine the accuracy of measurement. The vernier height gauge commonly used, have the measuring range from 0 to 300mm.

PROCEDURE:
1. Before using this instrument, it should be checked for zeroerror.
2. For this, the vernier height gauge is placed on a surface plate and the vernier head is brought down till the measuring jaw touches the surfaceplate.
3. In this position, the zero on the main scale should coincide with the zero on the vernier scale.
4. In order to measure the height the work is placed between the surface plate and the measuringface.
5. The final adjustment depending upon the sense of correct feel is made by the fine adjustmentscrew.
6. The measurement is read in the similar way as in the verniercaliper.
7. For scribing lines, the scriber is set at a specified height and moved along the work piece to bemarked.

Observation Table:

S.No.	Full Inches	Main Div.	Sub Div.	V. Div.	Total Reading

Conclusion:

PRECAUTIONS:

1. The height gauges are generally kept in their cases when not in use.
2. Every care should be taken, particularly in case of long height gauges, to avoid its heating by warmth from thehands.
3. The springing of the measuring jaw should be alwaysavoided.

DIAGRAM:

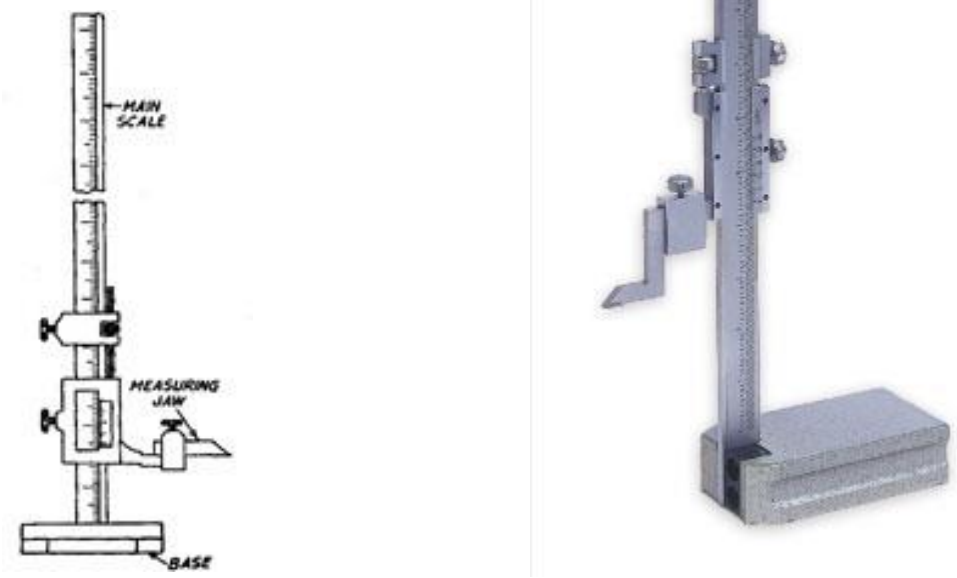

FIG. 14.1 Vernier Height Gauge

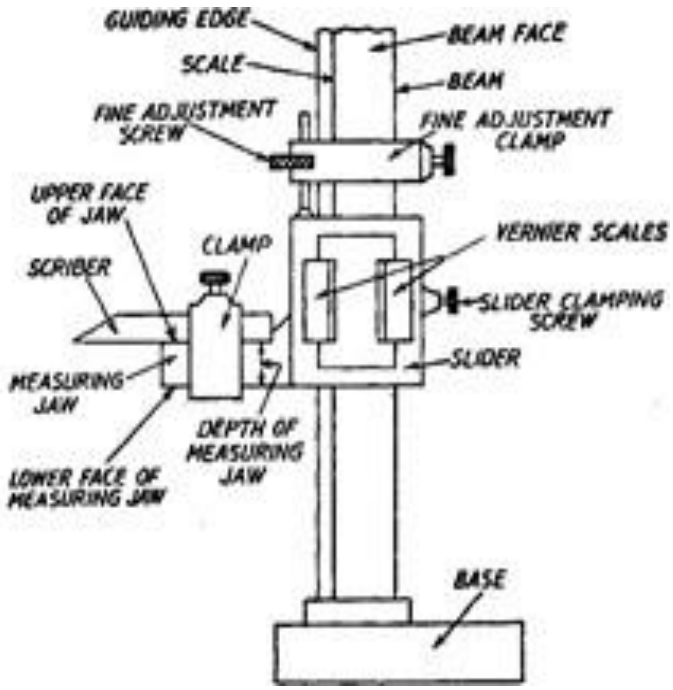

FIG. 14.2 Different Parts

QUESTIONS:

1. What is a vernier heightgauge?

2. Which material is used for making vernier heightgauge?

3. How the least count of vernier height gauge can bedetermined?

4. What are the uses of vernier heightgauge?

5. What do you understand by 50/49 method vernier height gauge?

6.What is least count of v. height gauge in metric system?

7.What is least count of v. height gauge in british system?

8.What is the principle of v. height gauge?

9.How determine the size of height gauge?

10.Always use the height gauge on?

11.For scribing line of small objects supporting by?

12.What is scriber?

13.The principle of v. height gauge same as?

14.What is fine adjusting screw?

15.What is the use of clamp of height gauge?

16.Name the parts of height gauge?

17.What is the relationship between the British system and metric system?

18.In metric system the accuracy of gauge is?

19.In British system the accuracy of height gauge is?

20.What is the main aim of height gauge?

Sign. OfHOD/Principal **Sign. Of Teacher**

Experiment No. 15

AIM: to learn and practice the use of vernier depth gauge.

APPARATUS: Vernier Depth Gauge, Specimen.

INTRODUCTION: Vernier depth gauge is used to measure the depth of holes, slots and recesses, to locate center distances etc. It consists of (i) A sliding head having flat andtrue base free from curves andwaviness.

(ii) A graduated beam known as main scale. The sliding head slides over the graduatedbeam.

(iii) An auxiliary head with a fine adjustment and a clamping screw. The beam is perpendicular to the base in both directions and its end square and flat. The end of the sliding head can be set at any point with fine adjustment screw depending upon the sense of correct feel. The clamping screw is then tightened and the instrument is removed from the hole and readings are taken in the same way as taken by vernier caliper. While using the instrument it should be ensured that the reference surface on which the depth gauge base is rested, is satisfactorily true, flat andsquare.

PRINCIPLE: The principle of vernier depth gauge is that when two scales or divisions slightly different in size are used the difference between them can be utilized to determine the accuracy of measurement. The vernier height gauge commonly used, have the measuring range from 0 to 300mm.

PROCEDURE:

1. Before using this instrument, it should be checked for zeroerror.
2. For this, the vernier depth gauge is placed on a surface plate and the vernier head is brought down till the measuring jaw touches the surfaceplate.
3. In this position, the zero on the main scale should coincide with the zero on the vernier scale.
4. In order to measure the depth of the work is placed between the surface plate and the measuringface.
5. The final adjustment depending upon the sense of correct feel is made by the fine adjustmentscrew.
6. The measurement is read in the similar way as in the verniercaliper.
7. For scribing lines, the scriber is set at a specified height and moved along the work piece to bemarked.

OBSERVATION TABLE:

Sr. No.	Main scale reading (A) mm	No. of vernier scale division	Vernier scale readings div X L.C. (B)	Total reading A + B

CONCLUSION:

_____

_____

_____

_____

_____

PRECAUTIONS:

1. The depth gauges are generally kept in their cases when not in use.
2. Every care should be taken, particularly in case of long height gauges, to avoid its heating by warmth from thehands.
3. The springing of the measuring jaw should be alwaysavoided.

DIAGRAM:

FIG.15.1 Depth Gauge.

QUESTIONS:

Q Q. 1 what is the use of DepthGauge?

Q. 2 Write the principle of depthgauge**.**

Q 3. Write Precaution in using DepthGauge.

4.What is least count of vernier depth gauge?

5.How to calculate the least count of v. Depth gauge?

6.What is the use of fine adjusting screw?

7.Which material is used for making v. depth gauge?

8.Name the parts of depth gauge?

9.The principle of v. depth gauge is?

10.What is the main aim of v. depth gauge?

11.What is main scale?

12.What is vernier scale?

13.What is auxiliary head?

14.What is Locking screw?

15.What is the principle of vernier depth gauge?

16.What is the relationship between British system and metric system?

17.How many mm are in one inch?

18.What is main division ofvernier depth gauge?

19.What is vernier division of depth gauge?

20.How many vernier divisions are in one inch?

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Experiment No. 16

AIM:
To measure the taper angle of given machined job piece, by using sine bar with surface plate and gauge blocks.

APPARATUS:
Sine bar, surface plate and gauge block.

INTRODUCTION:

(a). Sinebar:
It is used either to measure angles more precisely than a bevel protector or for locating any work to a given angle Q with in very close limits. It is generally used with conjunction with slip gauges and surface plate. A sine bar consists handened and ground steel bar which is staped at the ends. A roller is fastened in each step with a screw. A sine bar is specified by the distance between the centres of two roles some holes are drilled in the body of the sine bar in order to reduce the weight and to facilitate handling.

(b). Surfaceplate:
It is made of grey cast iron in various sizes. It is usually square or rectangular and has the top and the adjacent four edges very accurately machined and scraped to form a true flat surface and are brought in square. It is placed horizontally on a firm support whose working height is about 800 mm from the floor.
It is used to check the trueness of flat surfaces and to copy the master surface on a work. A thin coating of red lead mixed with oil is spread evenly over the surface plate. The work to be tested is cleaned, placed on the plate and gently moved along it. The parts which come in contact with red lead are marked and show where more metal has to be removed. The surface plate are made in two grades of accuracy i.e. A & B, depending upon scraping of within 0.005 mm and 0.02mm respectively. It should be oiled and covered with a wooden cover to protect from dust when not in use.

(c). Gaugeblock:
The slip gauges are used for checking the accuracy of measuring instruments such as micrometers, calipers, snap gauges, dial indicators etc. These are also used for setting the sine bars for angular measurement, for accurate measurements in die manufacture and in various precision measuring machines like tool room microscopes etc.
The slip gauge consist of alloy steel or tool steel block of section about 30mm by 10mm. These are hardened before being finished to size. The slip gauges are made in the following four grades.

1. Workshop or productiongrade.
2. Inspectiongrade.
3. Calibrationgrade.
4. Reference grade.

PRINCIPLE
The work having tapered top and flat base is placed on the surface plate and adjust the sine bar, with the help of gauge blocks on the top of work piece. In this way we can determine the taper angle with sine formula.

PROCEDURE

1. Clean the given work piece with sinepaper.
2. Place the work piece over the surfaceplate.
3. Then adjust the sine bar with the gauge blocks to coincides the top surface of the work piece with the sinebar.
4. Then determine the H1 & H2measurement.
5. Now apply the formula sin □ = P/H and determine the angle.
6. In this way we check the taperangle.

Observation Table:

S.No.	**Perpendicular distance P= H1-H2**	**Hypotenus (H)**	**Angles Sin θ = P/H**

CONCLUSION:

PRECAUTION:

1. The sine bar should not be used for angle greater than 60° because any possible error in construction is accentuated at this limit.

2. A compound angle should not be formed by mis-aligning of workpiece with the sine bar. This can be avoided by attaching the sine bar and work against an angleplate.

3. Accuracy of sine bar should beensured.

4. As far as possible longer sine bar should be used since many errors are reduced by using longer sinebars.

DIAGRAM:

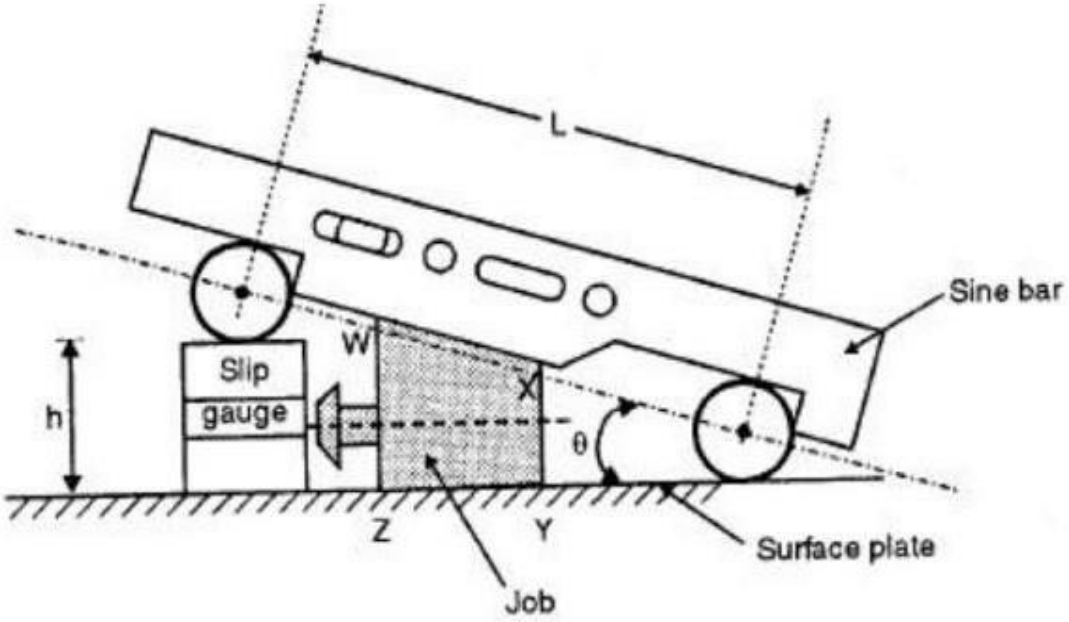

FIG. 16.1 Surface plate, Slip gauge And Sine Bar

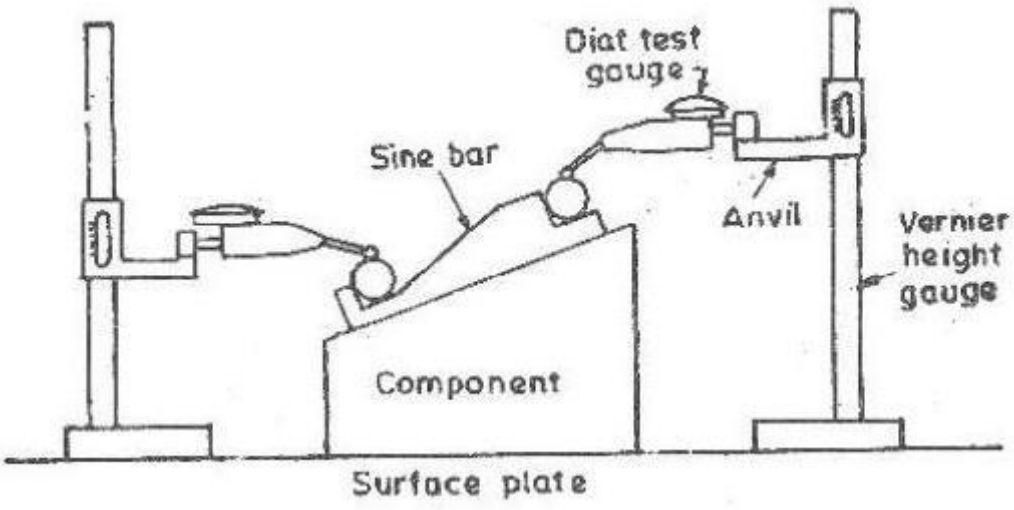

FIG. 16.2 Angle Measurement using Sine Bar

QUESTIONS:

1. What is sinebar?

2. Which material is used for making sinebar?

3. How the size of sine bar can bedetermined?

4. What are the uses of sinebar?

5. What do you understand by H1 &H2?

6. What is surfaceplate?

7. Which material is used for making surfaceplate?

8. What do you understand by highspots?

9. What is working height for surfaceplate?

10. What is the purpose of surfaceplate?

11. What are the gauge blocks?

12. What is the purpose of gauge blocks?

13. In what grades slip gauge aremade?

14. What is the principle for checking the taper angle of given work piece with sinebar?

15. What precaution must be followed while working with sinebar?

16.What is the purpose of some hole drilled in the body of sinebar?

17.Which material is used for making gauge blocks?

18.Name the two application of gauge blocks?

19.Name the parts of sinebar?

20.What is the accuracy of surface plate?

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Experiment 17

AIM: to learn and practice the use of different gauges.

APPARATUS: Plug Gauge, Filler gauge, Radius Gauge, Wire Gauge, Screw Pitch gauge, Ring Gauge, Snap Gauge, Work Pieces.

INTRODUCTION:

1. Plug Gauge: A Go-No gauge (orGo/no go) refers to an inspection tool used to check a workpiece against its allowedtolerances. Its name derives from its use: the gauge has two tests; the check involves the workpiece having to pass one test (Go) and fail the other (No Go). It is an integral part of thequalityprocess that is used in themanufacturingindustry to ensure interchangeability of parts between processes, or even between different manufacturers.

A Go NoGo gauge is a measuring tool that does not return a size in the conventional sense, but instead returns a state. The state is either acceptable (the part is within tolerance and may be used) or it is unacceptable (and must be rejected).

They are well suited for use in the production area of the factory as they require little skill or interpretation to use effectively and have few, if any, moving parts to be damaged in the often hostile production environment.

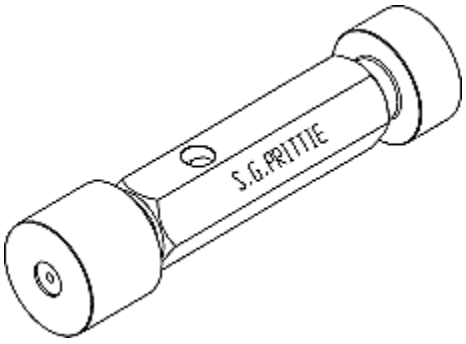

Fig.17.1 Pluggauge

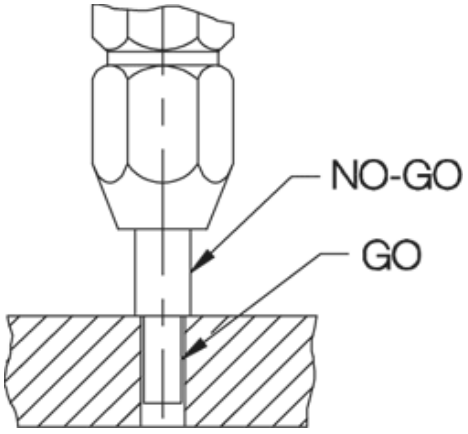

Fig.17.2 Go, No-Go condition

2. Feeler gauge: A feeler gauge is atoolused to measure gap widths. Feeler gauges are mostly used inengineeringto measure the clearance between two parts. They consist of a number of small lengths of steel of different thicknesses with measurements marked on each piece. They are flexible enough that, even if they are all on the same hinge, several can be stacked together to gauge intermediate values. It is common to have two sets forimperial units(typically measured inthousandths of an inch) andmetric(typically measured in hundredths of amillimeter)measurements.

A similar device with wires of specific diameter instead of flat blades is used to set the gap in spark plugsto the correct size; this is done by increasing or decreasing the gap until the gauge of the correct size just fits inside the gap.

The lengths of steel are sometimes called leaves or blades, although they have no sharp edge.

Fig.17.3 Feelergauge

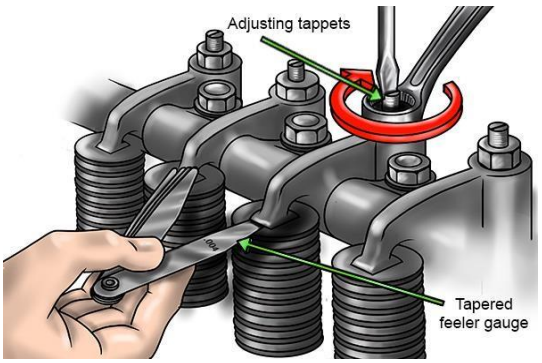

Fig.17.4 MeasuringClearance

3. Radius Gauge: radius gauge, also known as a fillet gauge, is atoolused to measure the radiusof anobject.

Radius gauges require a bright light behind the object to be measured. The gauge is placed against the edge to be checked and any light leakage between the blade and edge indicates a mismatch that requires correction.

A good set of gauges will offer both convex and concave sections, and allow for their application in awkward locations. Every leave has different radius. The material of the leaves is stainless steel.

Fig.17.5 Radius gauge

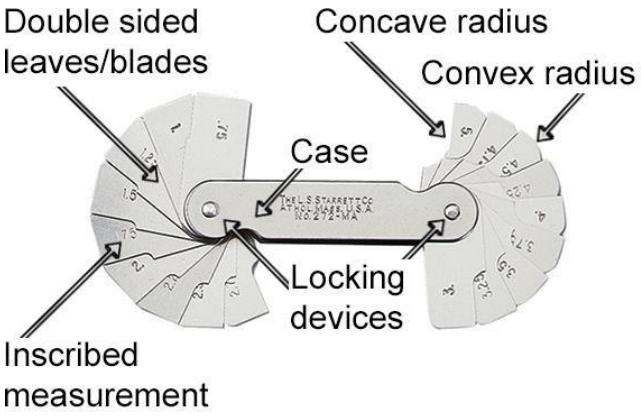

Fig.17.6 Different parts of radiusgauge

4. WIRE Gauge: Wire gauge is ameasurementof how large awireis, either indiameteror cross sectionalarea. This determines the amount ofelectric currenta wire cansafelycarry,as

well as its electrical resistanceand weightper unitof length. Wire gauge is applicable to both electrical and non-electrical wires, being important to electrical wiringand to structural cable.

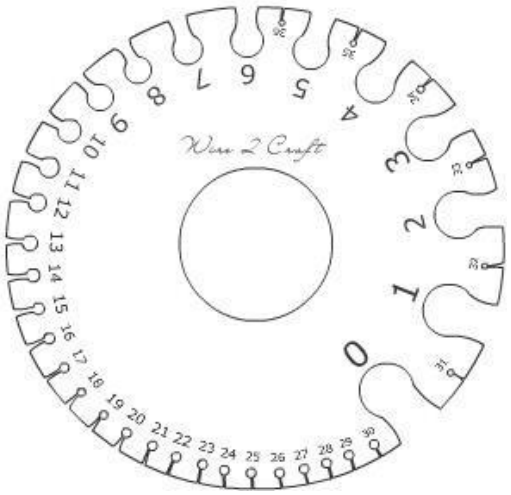

Fig.17.7 Wiregauge

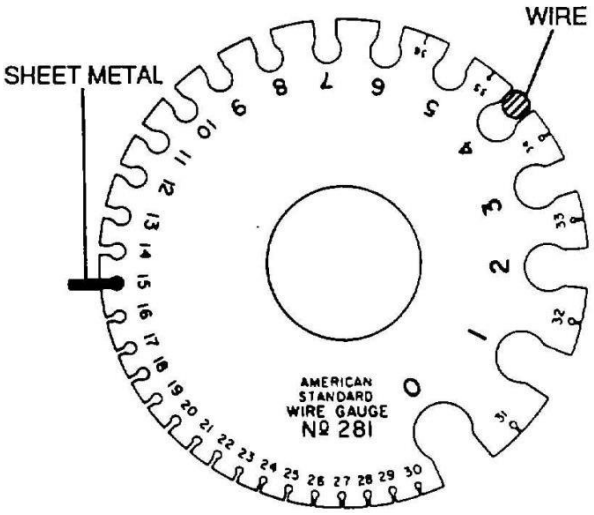

Fig.17.8 Measurement of wiredia.

5. Screw pitch gauge: A screw pitch gauge, also known as a thread pitch gauge or pitch gauge, is used to measure thepitch or leadof ascrew thread. The uppermost gauge in the image is anISO metricpitch gauge, the larger gauge in the center is for measuring theAcme thread form, and the lower gauge is forWhitworthscrews.

Thread pitch gauges are used as a reference tool in determining the pitch of a thread that is on a screw or in a tapped hole. This tool is not used as a precision measuring instrument. This device allows the user to determine the profile of the given thread and quickly categorize the thread by shape and pitch. This device also saves time, in that it removes the need for the user to measure and calculate the thread pitch of the threaded item.

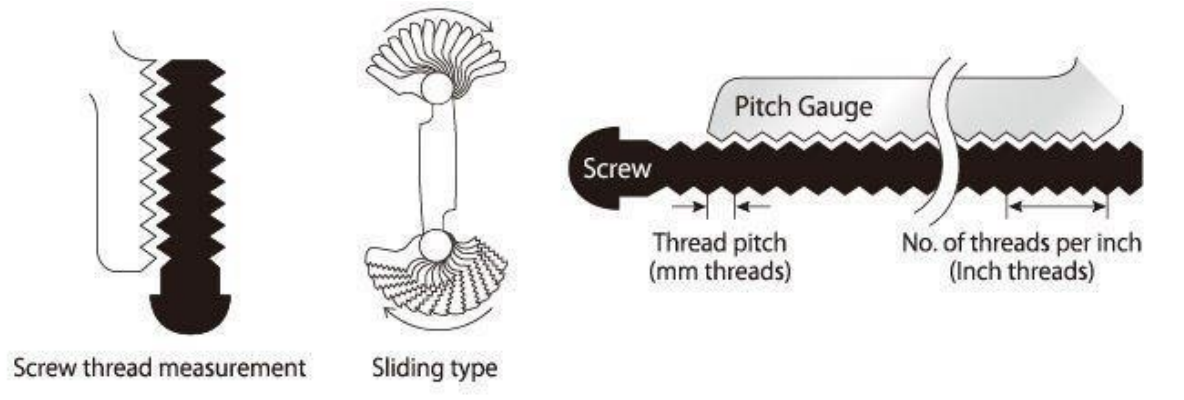

Fig.17.9 Screw thread gauge and Thread measurement.

6. Ring Gauge: A ring gauge, is a cylindrical ring of a thermally stable material, often steel, whose inside diameter is finished to gauge tolerance and is used for checking the external diameter of a cylindricalobject.

Ring gauges are used for comparative gauging as well as for checking, calibrating, or setting of gauges or other standards. Individual ring gauges or ring gauge sets are made to variety of tolerance grades in metric and English dimensions for master, setting, or working applications.

There are three main types of ring gauges: go, no go, and master or setting ring gauges.

Go gauges consist of a fixed limit gauge with a gauging limit based on the plus or minus tolerances of the inspected part. A go ring gauge's dimensions are based on the maximum OD tolerance of the round bar or part being gauged. The go ring (OD) gauge should be specified to a minus gauge makers' tolerance from the maximum part tolerance.

No-go gauges consist of a fixed limit gauge with a gauging limit based on the minimum or maximum tolerances of the inspected part. The no go ring (OD) gauge should be specified to a plus gauge makers' tolerance from the minimum parttolerance.

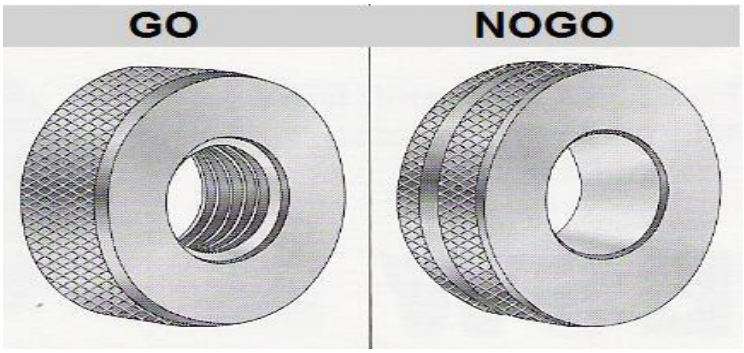

Fig.17.10 Ring gauge (Go & No-Go)

7. Snap Gauge: A snap gage is a form ofGo/no go gauge. It is a limitgagewith permanently or temporarily fixed measurement aperture (gaps) which is used to quickly verify whether an outside dimension of a part matches a preset dimension or falls within predefined tolerances. The surfaces which define the edges of the aperture are the anvils, which may be made of separate pieces of hard material such astungsten carbidefor wear resistance. Two apertures are frequently used to provide Go/No-Go testing and are often arranged such that a part being measured can pass through the two apertures in sequence; a part that is within tolerance will pass through the first maximum size limit aperture but will not be able to pass through the minimum size limit aperture. A snap gauge usually has a "C" shaped frame with the aperture(s) at the opening of the "C". Snap gages may be machined and ground out of a single block of metal or adjustable snap gages, which have movable anvils that may be adjusted over a limited range of sizes, may be used. They may also be of built up construction in whichoneormoregageblocksorfeelergaugesaresandwichedbetweentwoanvils.

Adjustable snap gages may be reset to compensate for wear or re-tasked for measuring a different dimension and can be purchased off the shelf and set rather than needing to be fabricated from scratch when a new gage is needed. Gauge blocks would typically be used to initially set the width of the measuring aperture(s).

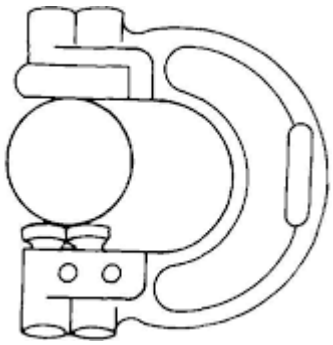

Fig.17.11 Snapgauge

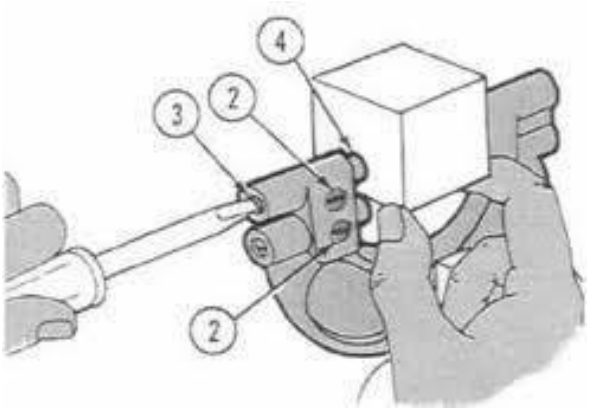

Fig.17.12 Measurement using snapgauge

CONCLUSION:

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_____
_____
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SAFETY PRECAUTIONS:

- Do not use gauges for any other purpose than inspection. For example, never substitute a thread gauge for a nut or bolt, and also never use a gauge instead of tools (hammer, tap,die)etc.
- As a gauge has a sharp portion to satisfy requirements for its function, concern about avoidinginjury.
- Be sure to check that the gauge and handle are not loose before use.
- While a gauge or product is moving, never conduct inspection with thegauge
- Before using a gauge, thoroughly wash the gauge and product with gas oil or kerosene, or wipe them with a clean cloth to remove dust and dirt.
- Before using a gauge, check the gauge for any rust, flaw, burr, etc. If rust, flaw or burr is found, remove it carefully with an Arkansas grinding stone of goodquality
- When inspecting a threaded product with a taper thread gauge, do not screw in the gauge rapidly to the end. Otherwise, the gauge is suddenly inserted, so that it will not come off. So carefully screw in at the finalinsertion.

- Do not hit the gauge by strong force. For example, when passing GO gauge or drawing an immobilized gauge, do not hit or shock it strongly with a hammeretc.
- If the gauge is dropped by accident, check the extent of damage and remove burr with an Arkansas grinding stone of good quality, or take other propercountermeasures.
- When keeping a gauge, do not leave the gauge fitted to a product or do not leave a plug gauge fitted to a ring gauge. Otherwise, the gauges or the gauge and product may stick firmly each other, sometimes resulting inrusting.

DIAGRAMS:

Fig.17.13 PlugGauge

Fig.17.14 Wiregauge

Fig.17.15 RingGauge

Fig.17.16 Snap Gauge

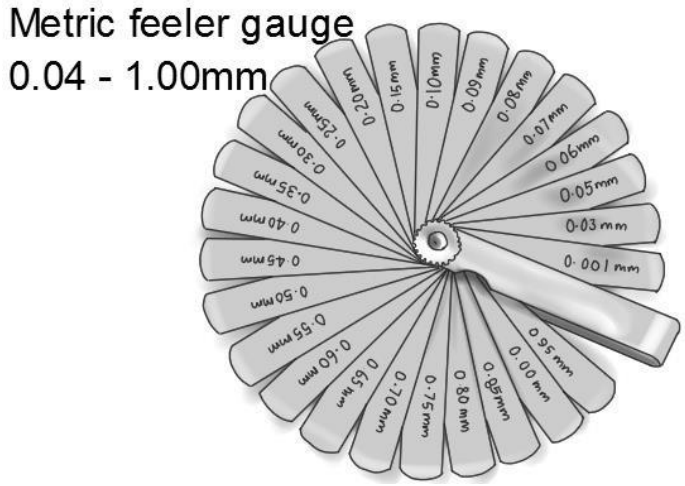

Fig.17.17 Feeler Gauge

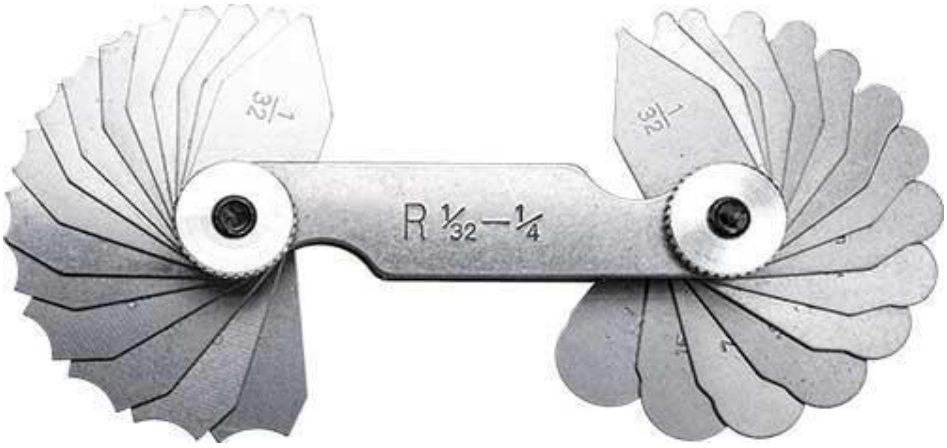

Fig.17.18 Radius Gauge

Fig.17.19 Screw Pitch Gauge

QUESTIONS:

Q 1. what is the use of Pluggauge?

Q. 2 what do you understand by Go and No-Gogauges?

Q. 3 How to use Snap gauge?

Q. 4 write the use of feelergauge?

Q. 5 How the screw thread gauge isuse?

Q. 6 Write safety precautions of usinggauges?

7,What is ring gauge?

8.What is wire gauge?

9.What is the main aim of feeler gauge?

10.What is the use of radius gauge?

11.How many types of radius gauge?

12.What is thread gauge?

13.What do you know about go & not go thread gauge?

14.What is adjustable snap gauge?

15.What is fillet gauge?

16.Give one application of feeler gauge?

17.What is progressive limit gauge?

18.How many types of feeler gauge?

19.What is the difference between go& not go gauge?

20.What is the main aim of wire gauge?

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Experiment no. 18

AIM: To learn and practice the use of Dial test Indicator and to check the straightness of the straight edge.

APPARATUS:
Straight edge, surface plate to accommodate the straight edge, support blocks, dial test indicator.

INTRODUCTION:

Dial test Indicator: A dial test indicator, also known as a lever arm test indicator or finger indicator, has a smaller measuring range than a standard dial indicator. A test indicator measures the deflection of the arm; the probe does not retract but swings in an arc around its hinge point. The lever may be interchanged for length or ball diameter, and permits measurements to be taken in narrow grooves and small bores where the body of a probe type may not reach. The model shown is bidirectional; some types may have to be switched via a side lever to be able to measure in the opposite direction.

These indicators actually measure angular displacement and not linear displacement; linear distance is correlated to the angular displacement based on the correlating variables. If the cause of movement is perpendicular to the finger, the linear displacement error is acceptably small within the display range of the dial. However, this error starts to become noticeable when this cause is as much as 10° off the ideal 90°. This is called **cosine error**, because the indicator is only registering the cosineof the movement, whereas the user likely is interested in the net movement vector. Cosine error is discussed in more detail below.

Straight edges: These are used for checking the straightness and flatness of parts in conjunctions with surface plate, spirit levels and the flatness of a surface background. These may be made of steel or cast iron. Steel straight edges are available up to 2'm length and may be rectangular in section with beveled edge. Cast iron straight edges are made up to 3 inch length and widely used for testing machine tool slide ways.

The straight edges are classified as follows:
1. Tool-maker's straightedge.
2. Wide-edge straightedge
3. Angle straightedge.

PRINCIPLE:
The magnification of the small movement of the plunger or stylus is converted into a rotary motion of the pointer on a circular scale.

PROCEDURE:

1. The distance of support point is calculated (2/9 of total length of straight edge from each end).
2. The straight edge is divided into convenient equal number parts (measuring using accuracy increase with max number of parts), which contain the support pointalso.
3. The surface plate, straight edge and support block arecleaned.
4. The straight edge is supported over the blocks at the calculateddistance.
5. Dial gauge is set below the straight edges so that the plunger is in its middle portion and the reading was taken at eachpoint.
6. The management was made throughout out the length of the straightedge.
7. The difference b/w the nominal and measured difference in heights at variouspoints

OBSERVATION TABLE:

Position	**Nominal Slip (mm)**	**Actual Slip (mm)**	**Error**

CONCLUSION:

_____

_____

_____

_____

_____

PRECAUTIONS:

(1) Check beforeusing

- Confirm whether operation issmooth.
- Confirm whether quiescent point of indicator (pointer / short hand) isstable.
- Dial Indicator: Confirm whether contact point and lug back (back lid) are notloose.
- Dial Test Indicator: Please confirm whether contact point and stem are not loose. Torquefor fasteningscrewsofcontactpoint istobeintherange1.5～2.0kg・cm.If it is fastened too strong, screw part will bedamaged.

(2) Installationmethod

- Dial Indicator should be installed with only stem or lug back. (Dial Test Indicator should be with stem or dovetail)
- Holding tool should be sufficientlystiff.
- Whether installation is right or wrong can be confirmed by that the pointer will return to the set position even after contact point of Dial indicator (Test Lever) is touched to measured substance and inner frame (case) is pushed from up and down byfinger.
- Angle of Dial Test Indicator contact point Please set contact point to be perpendicular to measuring direction. In case of measuring large angle, please correct it. Otherwise, angle error willoccur.

(3) Suppose dial is read from oblique direction of outer dial, error will happen. Please read from frontface.

(4) In case of using it where temperature changes, please frequently confirm the setting point of pointer with master gaugeetc.

(5) In case of dropping it down or making impact with it, please use it afterinspection.

DIAGRAMS:

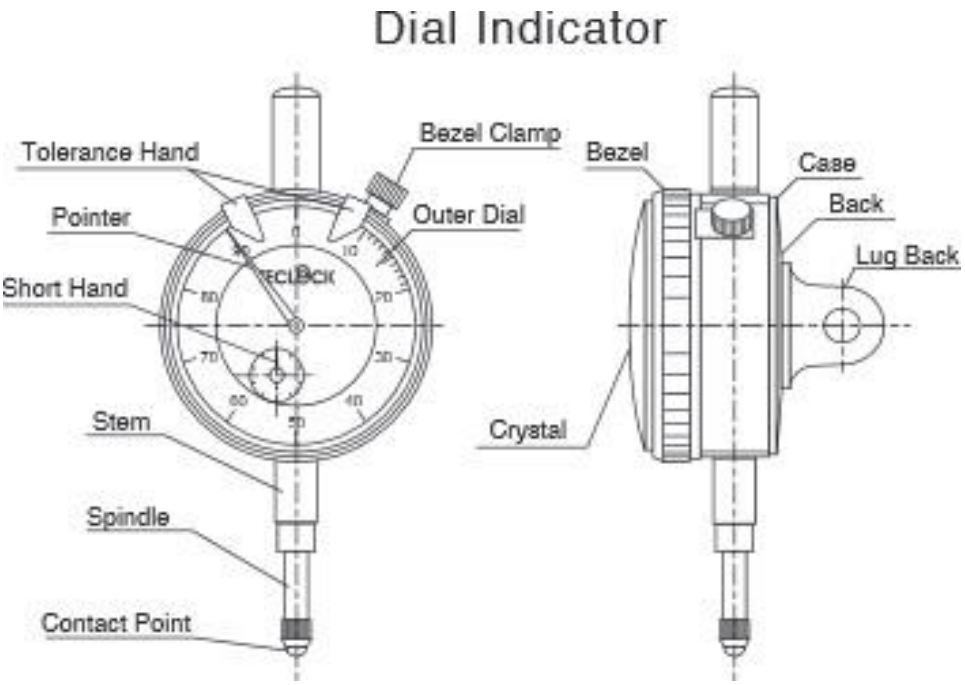

Fig.18.1 Dial Test indicator and its part.

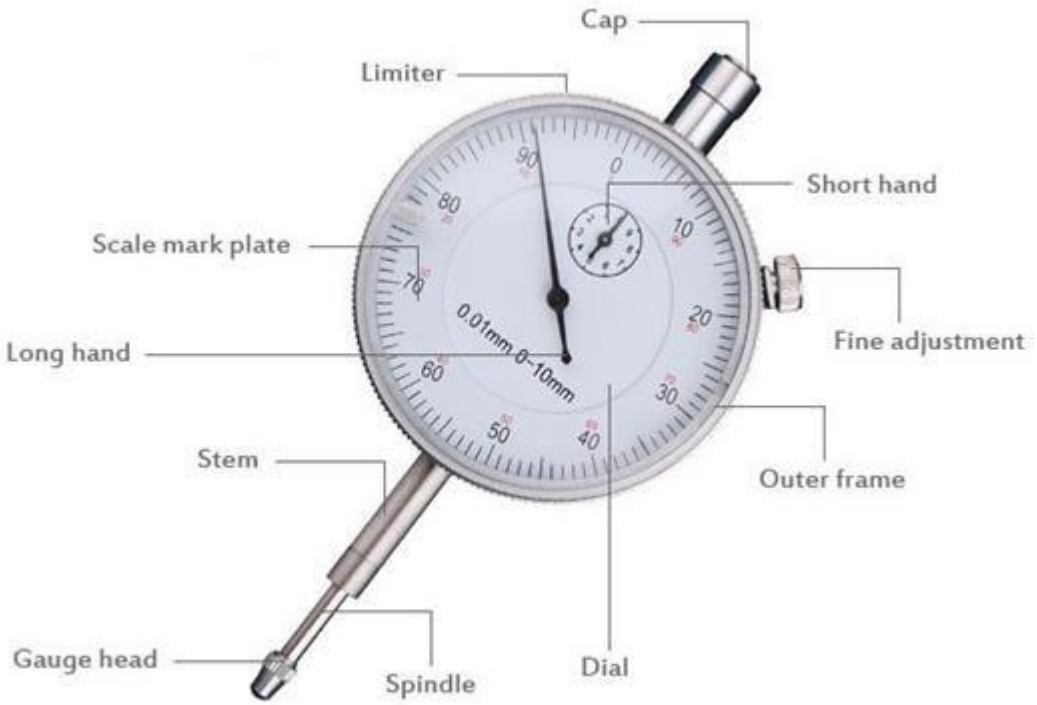

Fig. 18.2 Structure of Dial test indicator

QUESTIONS:

1. What is the purpose of dial testindicator?

2. What are the different types of straight edge?

3. What is the procedure of checking a Straightedge?

4. How the error is calculated while checking the straightness of straightedge?

5. Which material is used for making straightedge?

6. Give the specification of steel straight edge & cast iron straight edge.

7.What is the use of cast iron straight edge?

8.What is the use of steel straight edge?

9.What is tool-makers straight edge?

10.What is angle straight edge?

11.What is the least count of metric dial gauge?

12.What is the least count of British dial gauge?

13.How to use dial test indicator?

14.What is the use of magnetic stand?

15.Name the two types of straight edge?

16.What do you know about different types of straight edge??

17.What is bow shape straight edge?

18.What is triangular straight edge?

19.Whats are the different angles of prismatic straight edge?

20.Name the two types of dial gauge?

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Experiment no.19

AIM: to learn and practice the use of thread cutting tool.

APPARATUS: Dies, Workpiece.

INTRODUCTION: External threads are made with the help of a threading die or die−stock.

Die−stock:
It consists of a handle−equipped holder in which two threading dies are placed. One of them is fixed, the other one can be moved by means of a pressure piece via a locking screw. Three to five pairs of exchangeable threading dies for various sizes of threads belong to adie−stock.

Application of the tools

- Threading dies cut the thread in one operation; they are used with bolt diameters up to 12mm. Bolt diameters between 12 mm and 30 mm can be cut by threading die or die−stock aswell.
- Die−stocks are mainly used with bolt diameters over 30 mm; they are drawn over the bolt in several operations. Readjustment before every new operation is necessary. In the course of the last operation, the thread is accurately cut to size by a threadingdie,

Thread cutting operation

- The threading die is set in exactly horizontal position on the bevel of the bolt and turned clockwise slowly and with slight pressure from above (with right−hand thread). Only when the starting end of the thread is cut and the threading die guides itself, the breaking of chips canbegin.
- The die−stock is opened as much as is necessary to shove it over the bolt − a small piece of the bolt must project above. The die−stock is adjusted to horizontal position and the movable threading die is tightened. Then, the die−stock is turned up to the bevel so that it is still guided. The movable threading die is further tightened. Then, the thread can be cut by turning the die−stock up and down adjusting the threading diesimultaneously.

CARE AND MAINTENANCE:
Lubricating and cooling agents are chosen according to the kind of material.

- **Cleaning:**After thread cutting, the chips and rests of oil are removed from thethread flanks by compressed air orbrush.

- **Checking:** The length of the thread is checked by vernier caliper, the accuracy of fit of the thread by the thread ring gauge according to the nominal diameter. Thesurface of the thread flanks can be assessed by theeye.

- Use appropriate safety guards or machine encapsulations to securely collect particles such as chips or cutting elements, which may spinoff.

CONCLUSIONS:

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_____
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_____

DIAGRAMS:

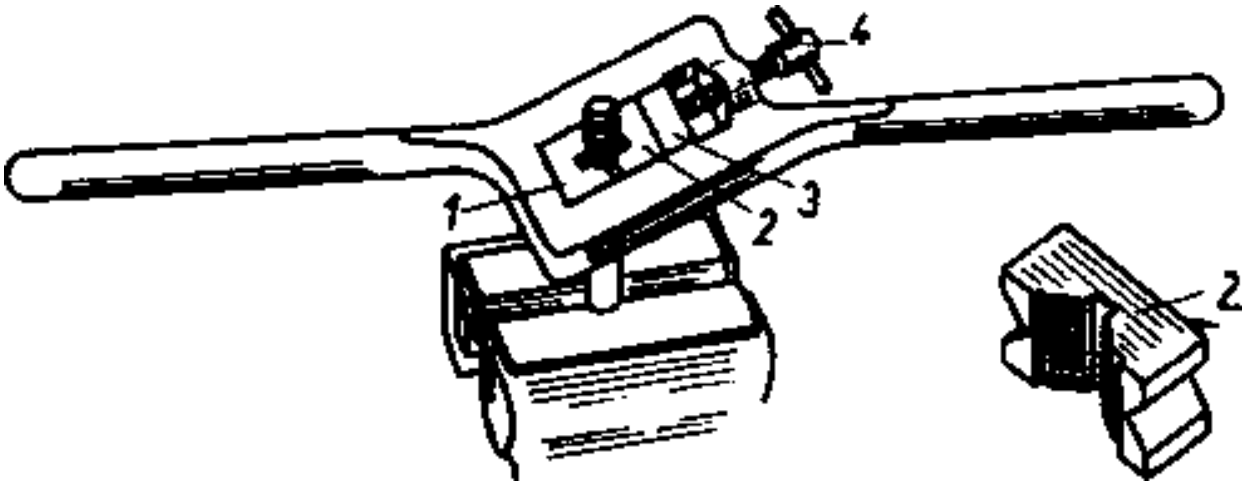

Fig.19.1 Die-Stock

Fig.19.2 DieStock

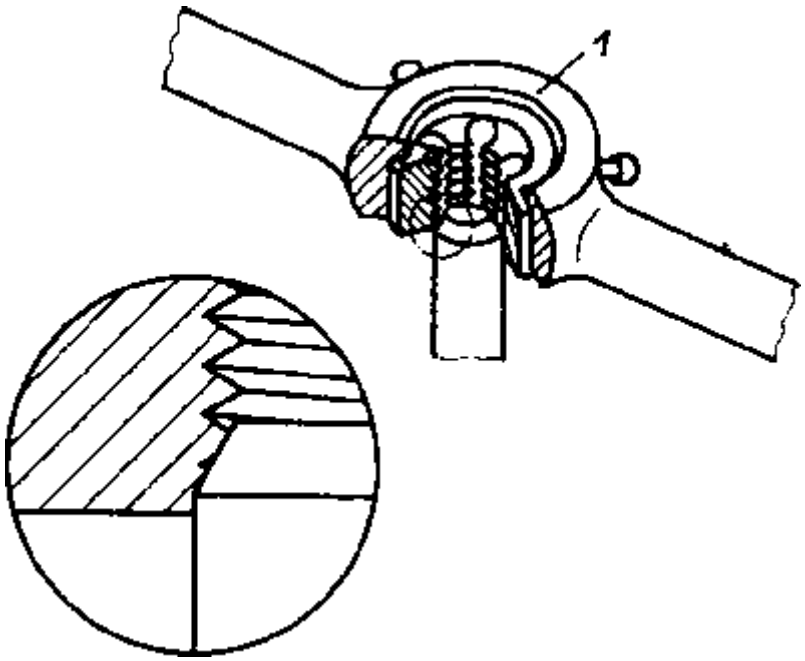

Fig.19.3 Thread cutting.

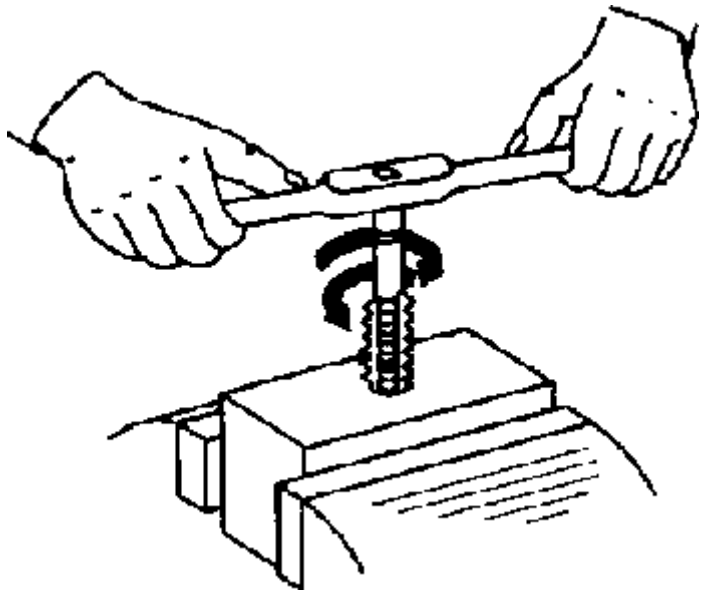

Fig.19.4 Thread Cutting Operation

QUESTIONS:

Q 1. What are the distinguishing features in the use of threading dies anddie−stocks?

Q. 2 Why must lubricating and cooling agents beused?

3. Why is it necessary to move the thread tap or threading die or die−stock,respectively, backwards at regularintervals?

4. Write safety Precautions in thread cuttingoperation?

5.What is a die-stock?

6.What is tap handle?

7.What is tap?

8.How many taps are in a sets?

9.What is a taper tap?

10.What is a plug tap?

11.Whay is a bottoming tap?

12.What is the use of die?

13.What is thread?

14.Which tool is used to cut external thread ?

15.Which tool is used to cut internal thread?

16.What is vice?

17.What is pipe vice?

18.What is solid die?

19.What is split die?

20.What is coolant?

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Experiment no. 20

OBJECTIVE: Analyze the various types of tolerances and applications, and to know the fundamental of the systems of fits.

INTRODUCTION:
In the early days, majority of the components were actually matted together, their dimensions being adjusted until the required type of fit was obtained. But with the passage of time, engineers and workers realized that the variations in the sizes of the parts had always present and that such variations could be restricted but not avoided. It has also been realized that exact size components are difficult to produce. Any attempt towards very closed dimensions of a product will increase cost of the production. The functional aspects of the component may be achieved even without going for its exact dimensions using limits, fit and tolerances. This reduces the unit cost of production and increases the rate ofproduction.

For **example**, a shaft of exact 10.00 mm diameter is difficult to produce by machining process. But if you provide tolerance, i.e. the amount of variation permitted in the size, then such parts can be easily produced. A dimension 10 ± 0.05 means a shaft may be produced between 10.05 and 9.95. These two figures represent limit and the difference, (10.05 – 9.95) = 0.10 is called tolerance.

FITS AND THEIR CLASSIFICATIONS
When two parts are to be assembled, the relation resulting from the difference between their sizes before assembly is called a fit. A fit may be defined as the degree of tightness and looseness between two mating parts.

The important terms related to the fit are given below:

(i) Clearance
In a fit, this is the difference between the sizes of the hole and the shaft, before assembly, when this difference is positive. The clearance may be maximum clearance and minimum clearance. Minimum clearance in the fit is the difference between the maximum size of the hole and the minimum size of the shaft.

(ii) Interference
It is the difference between the sizes of the hole and the shaft before assembly, when the difference is negative. The interference may be maximum or minimum. Maximum interference is arithmetical difference between the minimum size of the hole and the maximum size of the shaft before assembly. Minimum interference is the difference between the maximum size of the hole and the minimum size of the shaft.

(iii) Transition
It is between clearance and interference, where the tolerance zones of the holes and shaft overlap.
So, you can see that fits depend upon the actual limits of the hole and or shaft and can be divided into three general classes:

(i) Clearance Fit.

(ii) InterferenceFit.

(iii) TransitionFit.

Clearance Fit

In clearance fit, an air space or clearance exists between the shaft and hole as shown in Figure Such fits give loose joint. A clearance fit has positive allowance, i.e. there is minimum positive clearance between high limit of the shaft and low limit of thehole.

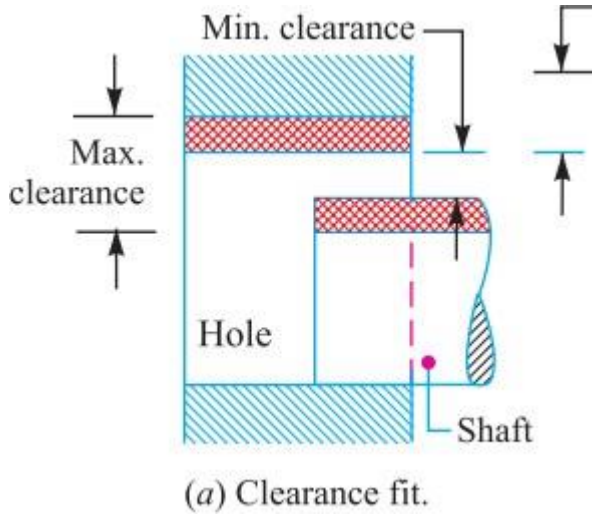


Figure 20.1: Clearance Fit

Clearance fit can be sub-classified as follows:

(a) Loose Fit

It is used between those mating parts where no precision is required. It provides minimum allowance and is used on loose pulleys, agricultural machineries etc.

(b) Running Fit

For a running fit, the dimension of shaft should be smaller enough to maintain a film of oil for lubrication. It is used in bearing pair etc. An allowance 0.025 mm per 25 mm of diameter of boring may beused.

(c) Side fit or Medium Fit: It is used on those mating parts where great precision is required. It provides medium allowance and is used in tool slides, slide valve, automobile parts,etc.

Example 20.1

A spindle slides freely in a bush. The basic size of the fit is 50×10^{-3} mm. If the tolerances quoted are $+\begin{matrix}62\\0\end{matrix}$ for the holes and $\begin{matrix}-80\\-180\end{matrix}$ for the shaft, find the upper limit and lower limit of the shaft and the minimum clearance.

Solution:

Tolerances are given in units of one thousandth of millimeter, so the upper limit of the hole will be 50.062 mm and lower limit for the hole is the same as the basic size of 50.000mm.

The shaft upper limit will be $(50.000 - 0.080) \times 10^{-3} = 49.92 \times 10^{-3}$ m The shaft lower limit will be $(50.000 - 0.180) \times 10^{-3} = 49.82 \times 10^{-3}$ m

The minimum clearance or allowance is $(50.000 - 49.920) \times 10^{-3} = 8 \times 10^{-5}$ mm.

Interference Fit:

A negative difference between diameter of the hole and the shaft is called interference. In such cases, the diameter of the shaft is always larger than the hole diameter. In Figure 20.2. Interference fit has a negative allowance, i.e. interference exists between the high limit of hole and low limit of theshaft.

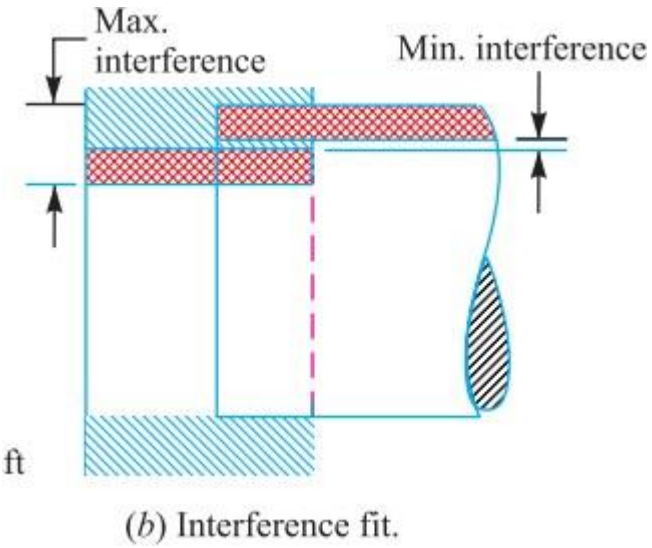


Figure 20.2: Interference Fit

In such a fit, the tolerance zone of the hole is always below that of the shaft. The shaft is assembled by pressure or heat expansion.

The interference fit can be sub-classified as follows :

(a) Shrink Fit or Heavy ForceFit

It refers to maximum negative allowance. In assembly of the hole and the shaft, the hole is expanded by heating and then rapidly cooled in its position. It is used in fitting of rims etc.

(b) Medium ForceFit

These fits have medium negative allowance. Considerable pressure is required to assemble the hole and the shaft. It is used in car wheels, armature of dynamosetc.

(c) Tight Fit or PressFit

One part can be assembled into the other with a hand hammer or by light pressure. A slight negative allowance exists between two mating parts (more than wringing fit). It gives a semi-permanent fit and is used on a keyed pulley and shaft, rocker arm, etc.

Example 20.2

A dowel pin is required to be inserted in a base. For this application H 7 fit for hole and a p 6 fit

for the shaft are chosen. The tolerance quotedare $\begin{matrix}+25\\0\end{matrix}$ forthe $\begin{matrix}+42\\26\end{matrix}$ holeand for the shaft. Find the upper and lower limits of the hole andalso dowel pin, and the maximum interference between dowel pin and the hole. The basic size of the fit is 50×10^{-3} m.

Solution

The upper limit for the hole will be $(50.000 + 0.025) \times 10^{-3} = 50.025 \times 10^{-3}$ m The lowerlimit for the hole will be (50.000 + 0) $50.000 \times 10^{-3} = 50 \times 10^{-3}$ m The upper limit for dowel pin will be $(50.000 + 0.042) \times 10^{-3} = 50.042 \times 10^{-3}$ m

The lower limit for dowel pin will be $(50.000 + 0.026) \times 10^{-3} = 50.026 \times 10^{-3}$ mm

The maximum interference between dowel pin and the hole is (50.042 – 50.000) $\times 10^{-3} = 0.042 \times 10^{-3}$ m $= 42 \times 10^{-6}$ m.

Transition Fit:

It may result in either clearance fit or interference fit depending on the actual value of the individual tolerances of the mating components. Transition fits are a compromise between clearance and interference fits. They are used for applications where accurate location is important but either a small amount of clearance or interference is permissible. As shown in Figure 20.3, there is overlapping of tolerance zones of the hole and shaft.

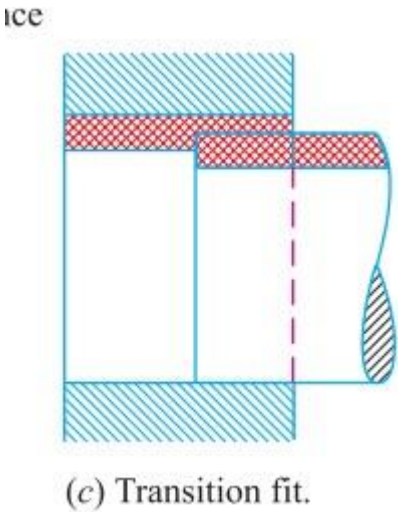


Figure 20.3 : Transition Fit

Transition fit can be sub-classified as follows :

(a) PushFit

It refers to zero allowance and a light pressure (10 cating dowels, pins, etc.) is required in assembling the hole and the shaft. The moving parts show least vibration with this type of fit. It is also known as snug fit.

(b) Force Fit or ShrinkFit

A force fit is used when the two mating parts are to be rigidly fixed so that one cannot move without the other. It either requires high pressure to force the shaft into the hole or the hole to be expanded by heating. It is used in railway wheels, etc.

(c) WringingFit

A slight negative allowance exists between two mating parts in wringing fit. It requires pressure to force the shaft into the hole and gives a light assembly. It is used in fixing keys, pins, etc.

Example 20.3

For a particular application, an H7/h6 fit has been selected for the hole and a K6 fit for the shaft. The tolerance quoted are $\begin{matrix}+25\\0\end{matrix}$ for the hole and $\begin{matrix}+18\\12\end{matrix}$ for the shaft.

Find the upper limit and lower limit for the hole and also for bush. The basic size of fit is 50×10^{-3} m.

Solution

The upper limit for the hole will be $(50.000 + 0.025) \times 10^{-3} = 50.025 \times 10^{-3}$ m. The lower limit for the hole will be $(50.000 + 0) \times 10^{-3} = 50.000 \times 10^{-3}$ m. The upper limit for the bush will be $(50.000 + 0.018) \times 10^{-3} = 50.018 \times 10^{-3}$ m. The lower limit for the bush will be $(50.000 + 0.002) \times 10^{-3} = 50.002 \times 10^{-3}$ m.

SYSTEMS OF FIT

A fit system is the systems of standard allowance to suit specific range of basic size. If these standard allowances are selected properly and assigned in mating parts ensures specific classes of fit.

There are two systems of fit for obtaining clearance, interference or transition fit. These are :

(i) Hole basissystem

(ii) Shaft basissystem

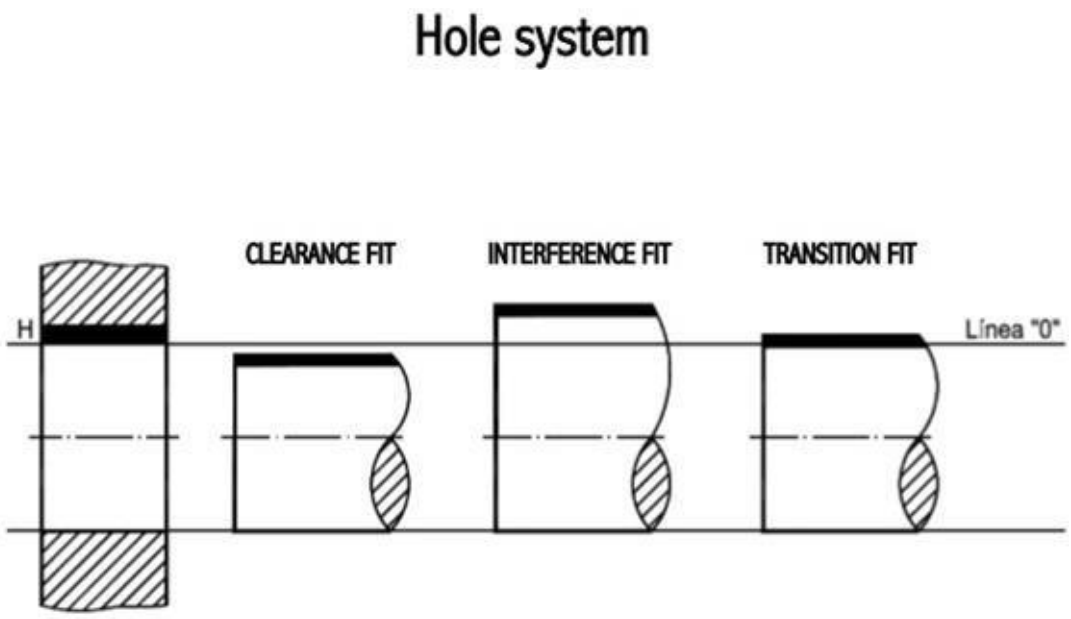


Figure 20.4 : Hole Basis System

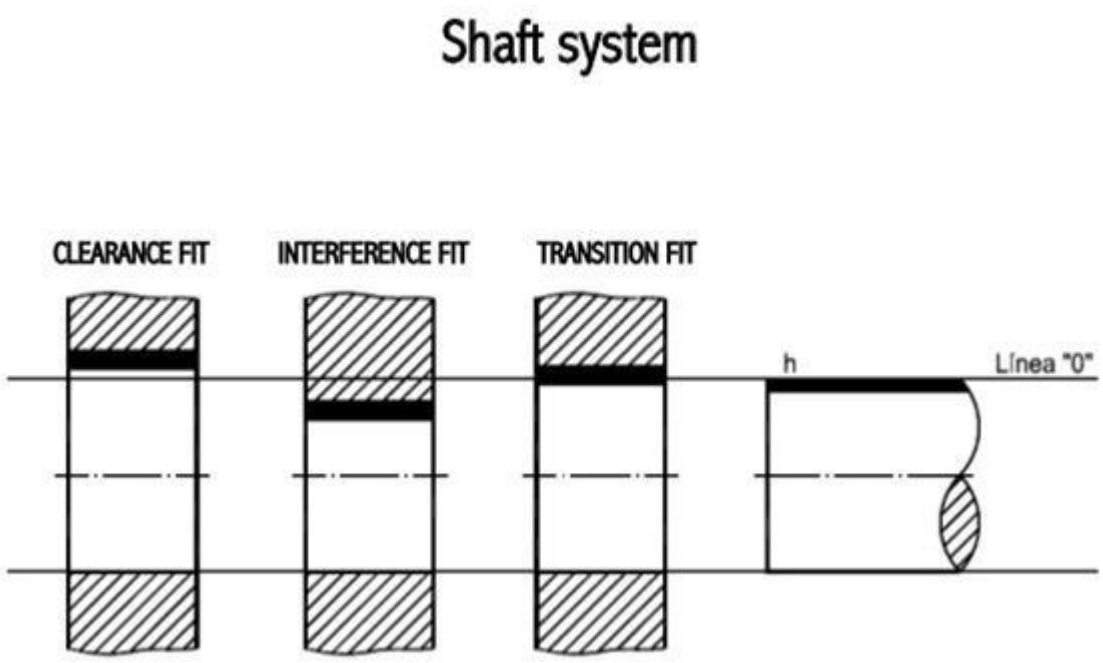


Figure 20.5 : Shaft Basis System

Hole basis system:
In the hole basis system, the size of the hole is kept constant and shaft sizes are varied to obtain various types of fits.
In this system, lower deviation of hole is zero, i.e. the low limit of hole is same as basic size. The high limit of the hole and the two limits of size for the shaft are then varied to give desired type of fit.
The hole basis system is commonly used because it is more convenient to make correct holes of fixed sizes, since the standard drills, taps, reamers and branches etc. are available for producing holes and their sizes are not adjustable. On the other hand, size of the shaft produced by turning, grinding, etc. can be very easily varied.

Shaft Basis System:
In the shaft basis system, the size of the shaft is kept constant and different fits are obtained by varying the size of the hole. Shaft basis system is used when the ground bars or drawn bars are readily available. These bars do not require further machining and fits are obtained by varying the sizes of thehole.
In this system, the upper deviation (fundamental deviation) of shaft is zero, i.e. the high limit of the shaft is same as basic size and the various fits are obtained by varying the low limit of shaft and both the limits of the hole.

TOLERANCE AND ITS CLASSIFICATION:
The permissible variation in size or dimension is tolerance. Thus, the word tolerance indicates that a worker is not expected to produce the part of the exact size, but definite a small size error is permitted. The difference between the upper limit (high limit) and the lower limit of a dimension represents the margin for variation to workmanship, and is called a tolerance zone (Figure20.6).

Tolerance can also be defined as the amount by which the job is allowed to go away from accuracy and perfectness without causing any functional trouble, when assembled with its mating part and put into actual service.

Example 20.4

A shaft of 25 mm basic size is given as 25 ± 0.02 mm. Find the tolerance.

Solution

The maximum permissible size (upper limit) = 25.02 mm and the minimum permissible size (lower limit) = 24.98 mm

Then, Tolerance = Upper Limit – LowerLimit

= 25.02 – 24.98

= 0.04 mm = 4×10^{-5} m

There are two ways of writing tolerances

(a) Unilateral tolerance

(b) Bilateral tolerance.

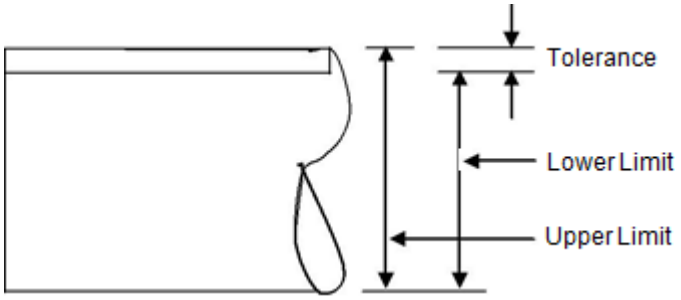


Figure 20.6 : Tolerance

UnilateralTolerance

In this system, the dimension of a part is allowed to vary only on one side of the basic size, i.e. tolerance lies wholly on one side of the basic size either above or below it (Figure 20.7).

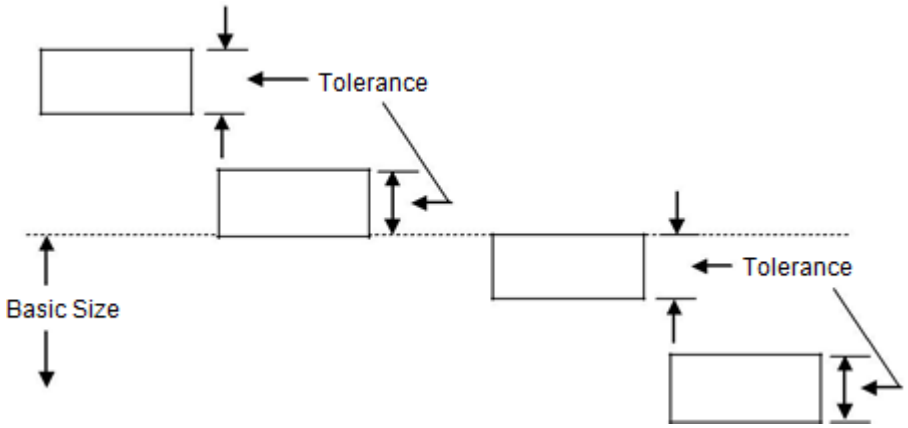


Figure 20.7 : Unilateral Tolerance

Examples of unilateral tolerance are :

$$25^{+0.02}_{+0.01}, 25^{-0.02}_{-0.01}, 25^{-0.01}_{-0.02}, 25^{+0.0}_{-0.02} \text{ etc.}$$

Unilateral system is preferred in interchangeable manufacture, especially when precision fits are required, because

(a) it is easy and simple to determinedeviations,

(b) another advantage of this system is that „Go" Gauge ends can be standardized as the holes of different tolerance grades have the same lower limit and all the shafts have same upper limit, and

(c) this form of tolerance greatly assists the operator, when machining of mating parts. The operator machines to the upper limit of shaft (lower limit for hole) knowing fully well that he still has some margin left for machining before the parts arerejected.

BiLateral Tolerance:
In this system, the dimension of the part is allowed to vary on both the sides of the basic size, i.e. the limits of tolerance lie on either side of the basic size, but may not be necessarily equally dispose about it (Figure 20.8).

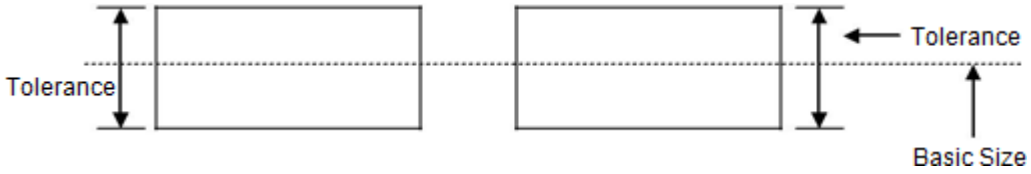


Figure 20.8 : BilateralTolerance

Examples of bilateral tolerance are:

$$25^{\pm 0.02}, 25^{+0.02}_{-0.01} \text{ etc.}$$

In this system, it is not possible to retain the same fit when tolerance is varied and the basic size of one or both of the mating parts are to be varied. This system is used in mass production when machine setting is done for the basicsize.

Example 20.5

A 50 mm diameter shaft is made to rotate in the bush. The tolerances for both shaft and bush are 0.050 mm. determine the dimension of the shaft and bush to give a maximum clearance of 0.075 mm with the hole basis system.

Solution

In the hole basis system, lower deviation of hole is zero, therefore low limit of hole = 50 mm.

High limit of hole = Low limit + Tolerance

$$= 50.00 + 0.050$$

$$= 50.050 \text{ mm} = 50.050 \times 10^{-3} \text{m}$$

High limit of shaft = Low limit of hole –Allowance

= 50.00 – 0.075

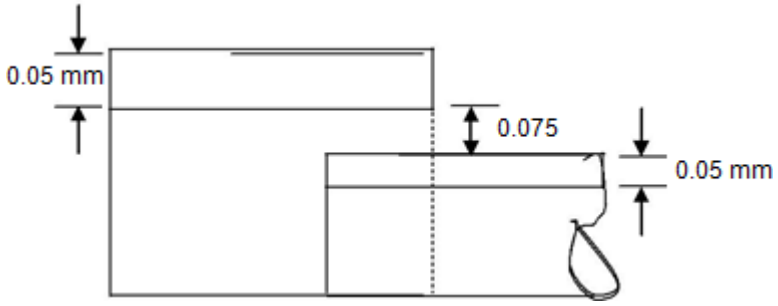
= 49.925 mm = 49.925×10^{-3} m

Low limit of the shaft = High limit – Tolerance

= 49.925 – 0.050

= 49.875 mm = 49.875×10^{-3} m

The dimension of the system is shown in Figure 3.8.



Example 20.6

For each of the following hole and shaft assembly, find shaft-tolerance, hole tolerance and state whether the type of fit is

(a) clearance,

(b) transition,and

(c) interference:

(i) Hole :$50^{+0.25}_{+0.00}$ mm, Shaft :$50^{+0.05}_{+0.005}$ mm

(ii) Hole : $30^{+0.05}_{+0.00}$ mm, Shaft: $30^{-0.02}_{+0.05}$ mm

(iii) Hole :$25^{+0.04}_{+0.00}$ mm, Shaft: $25^{+0.06}_{+0.04}$ mm

Solution

(a) Hole : High limit of hole = 50.025mm

Low limit of hole = 50.00 mm Hole tolerance =

50.025 – 50.00

= 0.025 mm = 25×10^{-6} m Shaft : High limit of shaft = 50.05 mm

Low limit of shaft = 50.005 mm Shaft tolerance

= 50.05 – 50.005

= 0.045 mm 45×10^{-6} m

If we choose high limit of hole with high limit of shaft then Allowance =

50.025 – 50.05

= – 0.025 (Interference)

Similarly, if we choose low limit of hole and either high limit or low limit of shaft, it is clear that there will beinterference.

Thus, we conclude that the type of fit is **Transition fit**.

(b) Hole : High limit = 30.05mm

Low limit = 30.00 mm

Tolerance = 0.05 mm = 5×10^{-5} m

Shaft : High limit = 30 – 0.02 = 29.98 mm

Low limit = 30 – 0.05 = 29.95 mm

Tolerance = 29.98 – 29.95 = 0.0 3 mm = 3×10^{-5} m

If we select high limit of hole and high limit of shaft then

Allowance = 30.05 – 29.98 = 0.07mm

If we choose low limit of hole and high limit of shaft then

Allowance = 30.00 – 29.98 = 0.02mm

Thus, we conclude that the type of fit is **Clearance fit.**

(c) Hole : High limit = 25.04mm

Low limit = 25.00 mm Tolerance = 25.04 – 25.00

= 0.04 mm = 4×10^{-5} m

Shaft : High limit = 5.06 mm

Low limit = 25.04 mm

Tolerance = 25.06 – 25.04

= 0.02 mm = 2×10^{-5} m

If we select high limit of shaft and low limit of hole, then

Allowance = 25.00 – 25.06

= – 0.06 mm = $– 6 \times 10^{-5}$ m

It is clear that for any combination of hole and shaft the allowance will be negative. Thus, we conclude that the type of fit is **Interference fit**.

QUESTIONS:

Q Q. 1 what is afit?

Q. 2 What is the difference between clearance and interference?

Q. 3 Mention the applications of clearance, interference and transitionsfits.

Q. 4 Which of the following are clearance, transition and interferencefits?

(i) Push fit,

(ii) Wringingfit,

(iii) Force fit,and

(iv) Slidefit.

Q. 5 Differentiate between „Hole basis system" and „Shaft basissystem".

Q. 6 A clearance fit is required between the mating parts with hole, specifiedas $25^{+0.04}_{-0.00}$ mm and shaft $25^{-0.02}_{-}$ mm.

Find maximum and minimum permissible size of the hole and also for the shaft.

7.According to ISI, how many types of fits?

8.Give the one example of clearance fit?

9.What is interference fit?

10.What is transition fit?

11.What is tolerance?

12.How many types of limits?

13.Give the one example of upper limit?

14.Give the one example of lower limit?

15.What do you know about hole basis system?

16.What do you know about shaft basis system?

17.State the difference between unilateral &bilateral tolerance?

18.What is unilateral tolerance?

19.What is bilateral tolerance?

20.What is running fit?

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