

LINEAR MEASUREMENT

Linear Measurement

- It is applied to measurement of length, Diameter, Height, and thickness including external and internal measurement.
- The line measuring instrument have series of accurately spaced lines marked on them.
- e.g : Scale

- Linear measurements can be classified as
 1. Direct measuring instrument
 2. Indirect measuring instrument
- Direct measuring instrument have two types
 1. Graduate
 2. Non Graduate

- In graduate instrument include rules, vernier callipers, vernier height gauge, vernier Depth gauge, Micrometer, Dial indicator.
- Non graduate instrument include wire gauge, Screw pitch gauge, radius gauge, thickness gauge, slip gauge etc.

- They can be classified as
 1. Non precision instrument such as steel rule
 2. Precision measuring instrument such as vernier, micrometer etc.

■ Steel rule:

- It is a line measuring device.
- It is a part replica of the international prototype meter.
- Its made from stainless steel having series of equally spaced lines engraved on it.
- It is most common used in workshop
- It manufacture in different size

- Precaution while using steel rule
 1. The rule should never be used for cleaning between parts or substitute for screw driver.
 2. To maintain sharpness of the graduation for easy and accurate reading.
 3. To avoid parallax error while making measurement eye should be at 90°

4. When taking measurement with rule it required graduation marks are as close as possible to the face being measured.

■ Callipers

The steel rule alone is not a convenient method of measuring directly the size of the circular part.

- A calliper is used to transfer the distance b/w the faces of component to a scale
- Classification of callipers
 1. Outside callipers
 2. Inside callipers
 3. Transfer callipers
 4. Odd edge callipers

- Outside calliper:



- Inside callipers:



Odd leg calipers



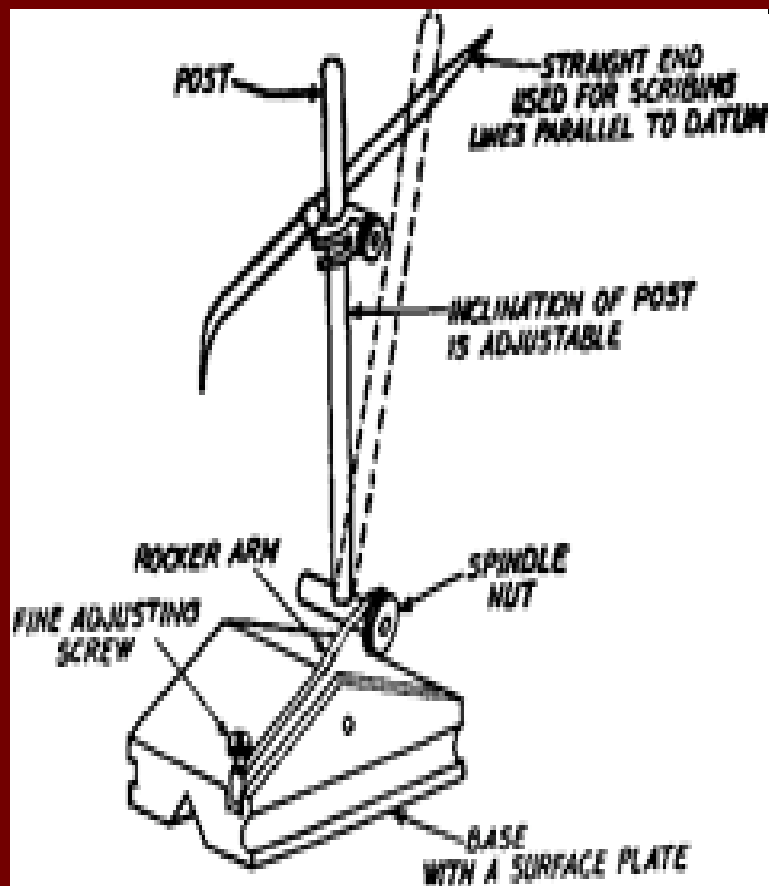
- Angle plate:



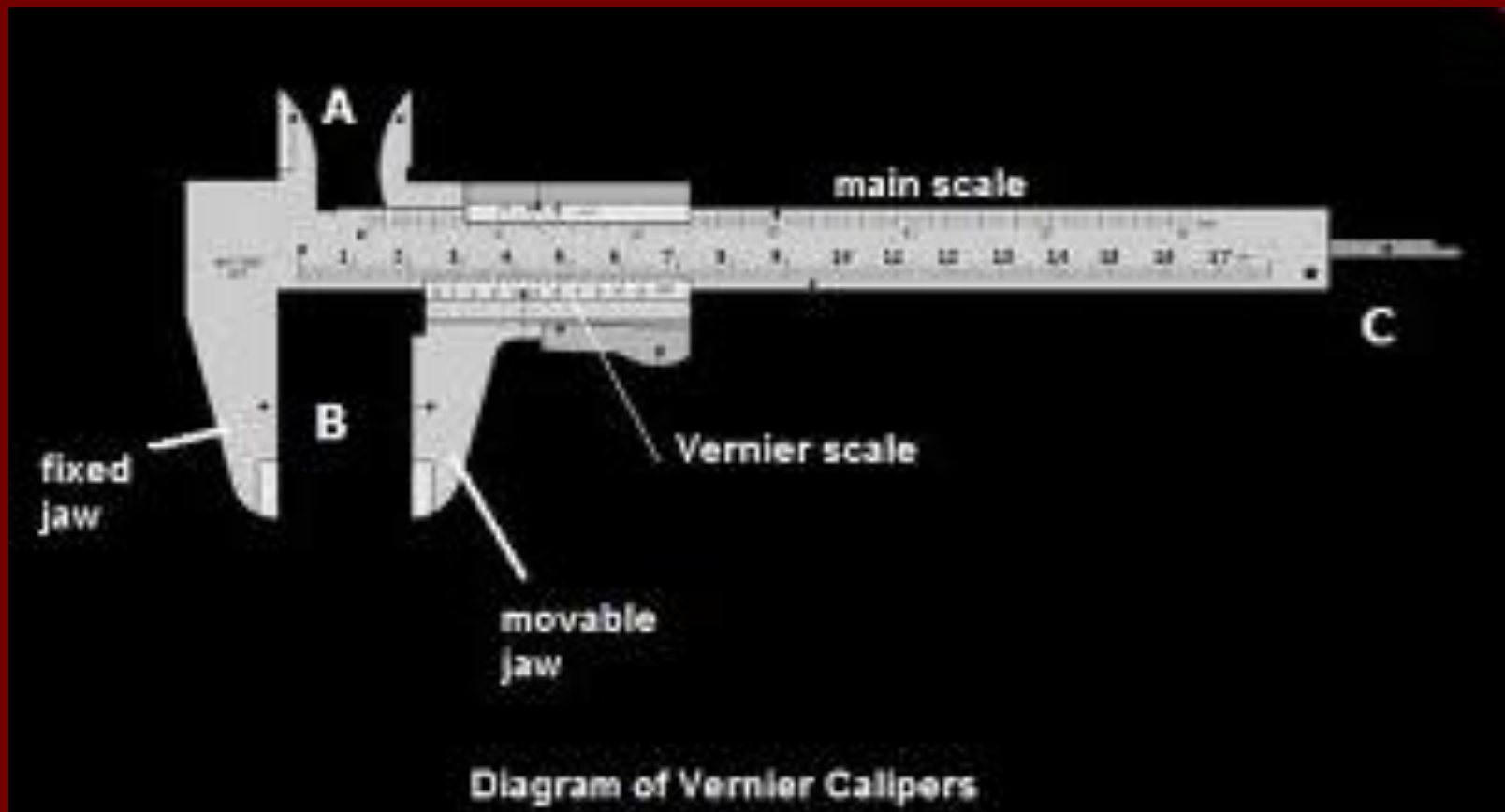
■ V-block



■ Universal surface gauge



■ VERNIER CALLIPER



- **Vernier calliper reading** = main scale reading + The number of division which exactly coincide with a number of main division \times Least count

- **Least count vernier instrument:**
- vernier instrument have two scale main scale and vernier scale.
- Main scale is fixed and vernier scale is slides on the main scale.
- When the zero of main scale coincides with zero of vernier scale the vernier scale has one more division than the main scale

- Least count = value of smallest division on main scale/ number of division on the vernier scale.
- L.C = $1/50$
= 0.02 mm

Vernier height gauge

- A Vernier height gauge has finely ground base.
- Base is massive and robust in construction to ensure rigidity and stability.
- Massive base give support to the graduated beam



- The vernier height gauge is design for the accurate measurement and marking of vertical height above the surface plate.
- It can also be used to measure the differences b/w two height.



- It can be used for number of application in the tool room and inspection department.

Important Features

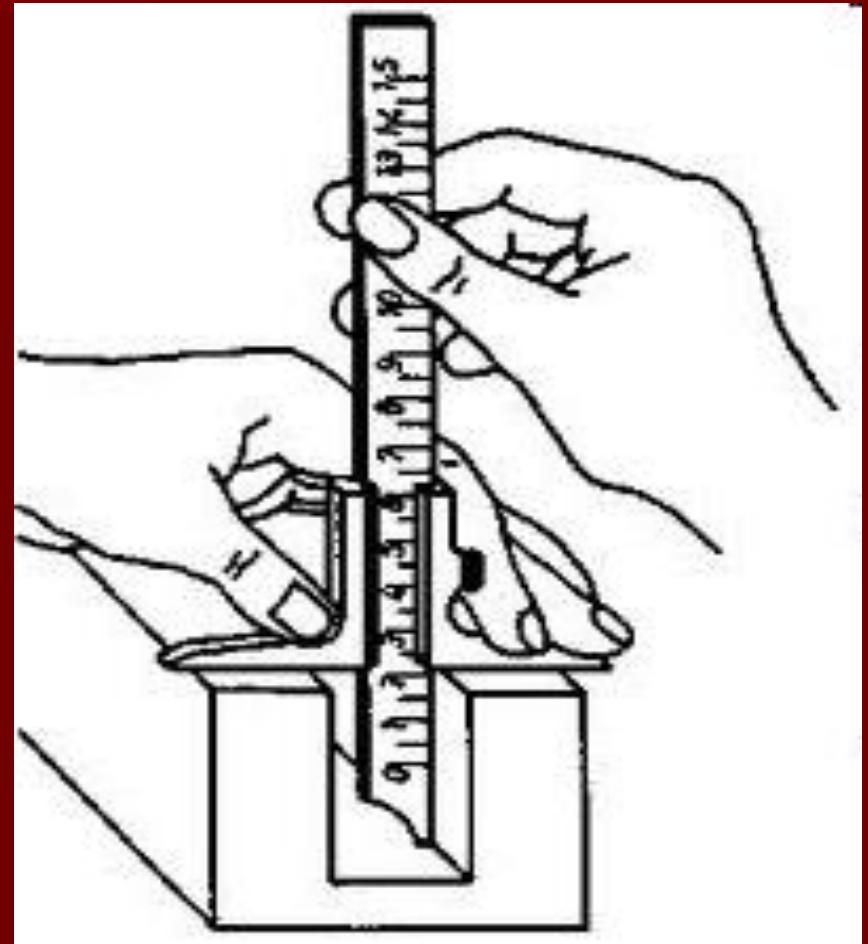
- All the parts made of good quality steel.
- Beam has sufficient rigidity.
- Measuring jaw should be flat.
- Slider should have good sliding.
- Height gauge can also be provided with dial gauge to get exactly and easy reading.

Vernier Depth gauge

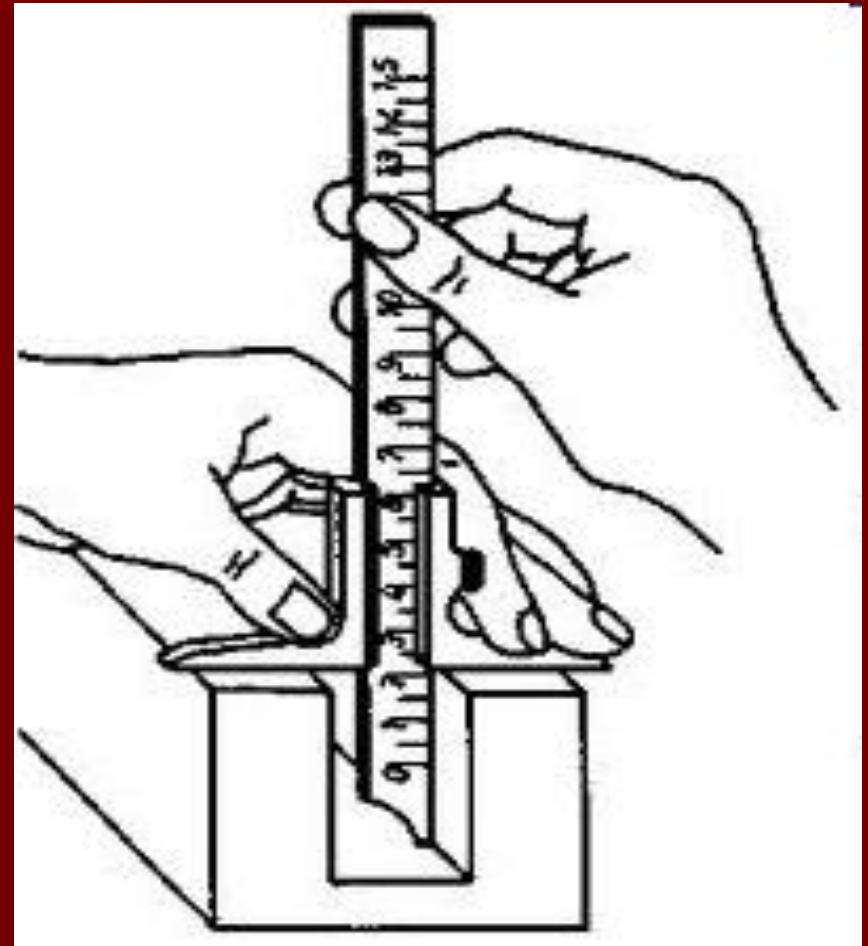


VERNIER DEPTH GAUGE

- Vernier depth gauge is used to measure the depth of holes, slots.
- It consist a sliding head it having flat and true base.
- A graduate beam known as main scale and and sliding head slide over the graduate beam.
- Beam is perpendicular to the base and its flat from the both ends.



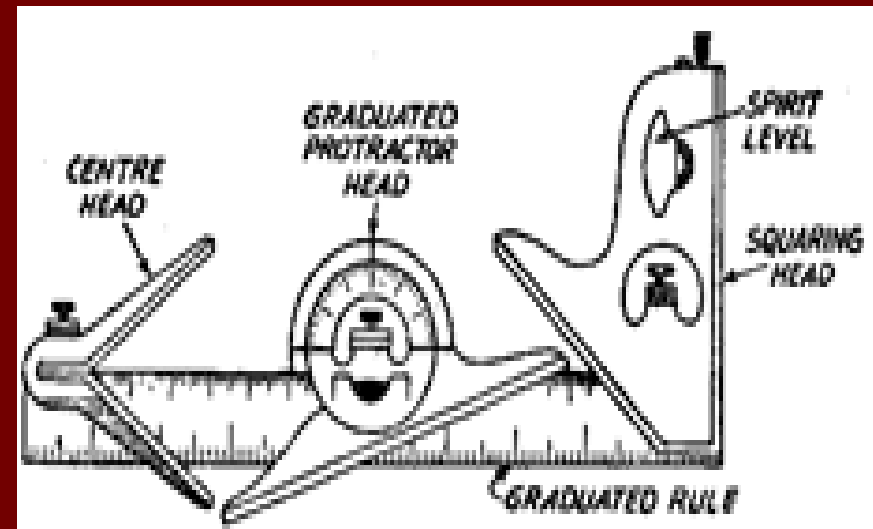
- While using this instrument the base is held over the reference surface and lower beam go downward until it contact the bottom surface of the hole.
- The clamping screw then tightened and remove vernier from the work piece and take reading same way of the vernier caliper.



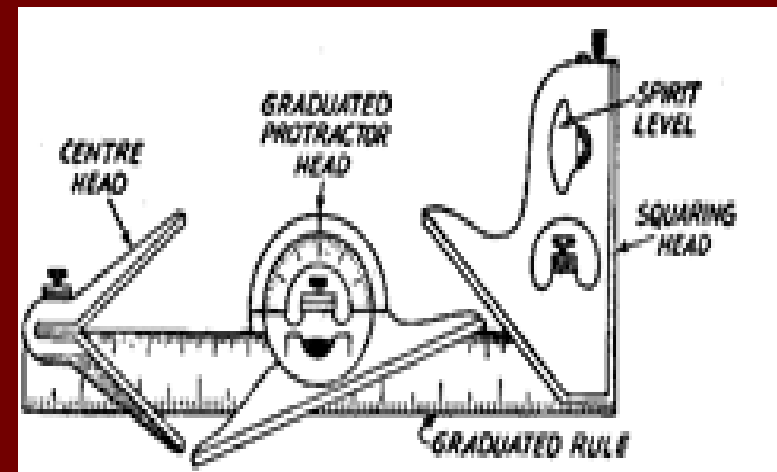
Combination Square (Combination set)

- it consist of
 1. Steel rule
 2. Square head
 3. Centre head
 4. Protector head

- It is use in layout and inspection work
- Steel rule grooved along its length and sliding square fitted in this groove.
- On surface of the square head is always perpendicular to the rule.



- And it can be adjust at any point by the clamping screw.
- Center square is obtain for finding the center line of cylindrical object.
- The centre square slotted at centre so that the rule when inserted bisect the 90° angle.

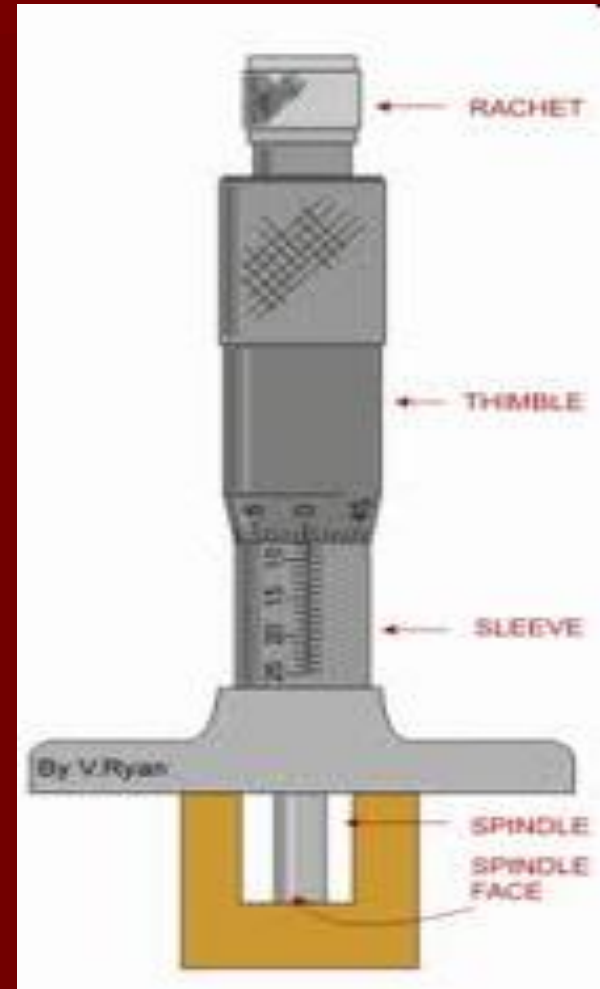
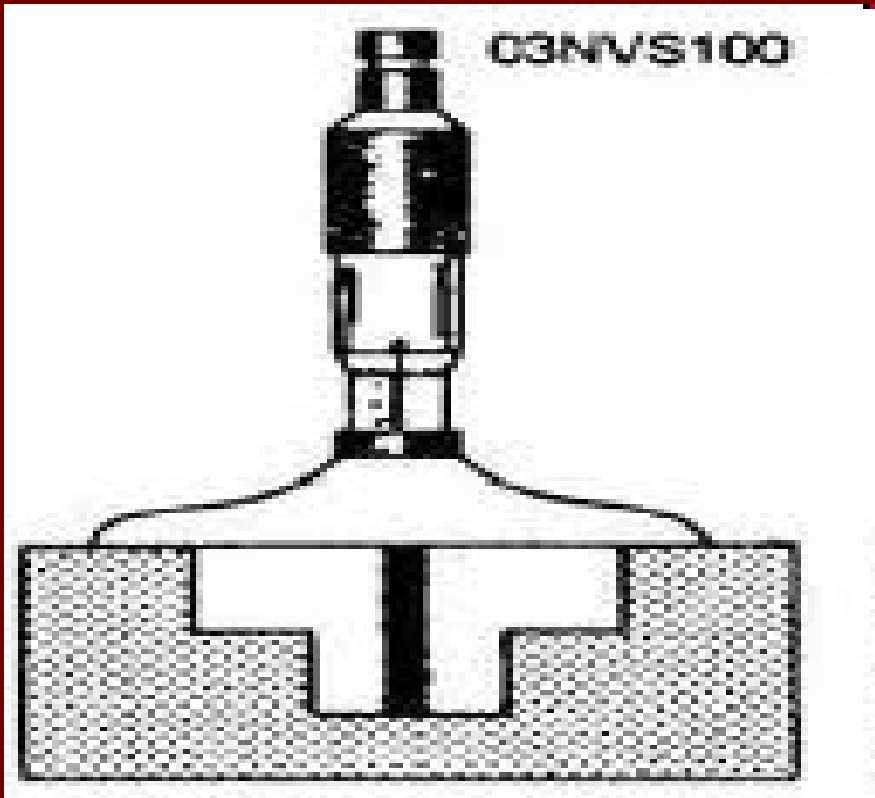


Micrometer

- Micrometer works on principle of Screw and nut.
- When the screw is turn through the nut through one revolution it advance by one pitch distance.
- **Least count of micrometer**
- The Micrometer has a screw of 0.5 mm pitch with a thimble graduated in 50 division to provide a direct reading of
- **$\text{Pitch}/n = 0.5/50 = 0.01 \text{ mm}$**

- Micrometer total reading =
Main scale reading + Reading on the
thimble * L.C

Depth Micrometer



Telescopic gauge

- It is used for measure the internal diameter of holes, slots , grooves etc.
- It consist of a handle with two rods in a tube at one end and a working screw at other end.
- The rods having spherical contacts can slide within a tube and a force apart by internal spring.



- The locking screw can lock the rods at any desire position through the spring.
- While taking the measurement the rods are pressed closer and inserted the hole to be measured.
- The rods then open out to touch the metal surface of the hole on both side.
- Then its lock by means of locking screw

- Then it taken out from the hole.
- And the dimension across tips measured by micrometer.

Slip gauges

- Slip gauges are rectangular blocks of high grade steel with close tolerance.
- It ensure the resistance to wear.
- They are than stabilized by heating and cooling successively in stages so that hardening stresses are removed.
- After being hardened they are carefully Finished by high grade lapping.

to a high degree finish, flatness and accuracy.

- Its having a truly flat surface for accurate reading.
- The cross section of these gauge is 9 x 30 mm for size upto 10 mm
- And 9 x 35 mm for larger size.

- **Slip gauges are used for**
- To get the high accuracy
- For checking the accuracy of vernier calliper, micrometer and such other measuring instrument.
- For measure the angle of work piece.

■ Wringing of slip gauge

