ROHINI

COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

24ME403 - METROLOGY & MEASUREMENTS

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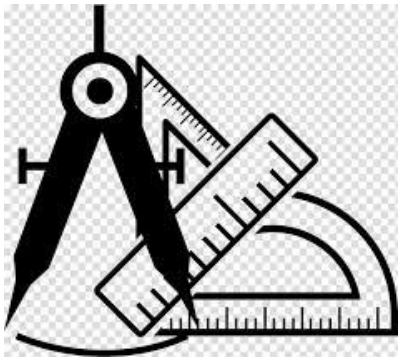


QUESTION: Explain the procedure for finding the chordal thickness of a gear using a gear tooth vernier caliper.

ANSWER:

CHORDAL THICKNESS:

Chordal thickness is the straight line distance measured across a gear tooth at the pitch circle, rather than along the arc.

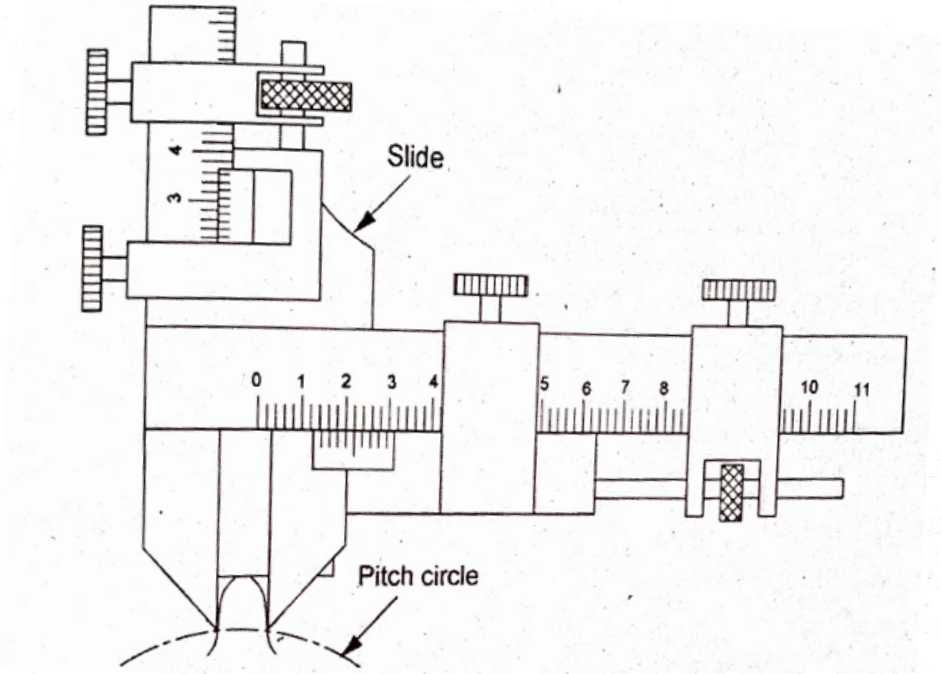
GEAR TOOTH VERNIER CALIPER:

A gear tooth vernier caliper is a specialized instrument used to measure the chordal thickness of a gear tooth. It is essentially a vernier caliper with two perpendicular scales: a vertical scale to set the chordal height (addendum) and a horizontal scale to measure the chordal thickness at that height.

This measurement ensures the gear tooth dimensions are within specified tolerances for proper meshing and power transmission.

PRINCIPLE:

The gear tooth vernier works on the principle of measuring the thickness of the tooth along the chord at the pitch circle diameter (PCD). Since the tooth profile is curved (involute), the thickness is measured as a chord length rather than an arc length for practical convenience.



PROCEDURE FOR MEASUREMENT:

The measurement is carried out in the following systematic steps:

Step 1: Calculate the theoretical values:

Before using the instrument, two theoretical values must be calculated using

gear parameters:

* chordal Addendum (h_c): The vertical height from the tooth tip to the chord at the pitch circle.

Formula: $h_c = m\left[1 + \frac{z}{2}\left(1 - \cos\left(\frac{90}{z}\right)\right)\right]$.

where, m → module,

z → Number of teeth.

* chordal thickness (T_c):

Formula: $T_c = zm \sin\left(\frac{90}{z}\right)$.

Step 2: Set the vertical height:

The vertical beam of the gear tooth vernier is set precisely to the calculated chordal Addendum (h_c) value using its fine adjustment screw.

This vertical setting is then locked to maintain the position.

Step 3: Position the caliper on the gear tooth:

The anvils of the caliper are placed over the gear tooth to be measured.

The instrument is positioned such that the vertical scale's reference edge rests firmly

on the top of the tooth, and the horizontal jaws contact the two sides of the tooth.

Step 4: Measure the chordal thickness

While keeping the vertical edge in contact with the tooth tip, the horizontal jaws are gently closed until they just make contact with the tooth flanks.

The reading on the horizontal vernier scale is then noted. This is the actual chordal thickness (Tc) of the gear tooth.

Step 5: Repeat and Record

The measurement is repeated on several teeth spaced around the gear circumference to checks for uniform thickness.

The measured values are compared against the calculated theoretical value to determine the deviation.

PRECAUTIONS:

Ensure the anvils of the caliper are perfectly square and clean before use.

Perform measurements at a controlled temperature to avoid thermal expansion errors.

The contact pressure should be just enough to touch the flanks; excessive force can lead to errors and damage the instrument.

The caliper must be held perfectly perpendicular to the tooth flanks to avoid angular misalignment errors.