ROHINI

COLLEGE OF ENGINEERING AND TECHNOLOGY

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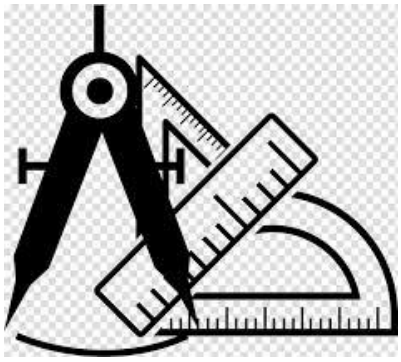
DEPARTMENT OF MECHANICAL ENGINEERING

24ME403 - METROLOGY & MEASUREMENTS

Dr. A. ARUL MARCEL MOSHI,

ASSOCIATE PROFESSOR / MECH.



QUESTION: Illustrate and explain an accurate method of measuring the effective diameter of screw threads.

ANSWER:

EFFECTIVE DIAMETER OF SCREW THREADS:

→ The effective diameter is also called as 'pitch diameter'.

→ The effective diameter is the diameter of an imaginary cylinder that intersects the thread profiles at a point where the internal thread and external thread overlap when screws are meshed together.

→ It is the most critical dimension for determining how well a bolt and nut will fit together.

TWO WIRE METHOD:

* The two wire method is a precise and commonly used technique for measuring the effective diameter of screw threads using cylindrical wires of accurately known diameter.

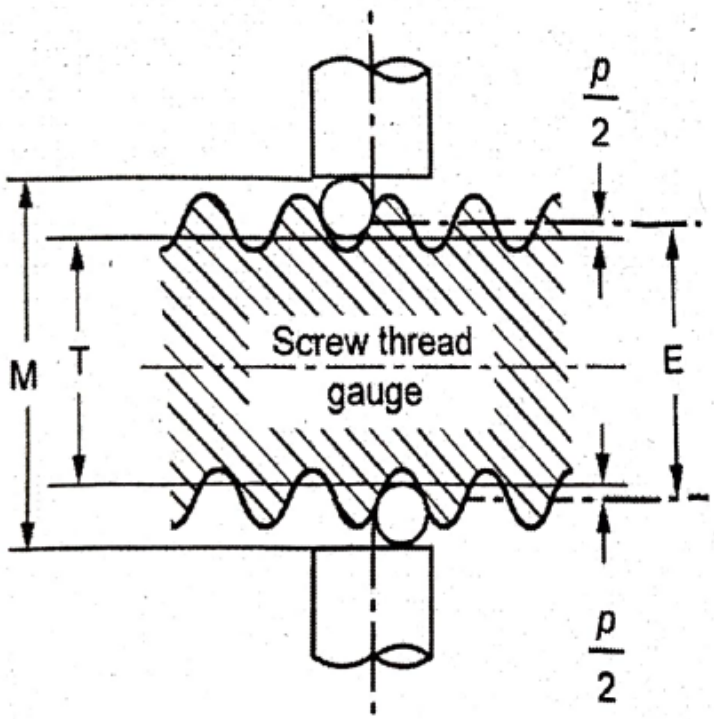
PRINCIPLE OF THE TWO WIRE METHOD:

* The two wire method works on the principle of two precision ground wires of identical diameter in the thread grooves on opposite sides of the screw.

* The wires are positioned such that they contact the thread flanks at the pitch line.

* The distance over the wires is then measured using a micrometer or a universal measuring machine.

* By knowing the wire diameter, the pitch of the thread and the thread angle, the effective diameter can be calculated.



PROCEDURE:

i) Selection of wires: Select two precision wires of identical known diameter.

ii) Setup: Clean the screw thread and the wires thoroughly to remove any dirt or oil. Place the screw thread securely on a stand or between centres.

iii) Placing the wires: Place the two wires in the thread grooves on opposite sides of the screw. Ensure that the wires are seated properly and make contact with the thread flanks.

iv) Measurement: Using an external micrometer, measure the distance over the two wires.

v) Record the pitch (P) of the thread and the thread angle (α).

vi) The effective diameter (E) can be calculated using the formula:

$$E = T + P \cdot \longrightarrow (1)$$

where

T → Dimension under the wires

P → Difference between the effective diameter and the diameter under the wires.

Dimension under the wires, $T = M - 2d$ ⟶ ②

where,

$M \rightarrow$ Dimension over the wires

$d \rightarrow$ Diameter of each wire

Difference between the effective diameter and the diameter under the wires, $P = 0.866p - d$ (for metric threads) ⟶ ③

Substituting equations ② & ③ in equation ①,

$$E = M - 2d - 0.866p - d$$

$$\Rightarrow E = M - 3d - 0.866p \quad \longrightarrow ④$$

[For metric threads, thread angle, $\theta = 60°$]

ADVANTAGES OF TWO WIRE METHOD:

- → High accuracy
- → Simple principle
- → Cost-effective
- → Versatile

LIMITATIONS OF TWO WIRE METHOD:

- → Time-consuming
- → Skill required
- → Wire selection