

EXPERIMENT 2

AIM

To measure diameter of a given wire and thickness of a given sheet using screw gauge.

YOU NEED

1. Screw gauge
2. Wire
3. Metre scale
4. Sheet

THEORY

If a wire or a sheet is placed between A and B, the edge of the cap lies ahead of x division on pitch scale, then

Linear scale or pitch scale reading = x

If n th division of circular scale coincides with reference line, then

$$\text{Circular scale reading} = n \times \text{L.C.}$$

$$\text{Observed diameter of wire or thickness of the sheet} = x + n \times \text{L.C.}$$

$$\text{Corrected diameter or thickness of the sheet} = \text{Observed diameter} - \text{Zero error}$$

HOW TO DO

(a) Measurement of Diameter of the Wire

1. First of all find the pitch and least count of the given screw gauge as explained earlier.
2. Determine the zero error with proper sign. Repeat it three times and record them. If there is no zero error, then record zero error nil.
3. Now insert the wire between the screw and stud A. Move the screw forward by rotating the ratchet till the wire is gently gripped between A and B as shown in Fig. 15. Stop rotating ratchet when ratchet slips without moving the screw.
4. Note the number of divisions of the linear scale visible and uncovered by the edge of the cap. The reading x is called linear scale reading.
5. Note which number of division on circular scale (n) is coinciding with the reference line. The product of n and L.C. gives the circular scale reading.
6. Now calculate the diameter of the wire from the readings.

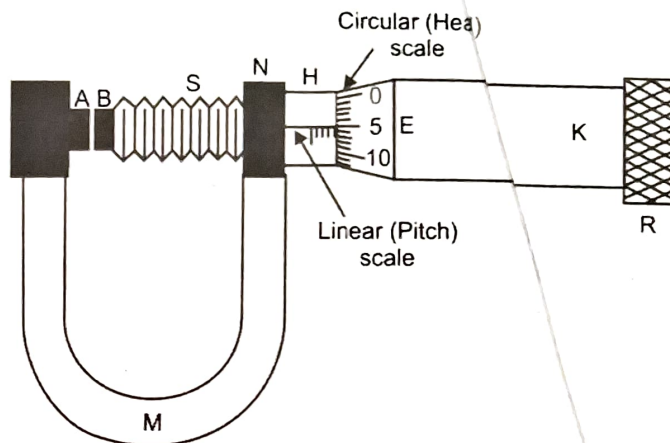


Fig. 15. Screw gauge

- 6 Repeat the above steps 3 to 5 for the three different positions of the wire.
- 7 Take the mean of these observed diameters.
- 8 Now apply the zero correction with proper sign to mean observed diameter and find the corrected diameter.

(b) Measurement of Thickness of the Sheet

- 9 Now insert the given sheet between the screw and stud A. Move the screw forward by rotating the ratchet till the sheet is gently gripped between A and B as shown in Fig. 15. Stop to move ratchet when ratchet slips without moving the screw.
- 10 Note the number of divisions of the linear scale visible and uncovered by the edge of the cap. The reading x is called linear scale reading.
- 11 Note which number of division on circular scale (n) is coinciding with the reference line. The product of n and L.C. gives the circular scale reading.
- 12 Repeat the steps 9, 10 and 11 for four different positions throughout the surface of the sheet. Record the observations in tabular form.
- 13 Take the mean of the observed thickness of the sheet.
- 14 Apply zero correction with proper sign to mean observed thickness to get corrected thickness.

OBSERVATIONS

1. Determination of Least Count of the Screw Gauge

$$1 \text{ L.S.D.} = 1 \text{ mm}$$

Number of full rotations given to screw = 4

Distance moved by the screw = 4 mm

$$\text{Hence, pitch } p = \frac{d}{n} = \frac{4 \text{ mm}}{4} = 1 \text{ mm}$$

Number of divisions on circular scale = 100

$$\text{Hence, least count,} = \frac{1 \text{ mm}}{100} = 0.01 \text{ mm} = 0.001 \text{ cm.}$$

2. **Zero Error.** (i) mm, (ii) mm, (iii) mm.

Mean zero error (e) = mm

Mean zero correction (c) = $-e$ = mm.

3. Table for diameter (D)

Serial No. of Observations	Linear Scale Reading (N) (mm)	Circular Scale Reading		Total Reading	
		No. of Circular Scale division on reference line (n)	Value $[n \times (\text{L.C.})]$ (mm)	Observed $D_0 = N + n \times \text{L.C.}$ (mm)	Corrected $D = D_0 + c$ (mm)
(a) $A \ominus B$ 1 —					$D_1 (a) =$
(b) \textcircled{I}					$D_1 (b) =$
(a) $A \ominus B$ 2 —					$D_2 (a) =$
(b) \textcircled{I}					$D_2 (b) =$
(a) $A \ominus B$ 3 —					$D_3 (a) =$
(b) \textcircled{I}					$D_3 (b) =$

3. Table for the thickness (t)

Serial No. of Observations	Linear Scale Reading (N) (mm)	Circular Scale Reading		Total Reading	
		No. of Circular Scale division on reference line (n)	Value [$n \times (\text{L.C.})$] (mm)	Observed $t_0 = N + n$ $\times \text{L.C.}$ (mm)	Corrected $t = t_0 + c$ (mm)
1.					$t_1 =$
2.					$t_2 =$
3.					$t_3 =$
4.					$t_4 =$

RESULT

1. The diameter of the given wire is cm.
2. The thickness of the given sheet is cm.

BE CAREFUL

1. The screw should be free from friction. It should be oiled if it is needed.
2. Screw should be always turned by ratchet and not by cap to avoid excess pressure.
3. Zero correction must be noted with proper sign and added algebraically.
4. The screw should be moved in the same direction for the same set of observations to avoid the backlash.
5. Stop turning the ratchet, when it starts slipping.
6. Take the reading of the diameter in two mutually perpendicular directions.
7. Error due to parallax should be avoided.

SOURCES OF ERROR

1. The screw gauge may have backlash error.
2. The threads of the screw may not be of equal pitch.
3. The screw may have friction.
4. The divisions on linear scale and circular scale may not be evenly spaced.