MACHINE TOOLS $\Longrightarrow$ **MACHINE + TOOLS**

MACHINE A machine is a combination of **mechanisms** intended for transference, transformation or utilization of energy. e. g. Printing press.

MECHANISM A mechanism is used to transfer or transform motion from one **element** into another.

TOOLS It is the part in contact with the job for doing different operation or generation of surfaces.

It may be classified according to the power supplied to it as –

a) Hand tools and
b) b) Machine tools.

Hand tools Hand tools are tools which are held and used by the hand for shaping and sizing the work. There is no mechanism in them. The quality and accuracy of the job depends on the performance of the operator. For example – Files, Saw, Chisel etc. are the hand tools

Machine tools Machine tool is a device provided with mechanisms which enable a cutting tool up on a piece of material to produce the desire shape and size by ***cutting away material in the form of chips***.

Lathe, Drilling machine, Boring machine etc. are the example of machine tools.

DESIRED PROPERTIES OF A GOOD CUTTING TOOL MATERIAL

I. ***HOT HARDNESS***

II. ***WERE RESISTANCE***

III. ***TOUGHNESS***

IV. ***FRICTIONAL COEFFICIENT***

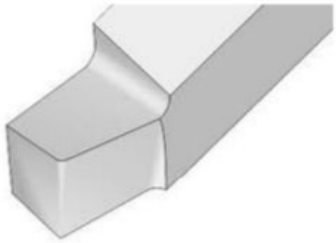
V. ***THERMAL CONDUCTIVITY***

DIFFERENT CUTTING TOOL MATERIALS –

- ✓ High carbon steel
- ✓ High speed steel (H.S.S.)
- ✓ Stellites or Non-ferrous cast alloy
- ✓ Cemented Carbide
- ✓ Ceramics
- ✓ Diamond

CLASSIFICATION OF CUTTING TOOL

A cutting tool may be used either for cutting apart, as with a knife, or for removing chip. Cutting tools are divided into two groups, namely a) Single point cutting tool and b) Multi point cutting tool.

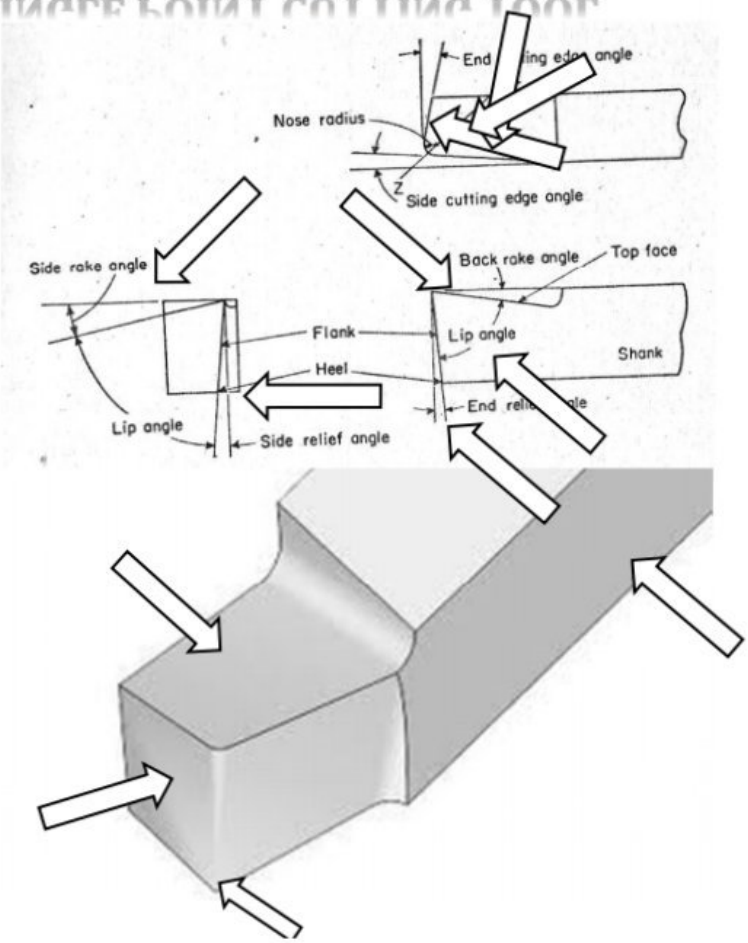


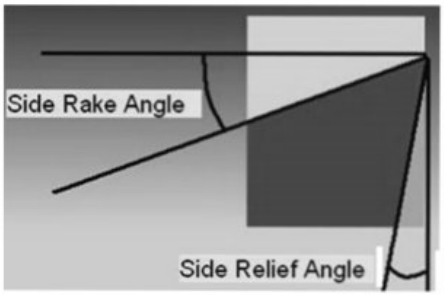
a) Single Point Cutting Tool : A single point cutting tool has only one cutting edge through which material is removed. There is basically a wedge-like action during cutting. It is widely used in machines like Lathe, Shaping, Slotting etc.

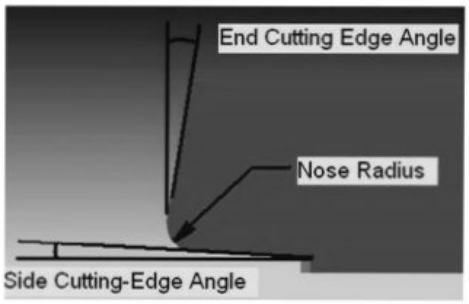
b) Multi Point Cutting Tool : A multiple point cutting tool has two or more cutting edges through which material is removed. For example Milling Cutters, Broaching Tool etc.

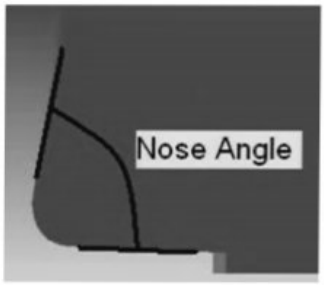
NOMENCLATURE OF A SINGLE POINT CUTTING TOOL

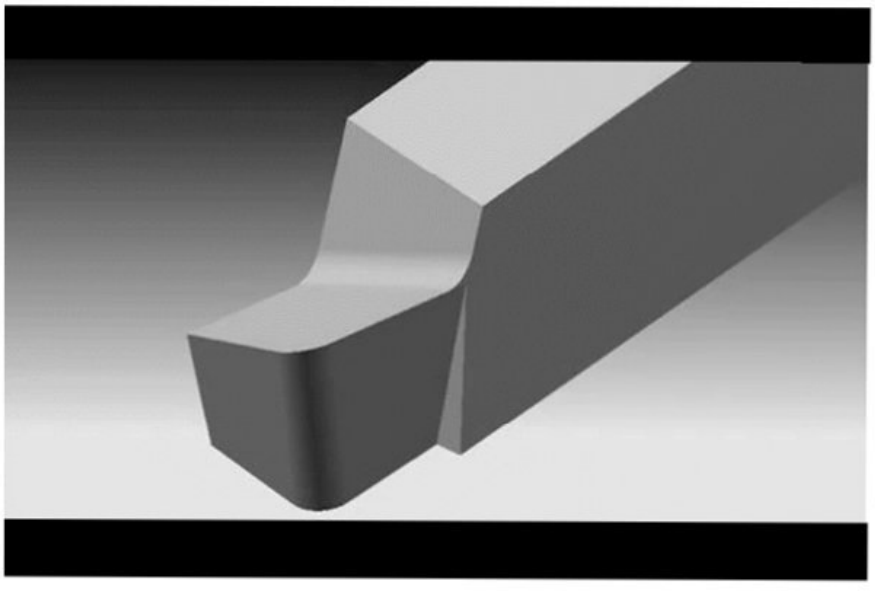
1. Shank
2. Face
3. Flank
4. Heel
5. Rake Angle
   - i) Back Rake Angle or Front Rake Angle
   - ii) Side Rake Angle
6) Side Clearance Angle or Side Relief Angle
7. Front Clearance Angle or End Clearance or End Relief Angle
8. End Cutting Edge Angle
9. Side Cutting Edge Angle
10. Lip or Cutting Angle
11. Nose Angle
12. Nose Radius

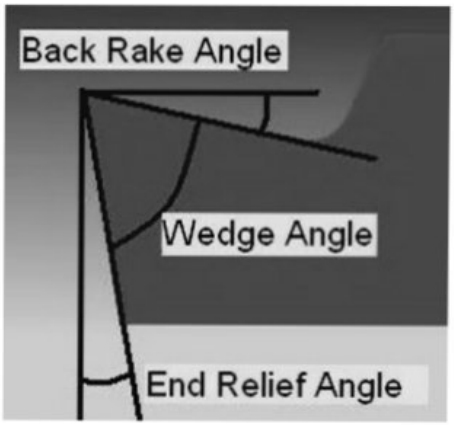












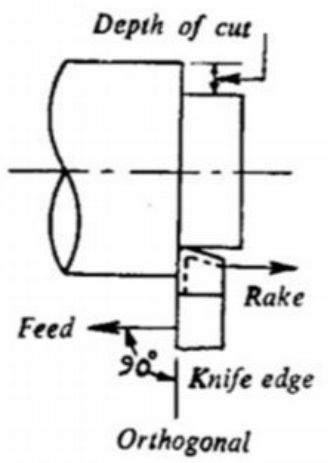
TOOL DESIGNATION OR TOOL SIGNATURE

Tool Signature is the systematic naming of different tool angles of a Single point cutting tool maintaining proper sequence. This designation of a single point tool requires 7 elements to be specified. According to the Indian Standard and British Standard, these 7 elements are as follows –

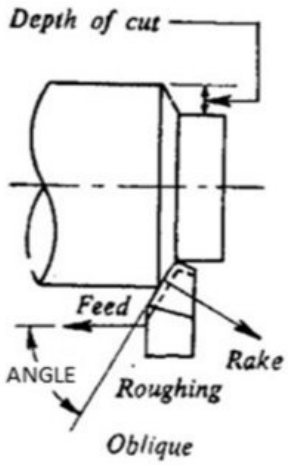
For example – **6-9-14-10-8-7-1·2** means

1. Front Rake Angle = 6°
2. Side Rake Angles = 9°
3. Front Clearance Angle = 14°
4. Side Clearance Angle = 10°
5. End Cutting Edge Angle = 8°
6. Side Cutting Edge Angle = 7°
7. Nose Radius = 1·2 mm.

ORTHOGONAL AND OBLIQUE CUTTING



Orthogonal Cutting: Orthogonal cutting takes place when the cutting face of the tool is 90º to the line of action of path of the tool. It is also known as two-dimensional cutting. Planning a wooden plank with a jack plane is a good example of orthogonal cutting, because at this condition the cutting edge is perpendicular to the motion of the jack plane.



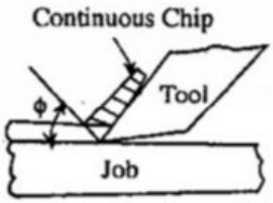
Oblique Cutting: Oblique cutting takes place when the cutting face of the tool is less than 90º to the line of action or path of the tool. It is also known as three-dimensional cutting. Turning a job in Lathe is the example of oblique cutting.

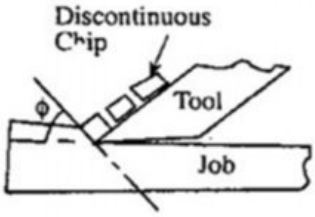
COMPARISON BETWEEN ORTHOGONAL AND OBLIQUE CUTTING

ORTHOGONAL CUTTING	*OBLIQUE CUTTING*
The cutting edge of the tool is perpendicular to the direction of feed.	The cutting edge is inclined (makes an acute angle) with the direction of feed.
The resultant force can be resolved into two components.	The resultant force can be resolved into three components.
The chip coil in a tight and flat spiral in front of tool.	The chip flows sideways in form of long curl.
The cutting edge is longer than the width of cut.	The cutting edge may or may not be longer than the width of cut.

TYPES OF CHIPS

1. Continuous Chips : If ribbon like chip is produced during machining then it is called continuous chip. Under favorable cutting conditions ductile material produces continuous chip.





2. Discontinuous Chips : Produced in small segments during machining are called discontinuous chip. Machining of brittle materials like C.I., Bronze etc. produces discontinuous chip.

3. Chips with built up edge : High temperature at the cutting point causes welding of the portion of chip on the surface and edge of the tool. This is called built up edge. This happened when machining ductile material with low cutting speed at higher feed rate and lack of cutting fluid.