

WITH GRADUATIONS MARKS ON THE EDGES FOR MEASUREMENT AND TO SET OUT  $90^{\circ}$  ON WORK PIECE.

- v. UNIVERSAL BEVEL MADE OF STEEL. USED TO MEASURE OUT ANGLES ON JOB. OTHER TOOLS IN THIS CATEGORY ARE THE COMBINATION SET, PROTRACTOR, ADJUSTABLE BEVEL
- vi. CALIPERS ARE NON-PRECISION LINEAR MEASURING TOOLS FOR TRANSFERING OR COMPARING DIMENSION FROM ONE OBJECT TO ANOTHER USING THE STEEL RULE OR THE VERNIER CALIPERS.
  - a. OUTSIDE CALIPERS FOR CHECKING OR MEASURING OUTSIDE DIMENSIONS OR PLATE THICKNESS.
  - b. INSIDE CALIPERS FOR CHECKING OR MEASURING INTERNAL DIMENSIONS OF HOLE DIAMETERS.
  - c. HERMAPHRODITE OR ODD LEG CALIPERS USED TO SET OUT PARALLEL LINES TO THE EDGE OF WORK AND FOR LOCATING CENTRE POINTS OF CYLINDRICAL WORK.

d. OTHER CALIPERS ARE INSIDE AND OUTSIDE SPRING CALIPERS AND INSIDE AND OUTSIDE TRANSFER CALIPERS.

vii. PRECISION MEASURING TOOL

a. MICROMETERS: THESE ARE PRECISION MEASURING TOOLS ARE OF VARIOUS TYPES:

- OUTSIDE MICROMETERS
- INSIDE MICROMETERS
- SCREW THREAD MICROMETERS
- DEPTH GAUGE MICROMETERS

THE OUTSIDE MICROMETER CAN MEASURE DIMENSION OF 2.54 MICROMETERS (0.0001 IN). THE ACCURACY OF A MICROMETER IS BASED ON THE TURNING OF A FINE SCREW THREAD KNOWN AS THE RATCHET. TO USE A MICROMETER, THE OBJECT TO BE

MEASURED IS PLACED AT THE OPENING BETWEEN THE ANVIL AND SPINDLE OF THE MICROMETER FRAME. WHILE THE THIMBLE, IS ROTATED UNTIL THE OBJECT IS HELD IN PLACE. THE READINGS IS TAKEN ON THE THIMBLE AND BARREL SCALES TO DETERMINE THE PRECISE MEASUREMENT.

b. VERNIER CALIPER USED TO MEASURE THE INSIDE AND OUTSIDE DIAMETER OF SHAFTS, THICKNESS OF PARTS, DEPTH OF HOLES AND SLOTS. IT IS USED FOR LONGER DIMENSION WHERE YOU CANNOT USE A MICROMETER SCREW GAUGE. THE ACCURACY FOR VERNIER CALIPER IS 0.002mm.

c. OTHER GAUGES USED IN THE WORKSHOP ARE:

- DEPTH GAUGE
- TELESCOPIC GAUGE
- SCREW THREAD MICROMETER
- DEPTH GAUGE MICROMETER
- VERNIER HEIGHT GAUGE

- VERNIER DEPTH GAUGE

- VERNIER GEAR-TOOTH CALIPER

d. SPECILIASED MEASURING TOOLS (GAUGES)

GAUGES ARE FIXED-DIMENSION INSTRUMENT USED TO CROSS CHECK PARTICULAR DIMENSION IN WORK PIECE FOR SPECIFIED TOLERANCE. IT REQUIRES MINIMUM TIME AND SKILL WHEN USED (GUPTA 1981). GAUGES DO NOT HAVE GRADUATIONS AND CANNOT BE ADJUSTED THEY ARE MADE TO CARRYOUT SPECIFIC MEASUREMENT FOR A SOME PARTICULAR JOB WHICH IS TO BE PRODUCED IN LARGE QUANTITIES.

GAUGES CAN BE CLASSIFIED :

-ACCORDING TO TYPES(E.G. STANDARD AND LIMIT GAUGES) (GUPTA 1981)

- ACCORDING TO THEIR PURPOSE AND

- ACCORDING TO THE FORM OF THE TESTED SURFACE. TYPES(E.G. SNAP , RING AND

THREAD GAUGES) (GUPTA 1981)

- i. THREAD GAUGE: ARE USED TO CHECK THE PITCH DIAMETER OF SCREW THREADS.
- ii. SNAP GAUGE: USE TO CHECK EXTERNAL DIMENSIONS.
- iii. RING GAUGE: FOR CHECKING DIAMETERS OF SHAFTS OR STUDS
- iv. PLUG GAUGE: TO TEST ACCURACY OF HOLES
- v. SLIP GAUGE: ALSO KNOWN AS PRECISION GAUGE BLOCK. ARE USED TO CROSS CHECK THE ACCURACY OF MEASURING INSTRUMENT SUCH AS MICROMETERS, CALIPERS, SNAP GAUGES , DIAL INDICATORS ETC
- vi. FEELER GAUGE TO CHECK AND SET CLEARANCE BETWEEN TWO SURFACES. MADE OF MANY THIN STEEL SHEET ( LEAVES) . EACH LEAF IS MARKED WITH ITS THICKNESS WHICH VARY FROM 0.05mm TO 1mm.
- vii. SCREW PITCH GAUGE TO CHECK THE PITCH OF SREWS IT IS SIMILAR TO A FEELER GAUGE EXCEPT THE LEAVES ARE NOTCHED AT ONE EDGE ACCORDING TO THE VARIOUS PITCHES OF SPECIFIC THREADS.