ROHINI

COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

24ME403 - METROLOGY & MEASUREMENTS

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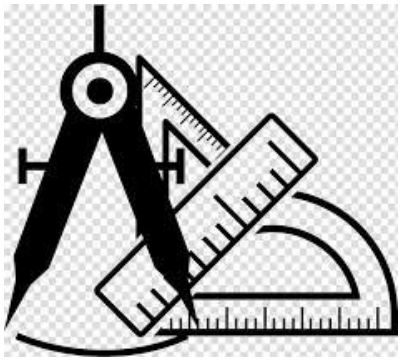


QUESTION: Enlist and explain the different methods used for measuring the roundness.

ANSWER:

ROUNDNESS (DEVIATION) MEASUREMENT METHODS:

i) Diametral method
ii) circumferential conferencing gauge
iii) Rotating between centers
iv) Measurement using V-Blocks
v) Measurement by plotting polar graph
vi) Three-point probe method
vii) Accurate spindle method
viii) Modern roundness measuring instruments.

i) DIAMETRAL METHOD:

In this method, the diameter of the cylindrical part is measured at several positions around its circumference using a micrometer or dial gauge.

The difference between the maximum and minimum readings indicates the out-of-roundness.

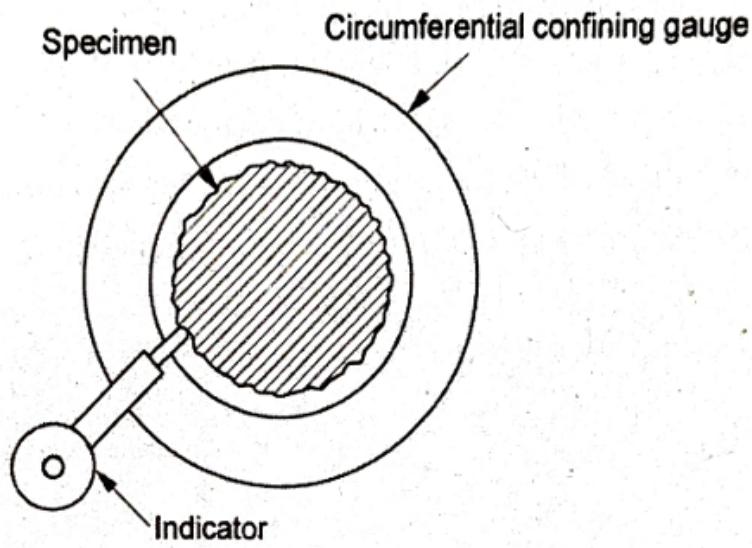
This method is simple but inaccurate, as it cannot detect odd-numbered lobing (Example: triangular shape) where the diameter remains constant.

ii) CIRCUMFERENTIAL CONFERRING GAUGE:

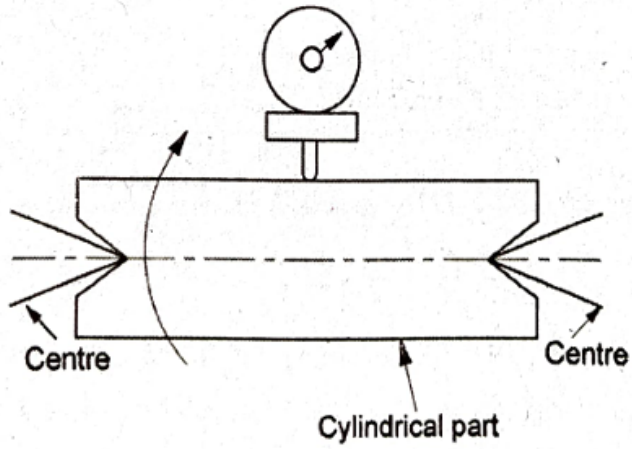
This method uses a precision ring gauge or setting standard to compare the circumference of the workpiece.

The part is rotated inside the gauge, and any deviation is sensed by a feeler or dial indicator.

It provides quick Go/No-Go assessment but does not give detailed lobe pattern information.



iii) ROTATING BETWEEN CENTERS:

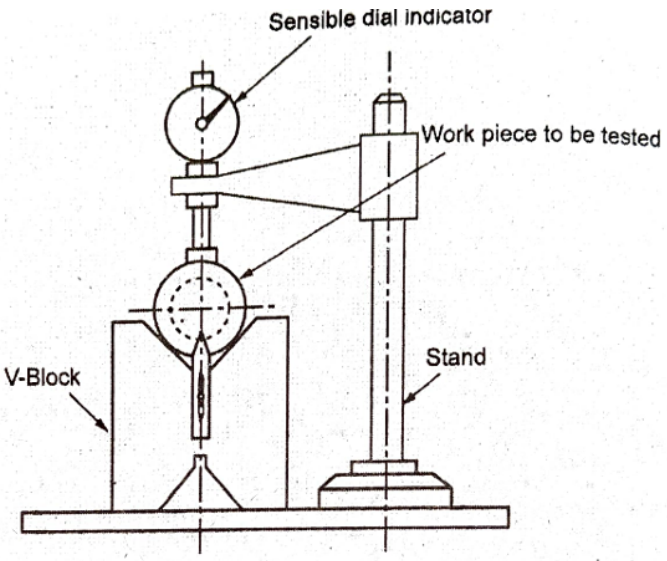


The workpiece is mounted between precision centers and rotated slowly.

A dial indicator touches the surface and measures radial variations as the part rotates.

This method is affected by any eccentricity of the centers and errors in the center holes of the workpiece.

iv) MEASUREMENT USING V-BLOCKS:

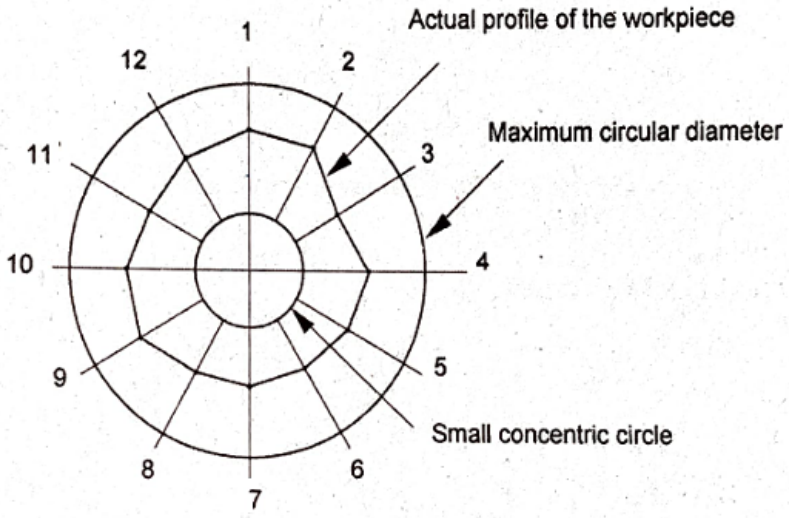


The workpiece is placed in a V-Blocks of known included angle (typically 60°, 90°, or 120°) and rotated.

A dial indicator contacts the top surface and measures radial deviations.

The V-Blocks method amplifies lobing errors but can not distinguish between all types of lobing patterns.

v) MEASUREMENT BY PLOTTING POLAR GRAPH:

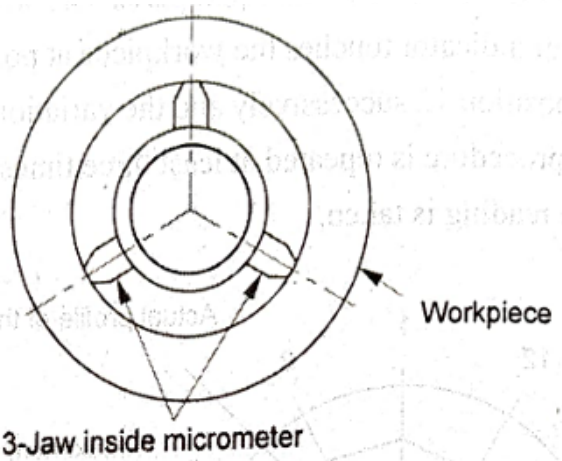


The workpiece is rotated on a precision spindle while a stylus traces its surface.

The radial movements are amplified and recorded on a polar graph (circular chart), producing a closed-loop trace of the actual profile.

The roundness error is the radial distance between two concentric circles that enclose the traced profile.

vi) THREE-POINT PROBE METHOD:

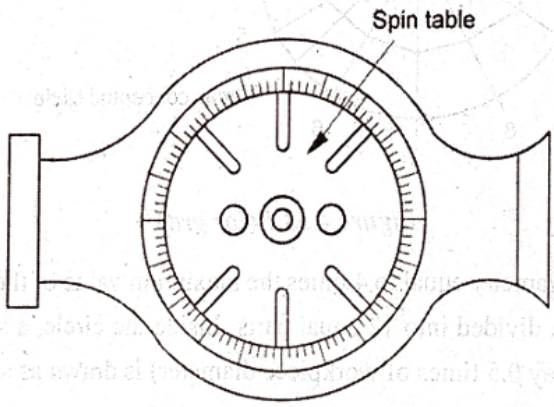


Three fixed probes (or one probe with two supports) contact the workpiece at specific angular positions (typically spaced at 60° or 120°).

As the part rotates, the probe measures radial variations relative to the support points.

This method can detect both even and odd numbered lobing by selecting appropriate support angles.

vii) ACCURATE SPINDLE METHOD:



The workpiece is mounted on a highly precise rotating spindle with minimal runout (within 0.05 μm).

A stationary LVDT or capacitance probe contacts the surface and measures deviations as the spindle rotates.

This method provides extremely accurate roundness measurement by eliminating external errors.

viii) MODERN ROUNDNESS MEASURING INSTRUMENTS:

These are computer-controlled instruments with ultra-precision air-bearing spindles and motorized centering stages.

They automatically scan the surface, compensate for tilt and eccentricity, and display roundness profiles with numerical parameters (such as least square circle, minimum zone circle).

Advanced software analyzes lobing, harmonics, and provides statistical quality control data.