EXPERIMENT No. 2
USE OF MICROMETER SCREW GAUGE

Aim: To measure

1. The diameter of a given wire and calculate its area of cross section
2. Thickness of glass plate.

Apparatus: Screw gauge, Wire, glass plate

Diagram :

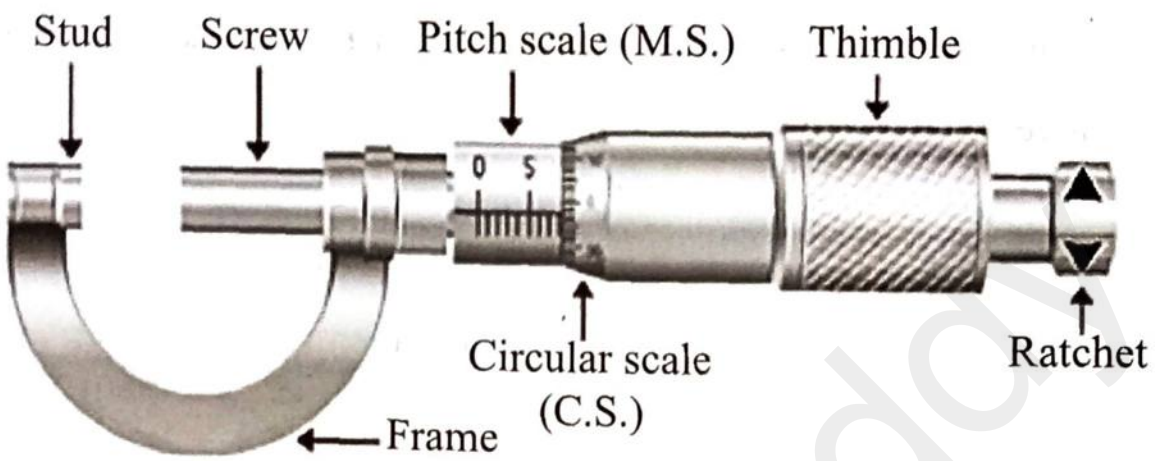


Fig. 2.1 Micrometer Screw gauge

Formula :

1. Least Count of the Screw Gauge

$$\text{Least Count} = \frac{\text{Pitch}}{\text{Total number of division on the circular scale}}$$

2. Area of cross section of wire :
   $A = \pi r^2$ ------ Where r is radius.

Zero Error and Zero Correction

To get the correct measurement the zero error must be taken into account. For this purpose, the screw is rotated forward, until the screw just touches the anvil and the edge of cap is on the zero mark of the pitch scale. The Screw gauge is held keeping the pitch scale vertical with its zero down wards.

When this is done, anyone of the following three situations can arise:

1. The zero mark of the circular scale comes on the reference line. In this case, the zero error and the zero correction, both are nil.
2. The zero mark of the circular scale remains above the reference line and does not cross it. In this case, the zero error is positive and the zero correction is negative depending on how many divisions it is above the reference line.
3. The zero mark of the head scale is below the reference line. In this case, the zero error is negative and the zero correction is positive depending on how many divisions it is below the reference line.

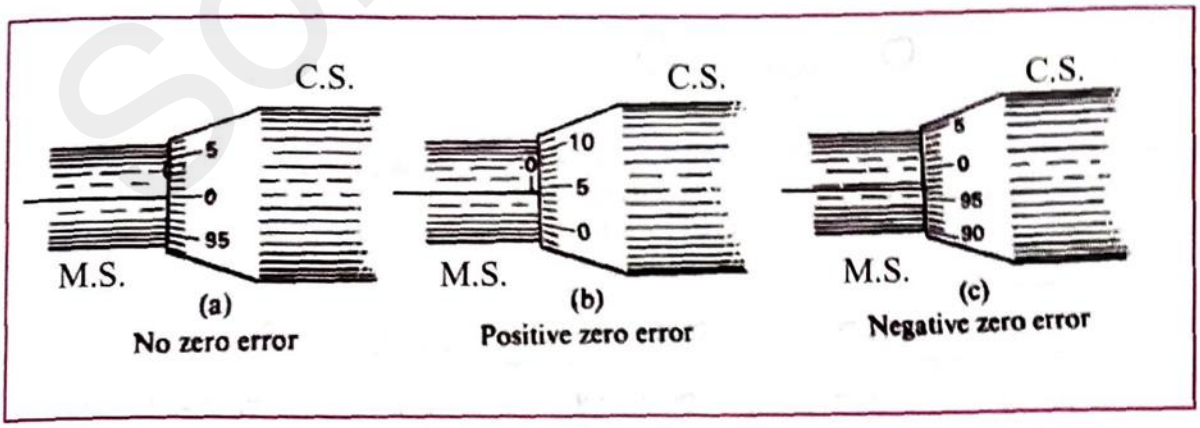


Fig. 2.2 Zero error

Procedure :

1. Determine the pitch and least count of the screw gauge using the formula.
2. Bring the anvil and screw in contact with each other and find the zero error. If there is no zero error, then record 'zero error nil'.
3. Move the screw away from the anvil and place the wire and move the screw towards the anvil using the ratchet head. Stop when the ratchet slips without moving the screw.
4. Note the number of divisions on the main scale that is visible and uncovered by the edge of the cap. The reading A is called the main scale reading.
5. Note the number (B) of the division on the circular scale lying over the reference line.
6. Repeat steps 4 and 5 for two different positions of the wire. Record the observations in the tabular column.
7. Find total reading using the formula and apply zero correction in each case.
8. Take the mean of different values.

Note: Place the other objects like wire, glass plate etc. between the screw and the anvil and follow the above procedure to find the measurement.

Observations :

1. Determination of Least Count of the Screw Gauge

a) Smallest division on main scale, S = 1 mm.

b) Number of full rotations given to screw, n = 10

c) Distance moved by the screw on main scale, D = 10 mm.

d) Hence, pitch $p = \frac{D}{n} = \frac{(10\ mm)}{10} = 0.1$ mm.

e) Number of divisions on circular scale, N = 100

f) Hence, least count, L.C.= $\frac{p}{N} = \frac{(1\ mm)}{100} = 0.01$ mm = 0.001 cm.

2. Zero Error

Zero error = Z = ------0------mm = ------0------cm
(with sign)

Object	Obs No.	Main Scale Reaing (A) (cm)	Coincident divisions on circular scale (B)	circular Scale Reading C = (B x L.C) (cm)	Total Reading		
					Observed $D_o = A + C$ (cm)	Corrected $D = D_o - Z.E$ (cm)	Mean
Wire	1	0.2	69	0.069	0.269	0.259	cm.
	2	0.3	49	0.049	0.349	0.359	0.276
	3	0.2	61	0.061	0.261	0.231	
Glass Plate	1	0.5	95	0.095	0.595	0.585	cm.
	2	0.5	95	0.095	0.595	0.585	0.585
	3	0.5	96	0.096	0.596	0.586	

Calculations :

1. Mean Diameter of the wire, D = 0.276 cm.
2. Radius of wire, $r = \frac{D}{2}$ = 0.1380 cm.
3. Area of cross section of the wire, $A = \pi r^2$ = 0.05850 cm^2.
4. Thickness of the glass plate, t = ~~0.276~~ 0.585 cm.

Result:

1. Diameter of the wire, D = 0.276 cm.
2. The area of cross section of the given wire is, A = .0.:0.5850..cm^2.
3. Thickness of the glass plate, t = 0.585 cm.

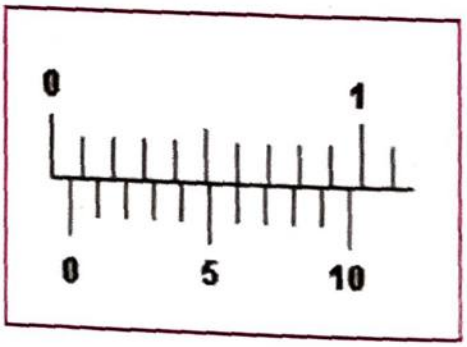
Precautions :

1. Rotate the screw in one direction to avoid backlash error.
2. Do not apply undue pressure while turning the micrometer screw.

Additional Experiment you can do : Find the volume of the small ball bearing/ metal sphere.

Multiple-choice Questions:

1. What is the zero error as shown in the figure?



✓a) 0.6 mm b) 0.06 mm c) 6mm d) 60 mm

2. Precision of micrometer screw gauge is----------.

a) 0.1 cm ✓b) 0.01 mm c) 0.1 mm d) 0.01 m

Questions

1. Define the terms pitch and least count.

Pitch : The smallest value of length or any other unit which can be react directly from a main scale accurantely.

Pitch : Unit of main scale
No. of division in the unit

Least count : It is the magnitude of the smallest measurement that can be measured any an instrument accurantly.

2. What is the backlash error? How do you reduce it?

The simplest and most common way to reduce blacklash is in a painful af gears is to shorten the distance between their centres this moves the gears into a lighter mesh with law or zero clear once between teeth. It slips in the nat and dose not cover any linear distance for same antation of screw Head.

Blacklash error : In case of micrometre screw gauge.
The blacklash error in which measure-ment due to blacklash of the intergeal gears in a pairs of machine gears the distance between two space and tooth thickness tun adjecent teeth measured along the pitch circle.

Remark and sign of teacher: .....