METROLOGY

METROLOGY IS SCIENCE OF MEASUREMENTS.

CONCERNED WITH---

-- ESTABLISHING UNITS OF MEASUREMENT

-- TO FORM STANDARDS

-- DEVELOPING METHODS OF MEASUREMENT

-- ANALYSING ACCURACY OF METHODS OF Mn.

-- FIND CAUSES OF MEASURING ERRORS & ELIMINATE.

OBJECTIVES OF METROLOGY

- To evaluate newly developed products
- To determine process capabilities
- T o determine measuring instrument capabilities
- To minimise cost of inspection
- To standardise measuring methods
- To maintain accuracy of measurement by perioical calibration of measuring instruiments

STANDARDS OF MEASUREMENT:-

The two standards of Measurement are –

- English system- yard
- Metric system- metre

The various standards known for linear measurement are –

- LINE STANDARD
- END STANDARD
- WAVELENGTH STANDARD

LINE STANDARD

When length is expressed as a distance between two parallel lines engraved across the standard it is called a line standard e.g.Ruler with its division.

END STANDARD

In this length is expressed as a distance between two flat parallel surfaces e.g. slip gauges,end of micrometer anvil etc.

WAVELENGTH STANDARD

In this,wavelength of pure monochromatic light is used to express length.Wavelength of red radiation of cadmium is used.This is not influenced by variation of environmental conditions like temp,pressure humidity,ageing etc.

REPEATABILITY

- It is the ability of the measuring instrument to give the same value every time the measurement of a given qty is repeated.
- Variations in readings : due to environmental changes,operator performance & instrument parameters.
- Characterized by dispersion of indications when same qty is repeatedly measured
- Dispersion is described by the two limiting values or by std deviation.

BIAS :

- These errors are due to mal-adjustment of instrument,permanent set,non-linear errors,errors of material measures etc.Summation of all systematic errors

INACCURACY:

- Total error of a measuring instrument including bias and repeatability errors.
- If known systemic errors are corrected,remaining errors are due to randon errors.This inaccuracy is called “uncertainty of measurement”

PRECISION AND ACCURACY

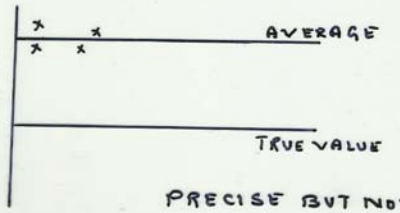
PRECISION--- Defined as Repeatibility of a measuring process.

ACCURACY– Defined as Agreement of the result of a measurement with the true value of the measured quantity.

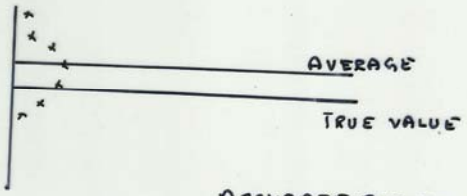
Mostly,precision is of greater importance

Accuracy= $\sqrt{(\text{repeatibility})^2+(\text{error})^2}$

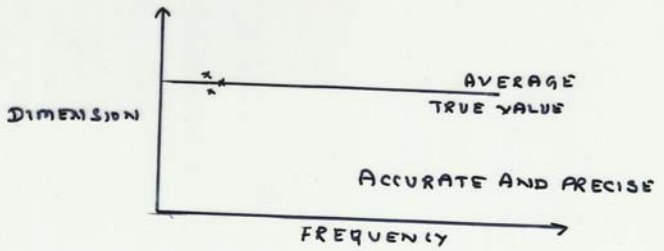
PRECISION & ACCURACY



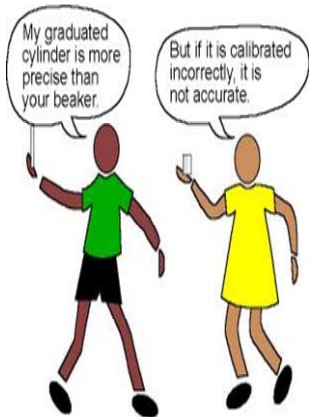
PRECISE BUT NOT ACCURATE



ACCURATE BUT NOT PRECISE



ACCURATE AND PRECISE


My graduated cylinder is more precise than your beaker.
But if it is calibrated incorrectly, it is not accurate.

PROCESS CAPABILITY :

- It is the minimum tolerance to which machine can be expected to work and produce no defectives under the specified conditions
- It is the minimum variation that has to be tolerated on any process under the existing situation

Two significant factors are-

- Process factors – process made up of no. of factors e.g.raw materials,macine,operator’s skill,measuring devices etc
- Process conditions – Measurements should be normally disributed and in a state of control

STANDARDISATION AND INTERCHAGEABILITY copy

Component selected randomly should assemble correctly with any other mating component.This is interchangeability.

Possible when certain standards are strictly followed---international standards 2/3

Reqd fit in an assy can be obtained by:

- Universal or full interchangeability
- Selective assembly

Full interchageability :-

Any component will match with any other mating part without classifying manufactured components into subgroups or carrying out minor alterations.

Selective assembly:

In this parts are graded according to size and only matched grades of mating parts are assembled e.g.

Mating of piston in car cylinder – The bore size is 63.5mm and the skirt clearance of piston is 0.13mm on the diameter,The tolerance on bore and on piston skirt each is 0.04mm.

HL of bore – 63.5+0.02 = 63.52mm

LL of bore - 63.5-0.02 = 63.48mm

Piston bore is 63.5- 0.13 = 63.37 mm

HL of piston – 63.37+0.02=63.39

LL of piston - 63.37 – 0.02=63.35

Max clearance = HL of bore – LL of piston = 63.52-63.35=0.17mm

Min clearance= LL of bore- HL of piston = 63.48-63.39=0.09mm

By grading bore and piston,selective assy will give :

Cyl bore	63.48	63.5	63.52
Piston	63.35	63.37	63.39

Assignment -- 1

Explain in detail the following :-

(a) Precision & accuracy

(b) interchangeability & standardisation