Workshop Technology
[Measuring and Gauging]

WORKSHOP TECHNOLOGY

Introduction


Tapes & Rules


Measuring Wheels


Squares & Bevels


Measuring Gauges


Dial Indicators & Stands


Counters


Micrometers


Verniers


Calipers, Dividers & Compasses


Scribers


Specialised Marking Tools


Chalks, Crayons & Pencils


Chalklines & Refills


Marking Gauges


Stencils


Levels


Surveyors Tools

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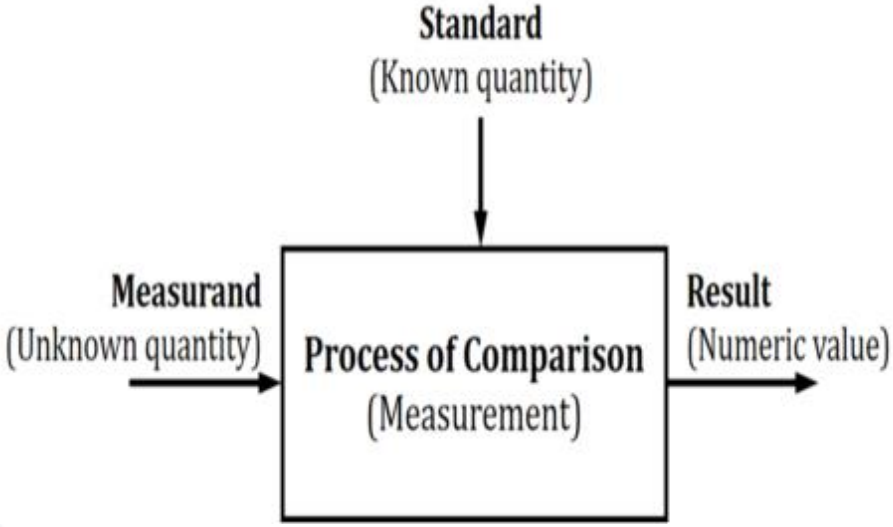
Introduction

Measurement is the assignment of a number to a characteristics of an object or event, which can be compared with other objects of events.

OR

Measurement of a quantity is the act or the result of a quantitative comparison between a predefined standard and an unknown magnitude.

Gauging is checking that a component fits within tolerance limits.



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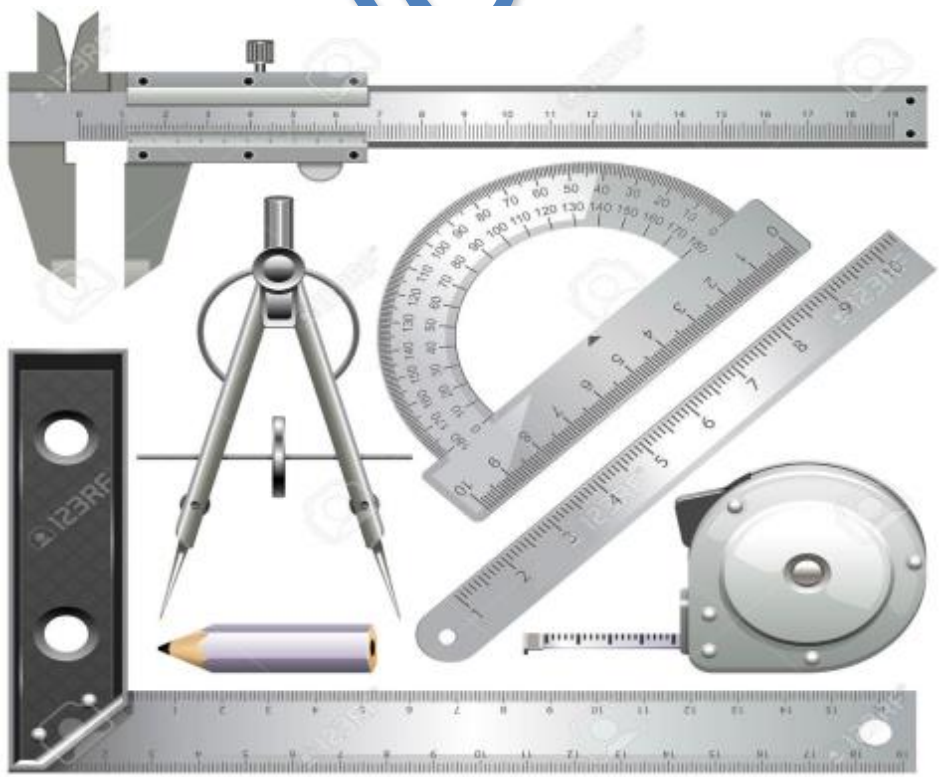
Classification

Semi-precision Tools

Semi-Precision measuring devices are for measurements of accuracy up to 1/64”, .5mm, or 1 degree.
Rules/scales, adjustable squares, protractors, calipers, feeler gauge, etc.

Precision Tools

Precision measuring devices are for measurements of accuracy around .001”-.0001”, .01mm-.002mm, or 1/10 of a degree.
Micrometers, vernier calipers, dial indicator, Surface plates, etc.



Classification

Line measurement

When length is measured as the distance between centers of two engraved lines.
Rules/scales, adjustable squares, protractors, calipers, feeler gauge, etc.

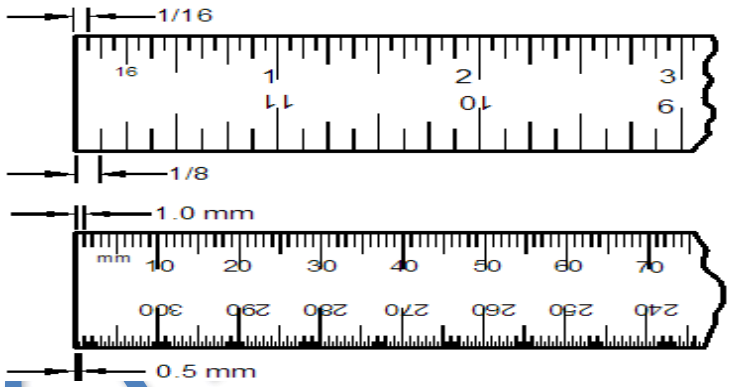


Figure: Line measurement

End measurement

When length is measured as the distance between two flat parallel faces
Micrometers, vernier calipers, slip gauge, etc.

Figure: End measurement

Classification

Direct measurement

In which the measured value is determined directly.

Example: micrometer, vernier caliper.

Indirect measurement

In which the dimension is determined by measuring other values functionally related to the required value.

Example: dividers, calipers.

Semi-precision Tools

Rules

It is used to measure length of an object or distance between two points.
It is made up of different materials like wood, plastic, steel, etc. and in a wide range of size.

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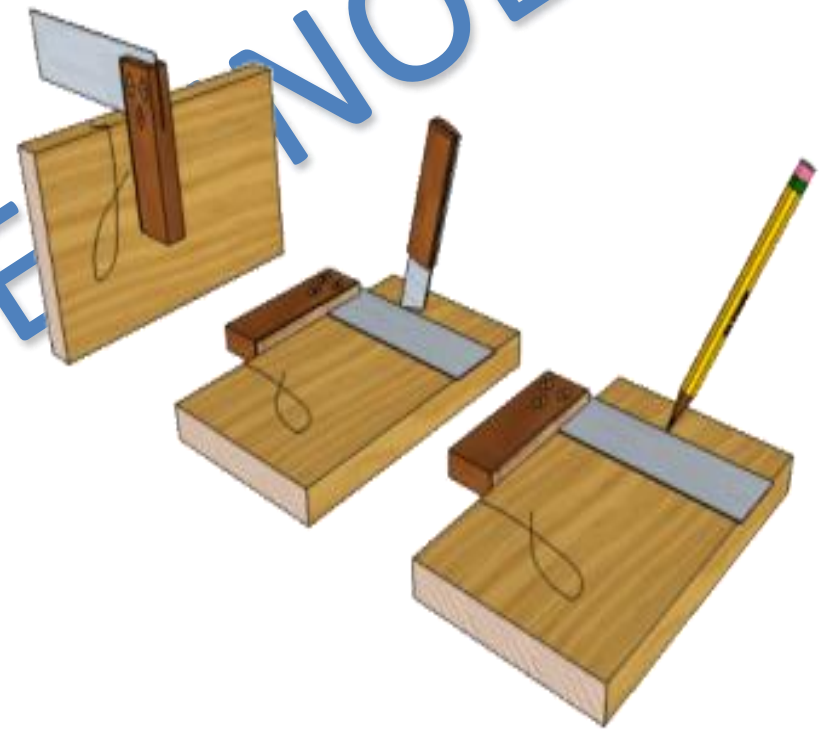
Semi-precision Tools

Try square

It is used to mark lines at 90 degrees to a straight edge.
It is used to mark out lines square to face edge and face side.
It may also be used to check if edges are straight. If the try square is placed on the edge of the material and held up to a light, any light shining through between the material and try square blade indicates that edge of the material is not straight.



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Semi-precision Tools

Outside Caliper

A caliper is a device used to measure the distance between two opposite sides of an object. The tips of the caliper are adjusted to fit across the points to be measured, the caliper is then removed and the distance read by measuring between the tips with a measuring tool, such as ruler.
Outside calipers are used to measure the external size of an object.

Semi-precision Tools

Outside Caliper

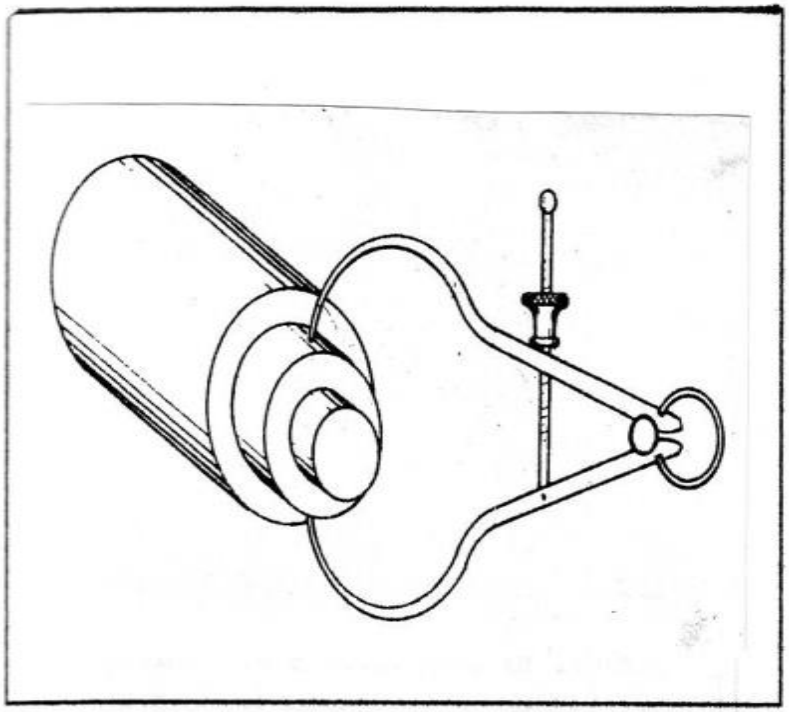


Figure: Setting outside calipers to the size of the work

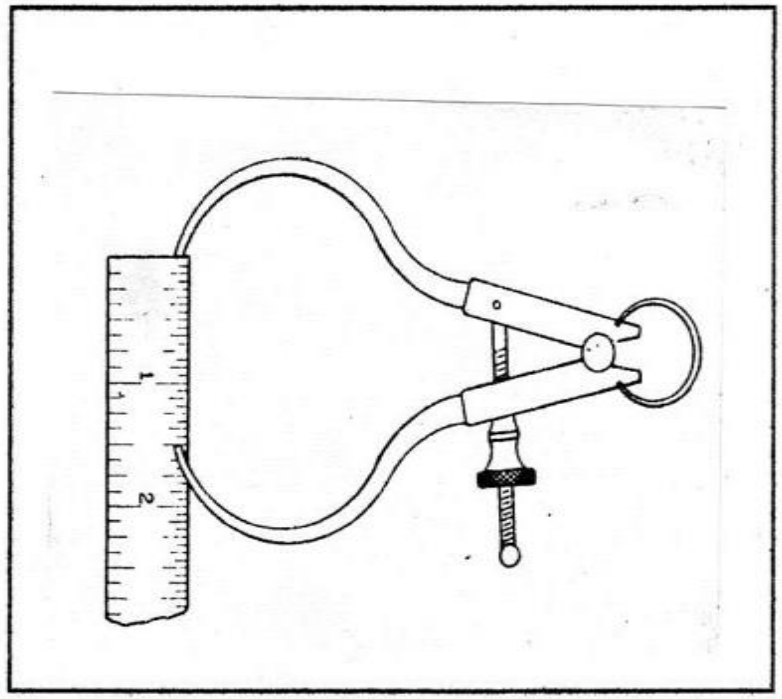
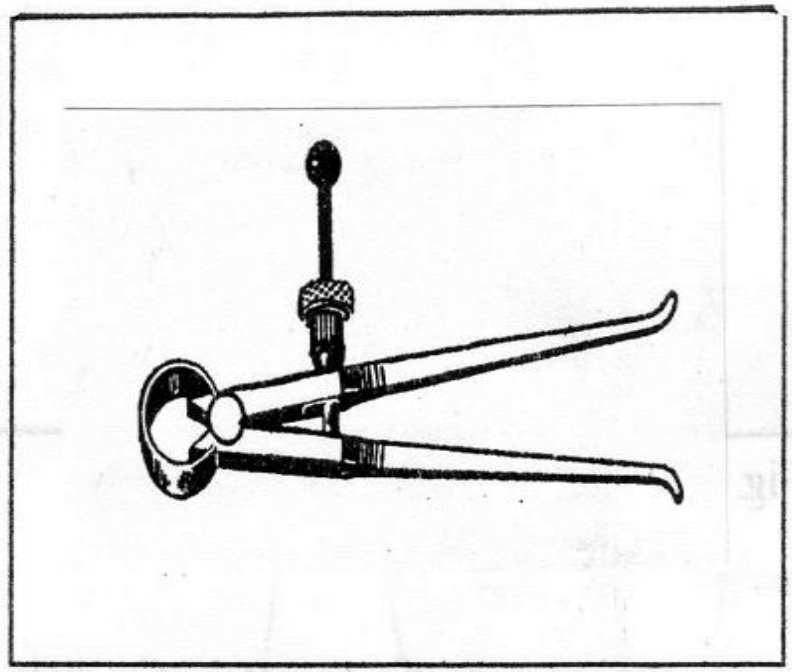


Figure: Measuring the size of caliper opening with a rule

Semi-precision Tools

Inside Caliper

Inside calipers are used to measure the external size of an object. Inside calipers are also used like outside calipers.



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Semi-precision Tools

Inside Caliper

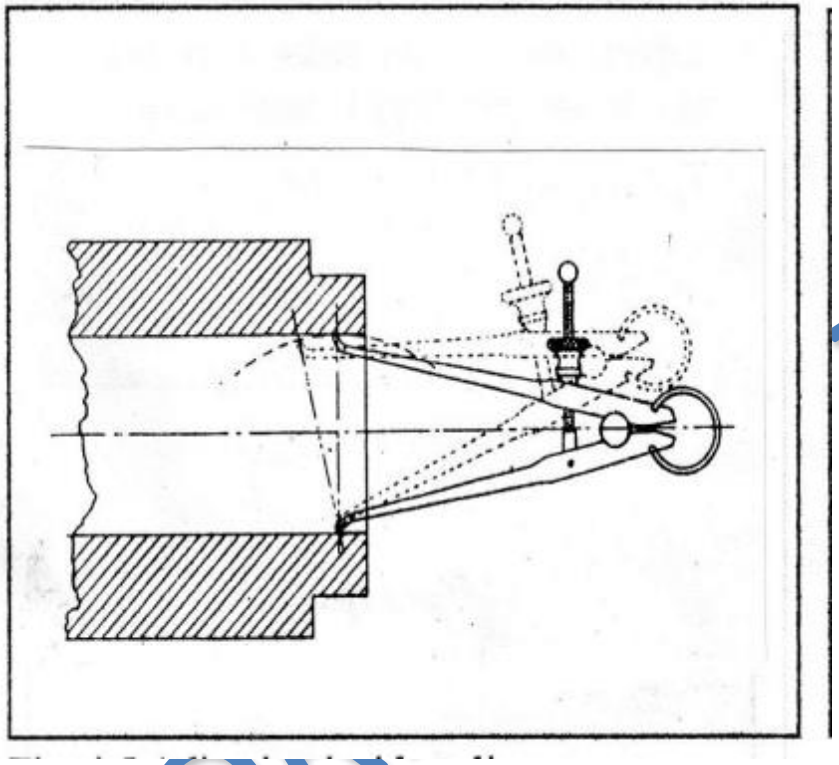


Figure: Adjusting inside caliper to the size of a hole

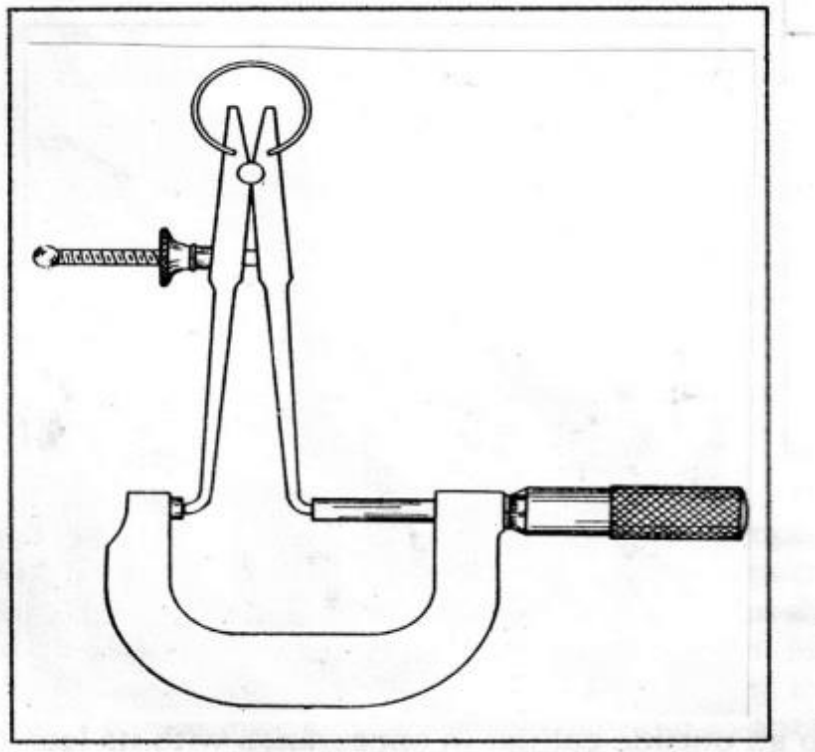
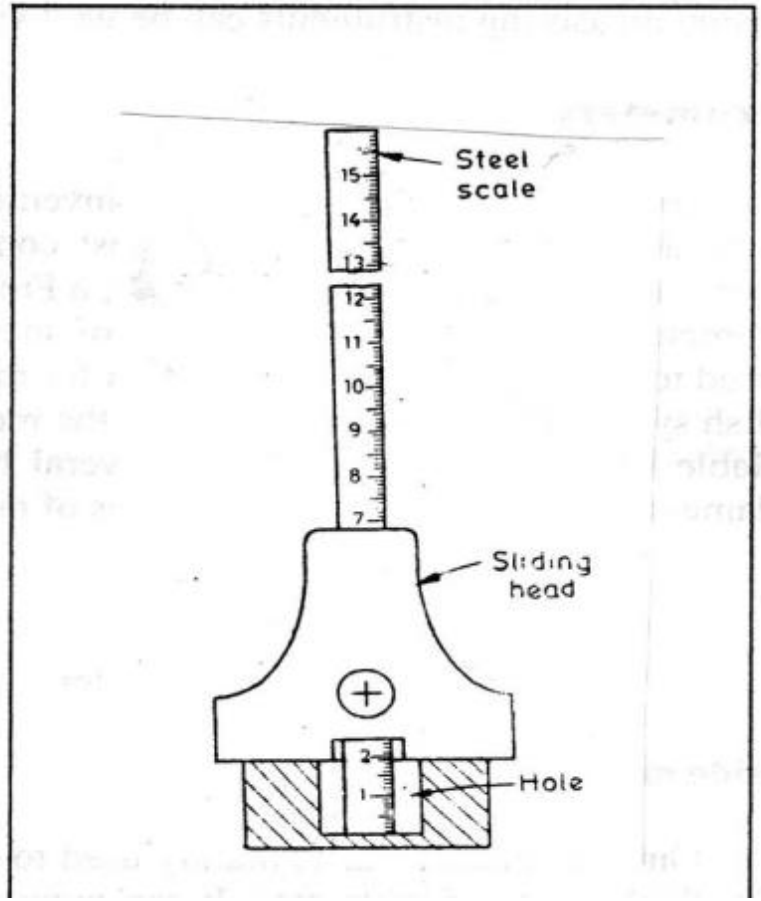


Figure: Measuring the setting of inside caliper with a micrometer

Semi-precision Tools

Depth Gauge

It is measurement instrument used by mechanical engineers, manufacturing engineers, and machinists among others, to obtain the measurement of the depth of a bored cavity, recess, hole, groove or other similar openings that were created below the surface level of a material.



Semi-precision Tools

Feeler Gauge

Feeler gauge is a tool used to measure gap width.
Feeler gauges are mostly used in engineering to measure the clearance between two parts.

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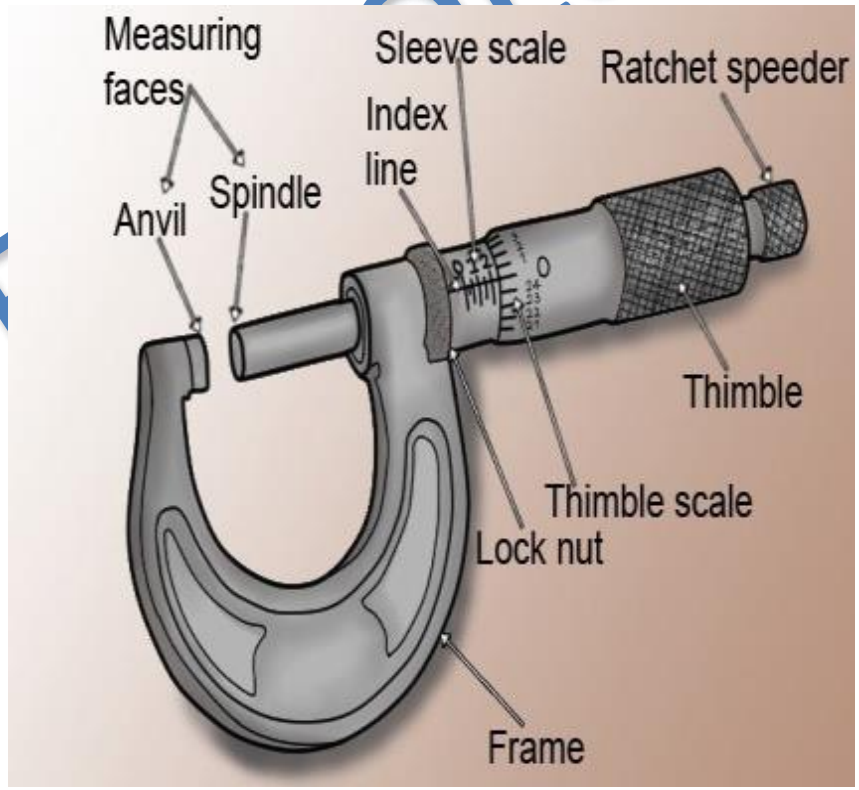
Precision Tools

Micrometers

A **micrometer** is a measurement instrument that can make extraordinarily precise measurements. Most micrometers are designed to measure within one one-thousandth of an inch.
Exact measurements like this are necessary when even the smallest of space between objects can cause problems or difficulties.



Precision Tools

Outside micrometer

It is used to measure the thickness and outside diameter of small parts.

Inside micrometer

It is used to measure inside diameter.

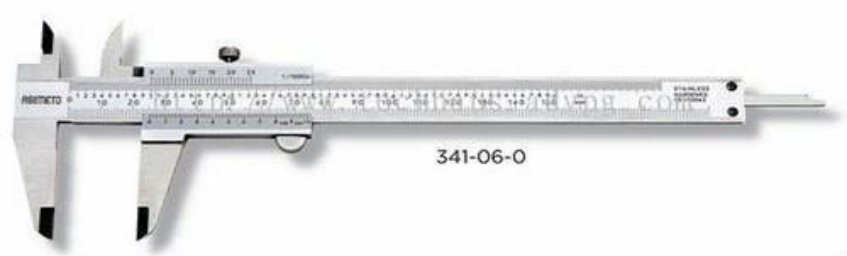
Depth micrometer

It is used to measure depth of hole, recess or slot.

Precision Tools

Vernier Caliper

A **vernier caliper** gives a direct reading of the distance measured with high accuracy and precision. It comprises of a calibrated scale with a fixed jaw, and another jaw, with vernier scale, that slides along the scale.



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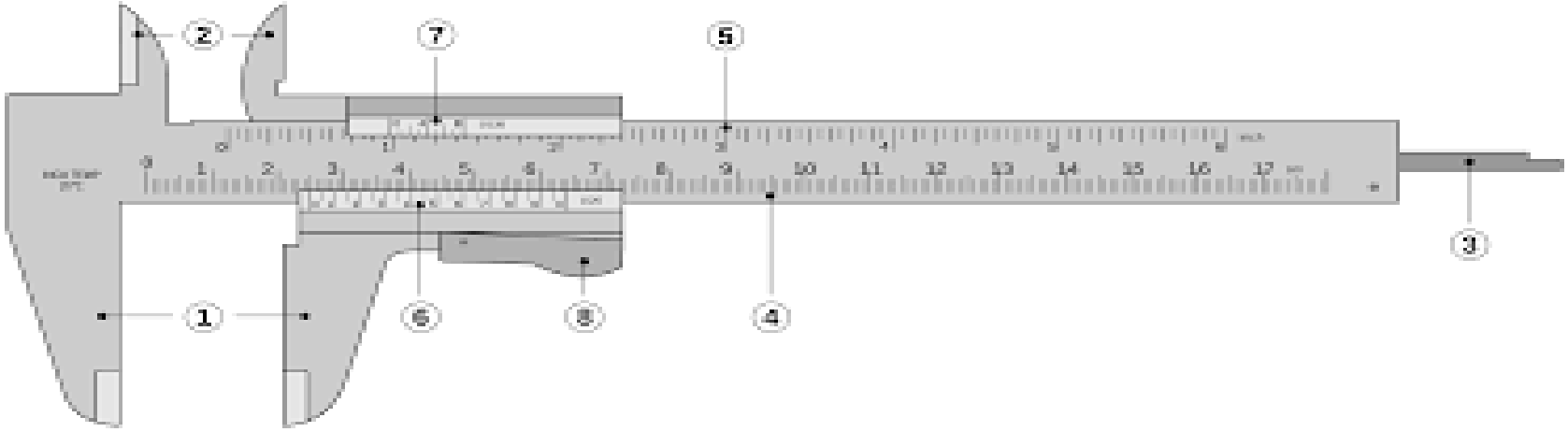
Precision Tools

Parts of vernier caliper



1. **Outside jaws:** Used to measure external diameter or width
2. **Inside jaws:** Used to measure internal diameter
3. **Depth probe:** Used to measure depth of an object or a hole
4. **Main scale:** Scale marked in mm
5. **Main scale:** Scale marked in inches
6. **Vernier scale:** Gives interpolation measurements to 0.1mm or better
7. **Vernier scale:** Gives interpolation measurements to fractions of an inch
8. **Retainer:** Used to block movable parts to allow the easy transferring of a measurement

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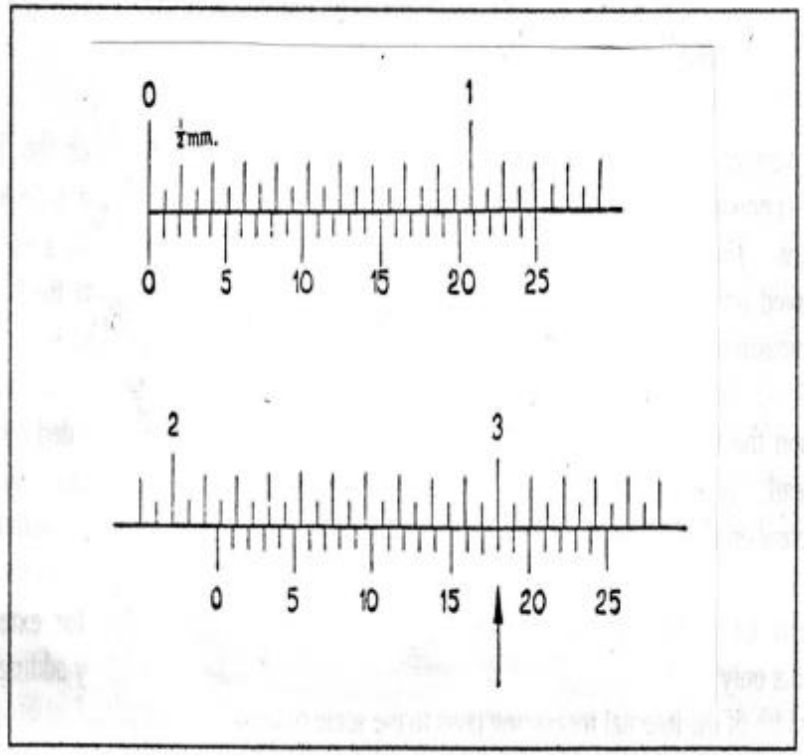
Precision Tools

Vernier Reading

Least Count (LC) = Smallest reading on main scale / No. of division on vernier scale

Final reading = Main scale reading + LC x vernier scale reading



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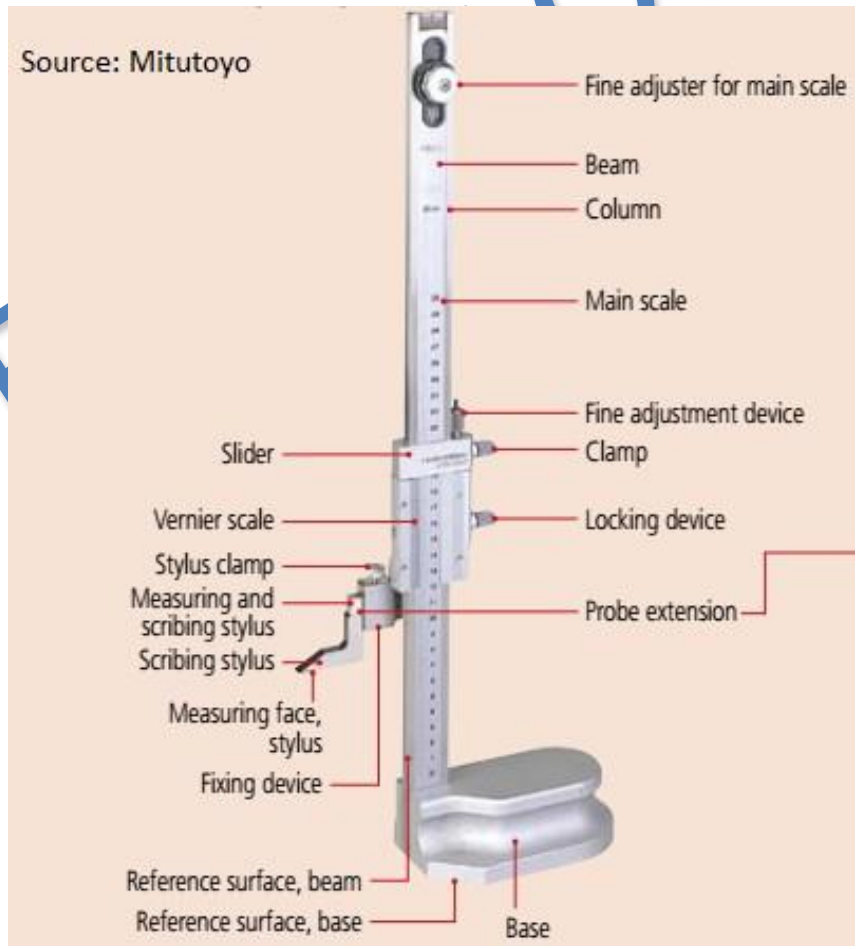
Precision Tools

Vernier height gauge

It is used to measure height.
It employs the use of a main scale and a vernier scale to provide for greater resolution of measured value.



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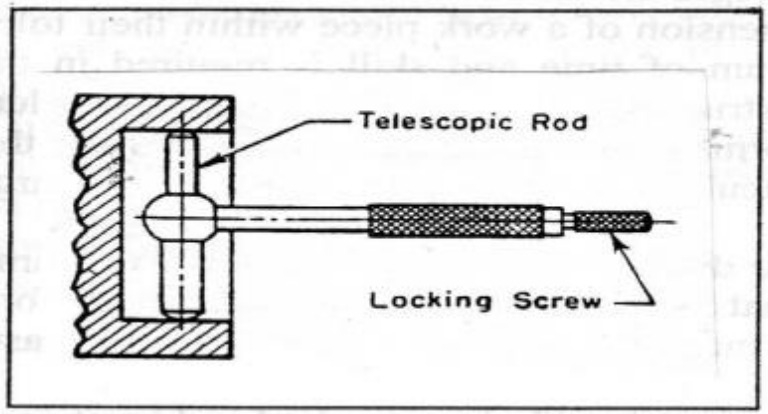
Precision Tools

Telescope gauge

A **telescoping gauge** is a measuring tool with spring-loaded plunges used together with a micrometer to measure the inside of holes or bores.
Telescope gauges are made insets to measure from small to very large bores.
It has a handle that is attached to two spring-loaded plungers.



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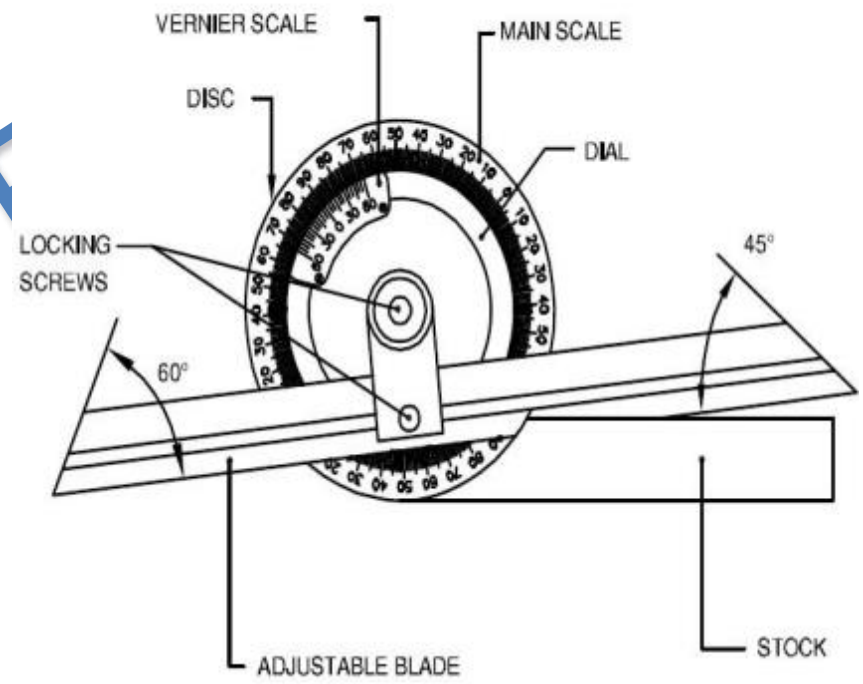
Bevel protractor

A **bevel protractor** is an angular measuring instrument capable of measuring angles with a least count of 5′.

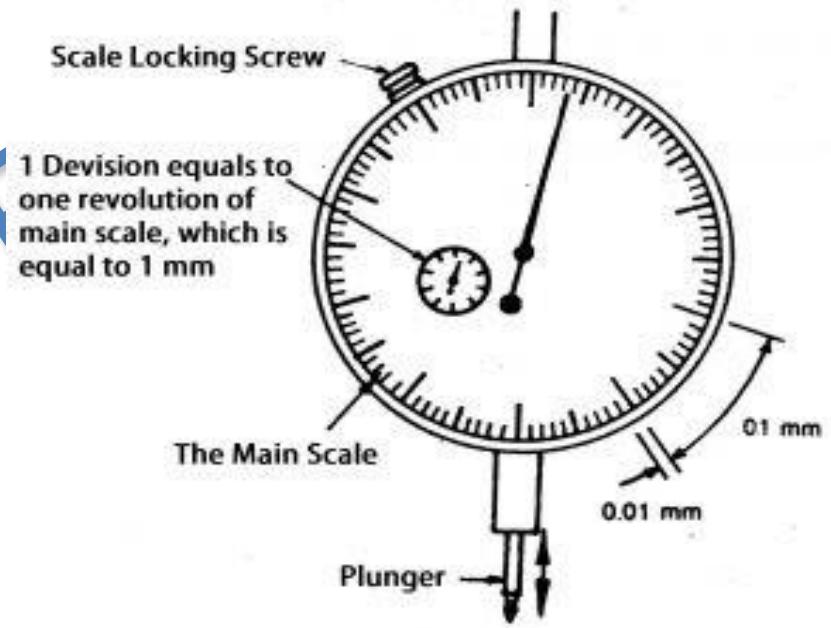
The protractor dial is graduated in degrees with every tenth degree numbered. The sliding blade is fitted into this dial.

This protractor dial may be locked in any position by means of the spacing in the vernier scale is made in such a way that the least count of it corresponds to 1/12th of a degree, which is equal to 5′.



Dial indicators

Dial indicators are one of the primary measuring tools used in precision engine building.
They are typically used to measure deck clearances, crankshaft thrust and straightness, lifter travel and other measurements that involve the distance between two surfaces or small amounts of component travel.



Precision Tools

Gauge block

Gauge blocks are a system of producing precision length.
They can serve as a simple go/nogo gauge, or be used to calibrate other equipment, such as micrometers, calipers, or dial indicator.

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Precision Tools

Surface plate

A **surface plate** is a solid, flat plate used as the main horizontal reference plane for precision inspection, marking out (layout), and tooling setup.

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THANK YOU!

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