UTeM
UNIVERSITI TEKNIKAL MALAYSIA MELAKA
OPENCOURSEWARE

MANUFACTURING PRACTICES
BETP 1303

REVISION

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Lesson Outcomes

At the end of this topic, students be able to:

1. Demonstrate uses of manual drafting tools to draw prescribed shapes to specifications
2. Use proper tools in cutting and shaping of pattern designs
3. Apply knowledge of mathematics and geometry skills

Introductions

-The importance of tools-

- Machine tools are used directly in the manufacture of products
- Machine tools are needed to create the machinery and the equipment necessary for product processing

Introductions

-What is machine tools-

- A machine tool is a power-driven machine not portable by hand, used to shape of form metals or materials by cutting, impacting, forming, eroding or a combination of these processes

The main categories of machine tools :

- Non-chip producing machine tools.
- Conventional chip producing machine tools
- New generation of machine tools

Non-chip producing machine tools

- This type of machine shapes metals by shearing, pressing and drawing to a desired shape

Conventional chip producing machine tools

- They shape metal to a size and contour by cutting away the unneeded portions in the form of metal chips
- The collection of material-working processes used is called conventional machining
- The operator uses machine handwheels to manually control the machine to produce the part
- The accuracy of the part produced depends upon the skill of the operator or machinist

New generation of machine tools

- Computerized Numerical Control (CNC) machines
- Electric Discharge Machines (EDM)
- Electrochemical Machines
- Their purpose:

  - To increase the production rate

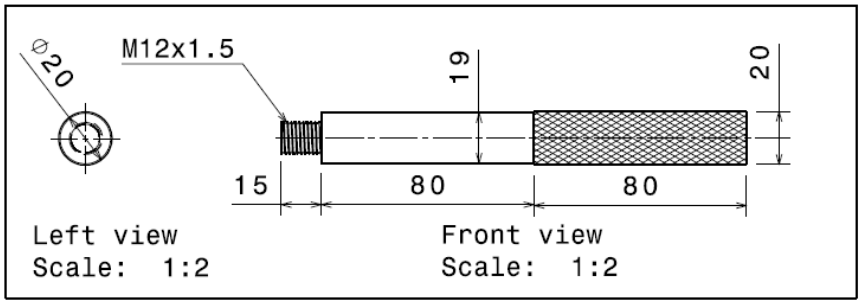
  - To increase the preciseness of machined parts

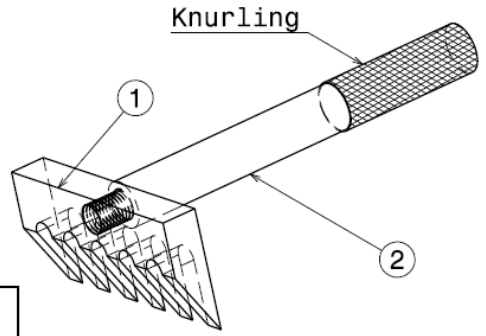
- The programmer programs the machine control unit (MCU), through the use of symbols, letters and numbers (coded instructions) which automatically control themachine tool movements to produce the desired part

Engineering Drawing

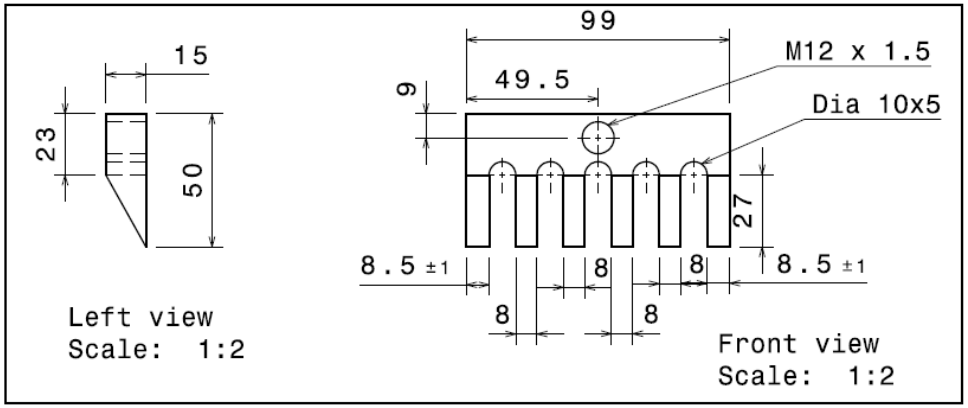
- It is a common language between drafts persons, tool designers, engineers machinist and tolerance.
- Drawing are made up of a variety of lines, which represent contours, surfaces and edges of a workpiece.
- By adding symbols, sizes, word notes and dimension lines. The draft person can indicate the exact specifications of each individual part.

Example of Engineering Drawing





Isometric view
Scale: 1:2



No	Part	Qty
1	Hoe	1
2	Handle	1

DESIGN BY: MOHD NAZRI AHMAD	DATE: 10/02/2016	TOLERANCE IN MM (EXCEPT AS NOTED)	PROJECTION	UNIVERSITI TEKNIKAL MALAYSIA MELAKA
DRAWN BY/ISSUED BY: MOHD NAZRI AHMAD	DATE: 10/02/2016	X. ± 0.5 .X ± 0.3 .XX ± 0.10 ANGLE ± 0.5°		
CHECKED/APPROVED BY:	DATE:	DATE:	PROJECT TITLE: Hoe Assembly	
MATERIAL/FINISH: Mild steel		SCALE: 1:1	TITLE: Lab - Manufacturing Practice (Turning & Milling)	
FINISH:		QTY: 1	DRAWING NO.: 1/1	

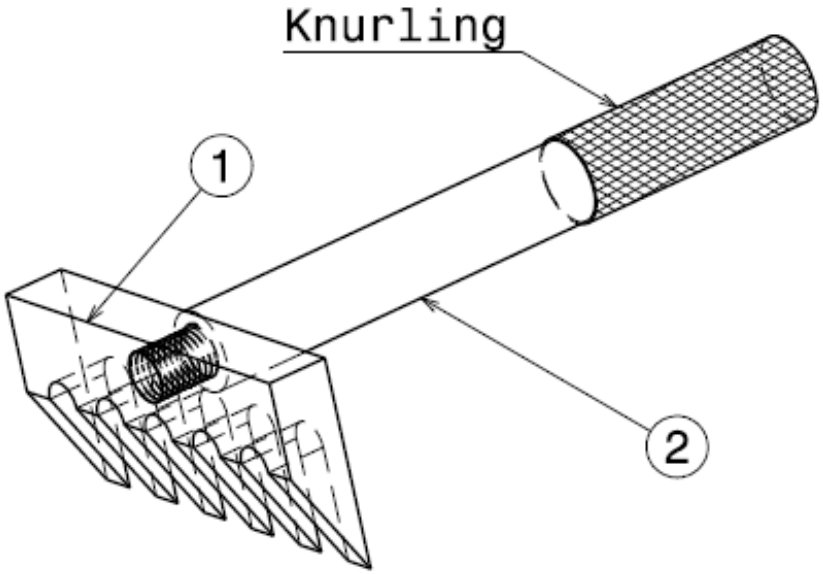
Types of Engineering Drawing

- Orthographic projection
  - Drawing a 3D object from different directions and useful when design is almost ready to manufacture.

- Sectional view
  - To clarify interior or hidden details on a multi-view drawing of an object
  - Located by creating a cutting plane line in one view
  - Mainly to distinguish the solid portions from the hollow areas of an object.

Types of Engineering Drawing

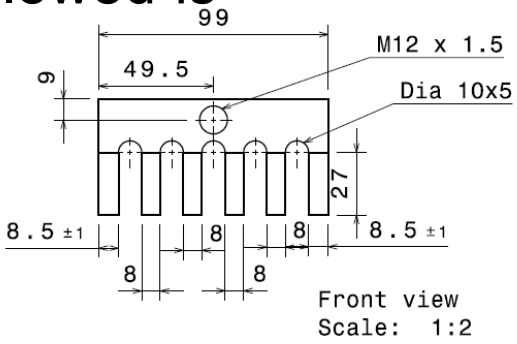
- Isometric drawing
  - Consist of two-dimensional drawings that are titled some angle to expose other views and give the viewer the feeling that what he/she is viewing is a three-dimensional drawing.



Isometric view
Scale: 1:2

Engineering Drawing

- Tolerance
  - Permissible variation of specified size of a part.
  - Basis dimension plus or minus the variation allowed is given on a drawing



  - Example :

    - **The largest permissible dimension** = 9.5 mm

      (8.5 + 1.0 = 9.5 mm)

    - **The smallest permissible dimension** = 9.5 mm

      (8.5 - 1.0 = 7.5 mm)

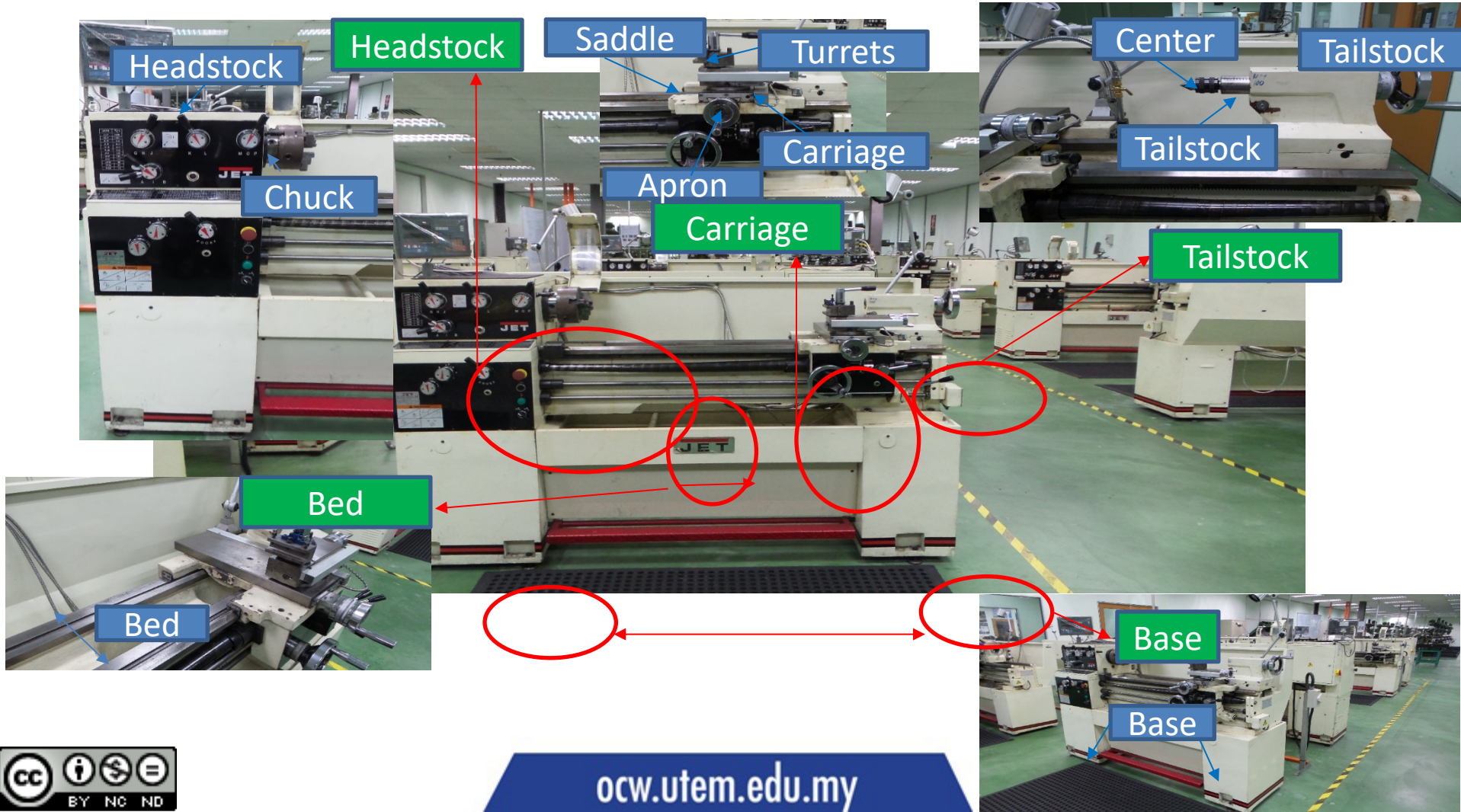
    - **The largest tolerance** = 2.0 mm (9.5 - 7.5 = 2.0 mm)

Summary

- ✓ Recognize the function and importance of machine tools.
- ✓ Read and understand the main technical drawing's symbols.
- ✓ Take precise measurement using Vernier Caliper and Micrometer.

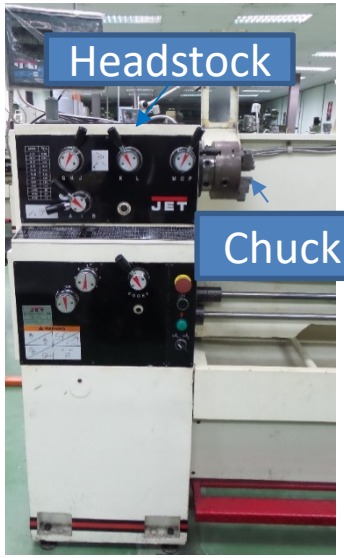
Lathe nomenclature

-Main structure of lathe-



Lathe nomenclature

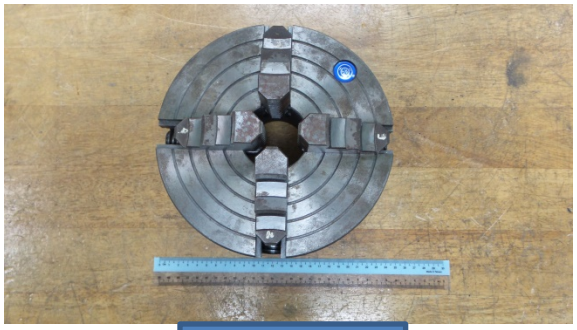
-Main structure of lathe-



Headstock – Fixed to the bed and supply power to spindle and at various rotational speeds that can be manually controlled or by electrical controls.

Chuck - Adjustable jaws permit holding of larger diameter materials usually in three of four jaws.

Headstock



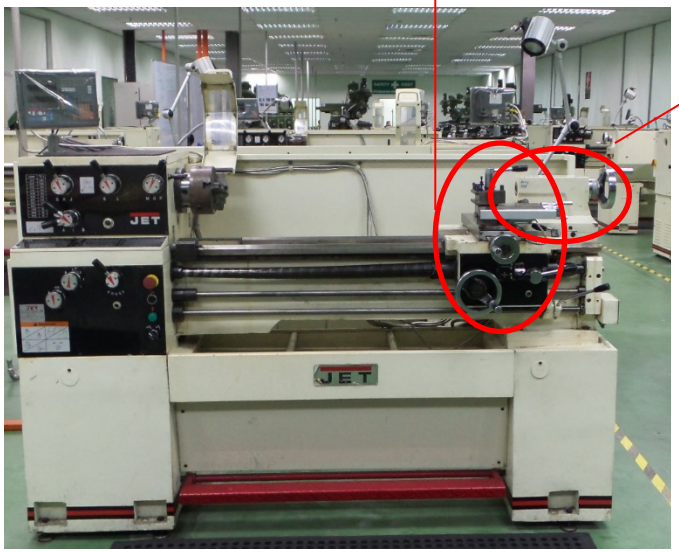
Four jaws

Lathe nomenclature

-Main structure of lathe-

Carriage

Tailstock



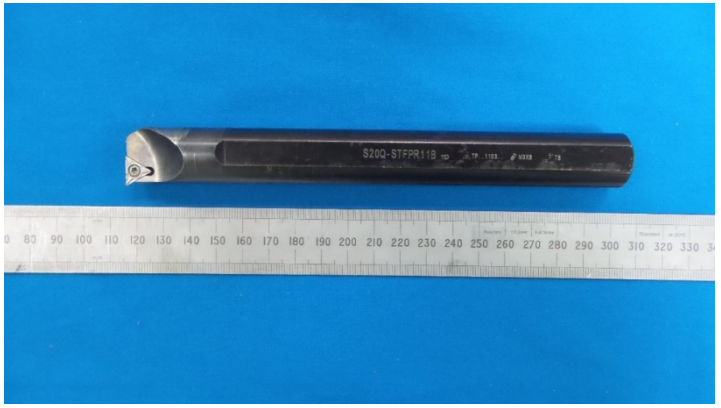
Tailstock – Can be clamped at any position, supports the other end of materials and slide along the ways.

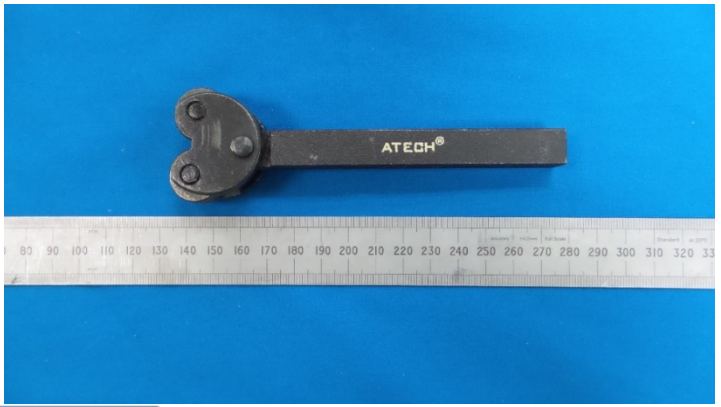
Carriage – Carriage assembly, slides along the ways and consists of the apron, cross-slide and tool post.

Lathe nomenclature

- Type of cutting tools-

Tool bits - Types of tool bits include threading tools, facing tools, cutoff tools and right and left hand turning tools.





Lathe nomenclature

- Types of toolholders -

Straight shank toolholder

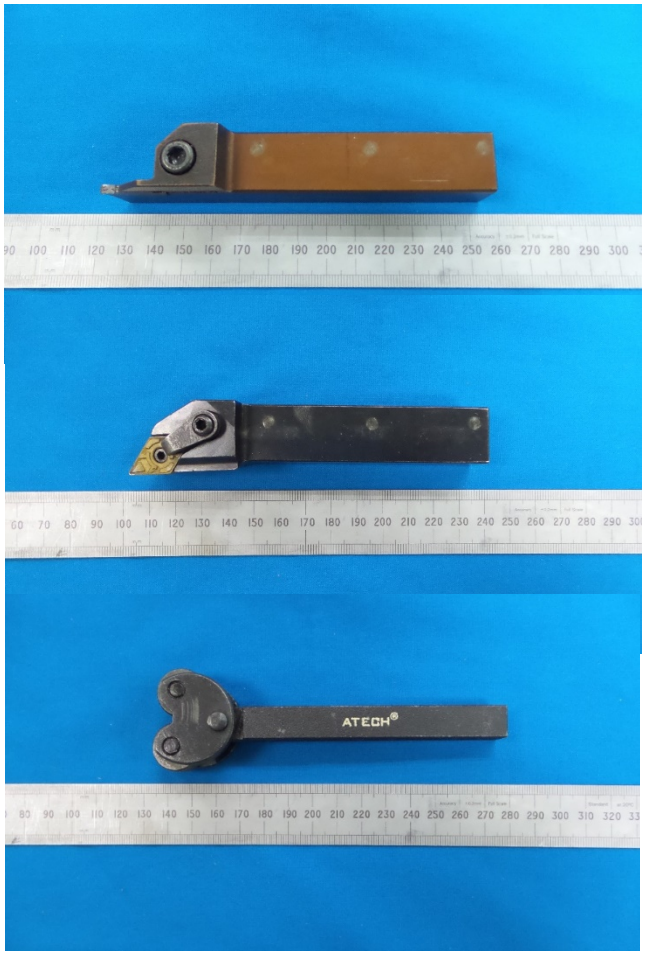
-Hold tool bit parallel to the base of the toolholder shank. Intended for holding cast alloy bit also carbide tipped tool bit

Throwaway insert toolholder

-Used to hold a chip breaker and ceramic/carbide cutting tool. Many types throwaway insert toolholder are made to hold variety of insert.

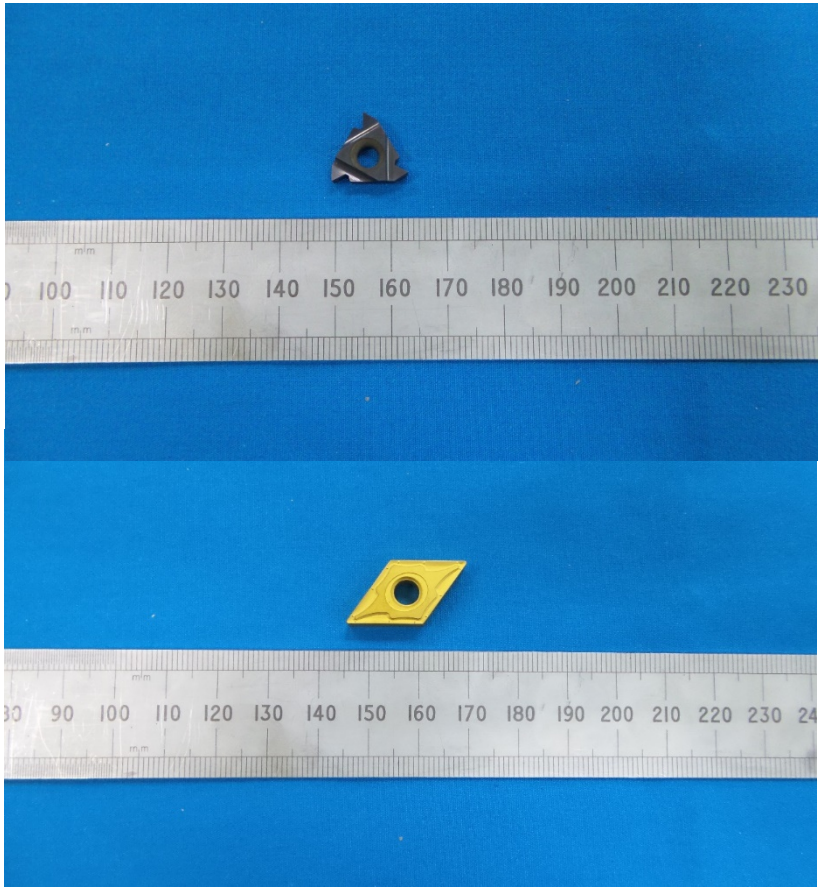
Knurling tool

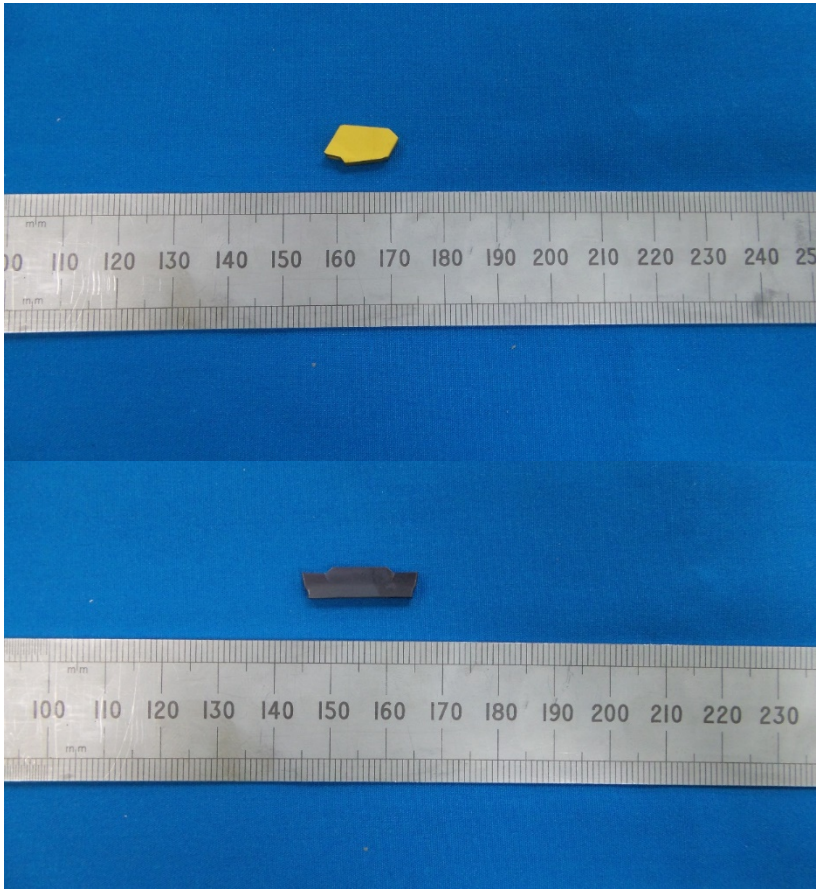
-Used for performing operations of knurling



Lathe nomenclature

- Types of insert -





Lathe nomenclature

- Lathe operations -

INSTALLING A CUTTING TOOL - first make sure to clean the holder and then tighten the bolts that will hold cutting tools on tool holders of lathe.

POSITIONING THE TOOL – release the bolts and tighten the cutting tool to the saddle. Use a dial indicator to position the saddle accurately. After that, rotate the cutting tool to the desired angle referencing the dial indicator at the base of the compound. The cutting tool can be hand fed along the desired angle. Use a micrometer dial to allow accurate positioning of compound and cross slide.

Lathe nomenclature

- Lathe operations -

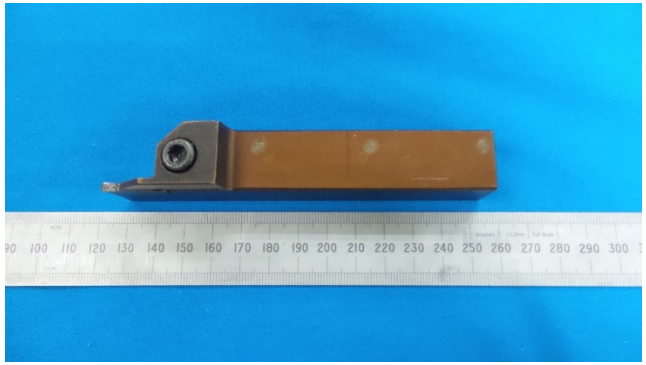
TURNING - To reduce the radius of a materials to a desired length. Firstly, clamp the materials in a lathe chuck. Secondly, install a roughing or finishing cutting tool. Thirdly, feeding the saddle toward the headstock and use the cross feed to set the desired depth of cut. Move the tool off from materials by backing the carriage up with the carriage handwheel.

FACING - To create a face, flat and smooth perpendicular to the axis of a cylindrical materials. Firstly, clamp the materials. Secondly, install a facing cutting tool. Thirdly, bring the cutting tool approximately into position, but slightly off of the materials. Then, move the cutting tool outside the materials and change the saddle to take the desired depth of cut.

Lathe nomenclature

- Lathe operations -

PARTING - It is to make narrow grooves and for cutting off materials. Make sure that the parting tool is perpendicular to the axis of rotation and the tip of parting tool is the same height as the center of the materials. Place the height of the cutting tool, lay it flat against the face of the materials, then lock the cutting tool in place. When the cut is deep, the side of the materials can rub against sides of the groove, so it's especially important to apply cutting lubricant.



Lathe nomenclature

- Lathe operations -

DRILLING - To drill hole accurately on a lathe with the centerline of a cylindrical materials . Firstly, install a drill chuck into the tail stock. Move the saddle forward to make room for the tailstock. Secondly, move the tailstock into position and lock the it in place. Use a center drill to start the hole with cutting tool.

Lathe nomenclature

- Cutting speeds and feeds for lathe work -

- It is important for good tool life and efficient machining with correct cutting speeds. For **lathe work, cutting speed refers to the rate in meter per minute at which the surface of the material moves past the cutting tool.**
- Condition that affect cutting speed:

1. Types of materials and the cutting tool is made
2. Types of the cutting process
3. Rigidity of the materials and lathe machine
4. Types of cutting fluid being used

Lathe nomenclature

- Cutting speeds and feeds for lathe work -

Cutting speeds are determined using the formula

$$rpm = v / (D \times \pi)$$

where

rpm = revolutions per minute

v = cutting speed, in meter per minute (mpm)

D = diameter of workpiece

π = 3.14

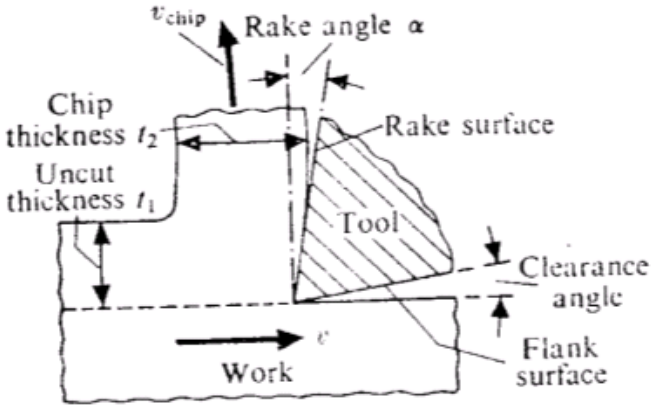
Lathe nomenclature

- Cutting tools geometry -

- **Cutting tool is suited to the machining operation which can be classified according to the machining process**. Lathe have drill bit, reamers, turning tools, cutoff tools, tap and many other cutting tool that are name for operation.
- Cutting tools can be divided into **two categories**: **Multiple cutting edge tools and single point tools .**

Lathe nomenclature

- Cutting tools geometry -



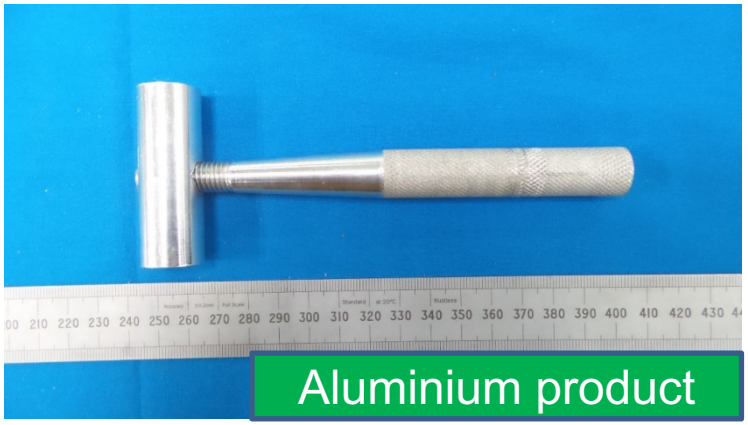
MECHANICS OF BASIC MACHINING

The important parameter involve

1. Thickness of the uncut layer (t_1)
2. Thickness of the chip deformation produced (t_2)
3. Inclination of the chip-tool interface with respect to the cutting velocity; i.e the rake angle(α)
4. The relative velocity of the workpiece and the tool (v)

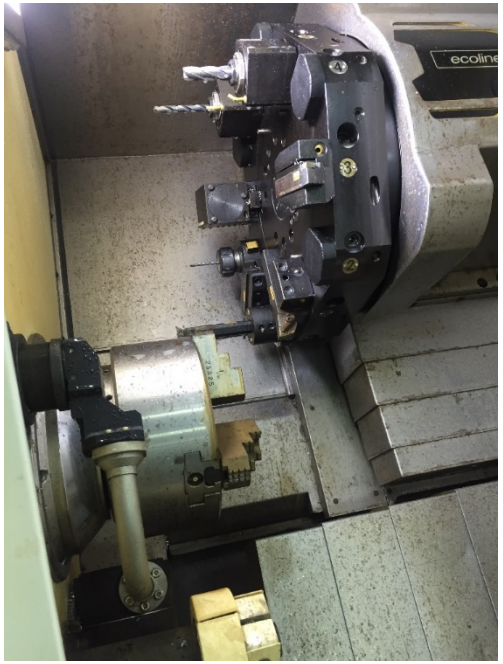
Lathe nomenclature

Examples of products by lathe



Lathe nomenclature

Advance lathe/CNC lathe machine



Self-Test

1. Define what is lathe/turning?

2. Differentiate between straight shank toolholder and throwaway toolholder.

3. Differentiate between turning and facing process.

4. What is the formula to calculate cutting speeds?

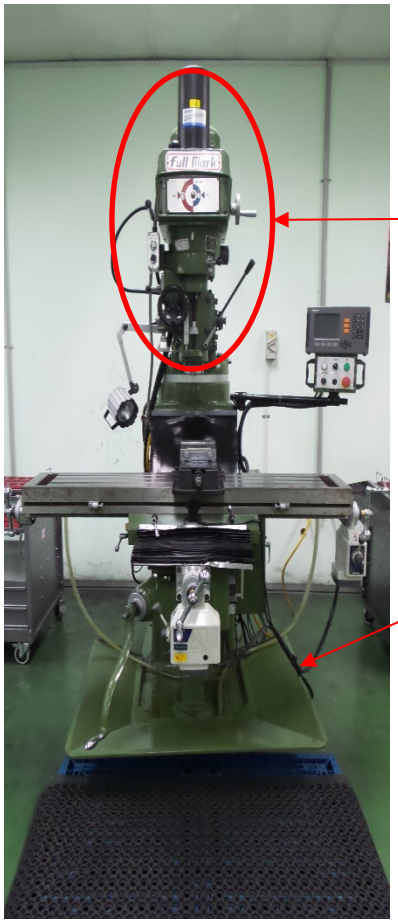
5. What's the difference between conventional and advance lathe/turning machine?

Summary

- ✓ Introduction to lathe/turning machine which **processing of round bar materials.**
- ✓ Lathe machine nomenclature which composed from **5 compounds; carriage, tailstock, bed, base and headstock.**
- ✓ Lathe operations included **facing, turning, cutoff, knurling etc.**

Milling nomenclature

- Main structure of milling -



Column

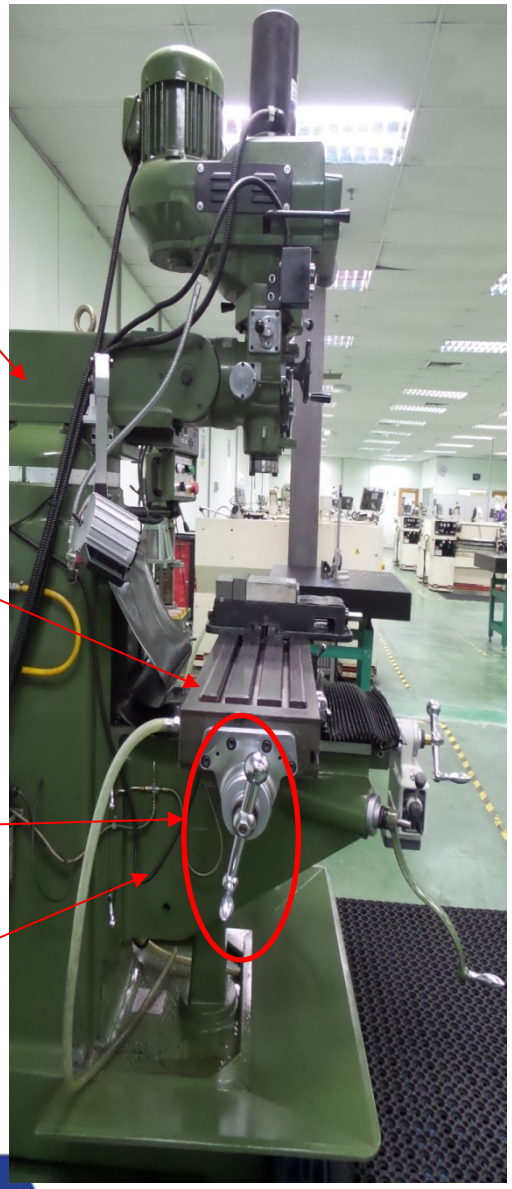
Spindle head

Worktable

Base

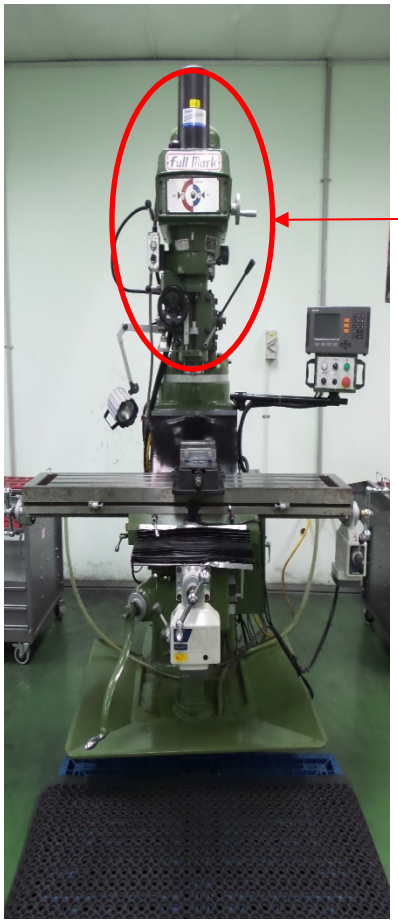
Spindle

Knee



Milling nomenclature

- Main structure of milling -



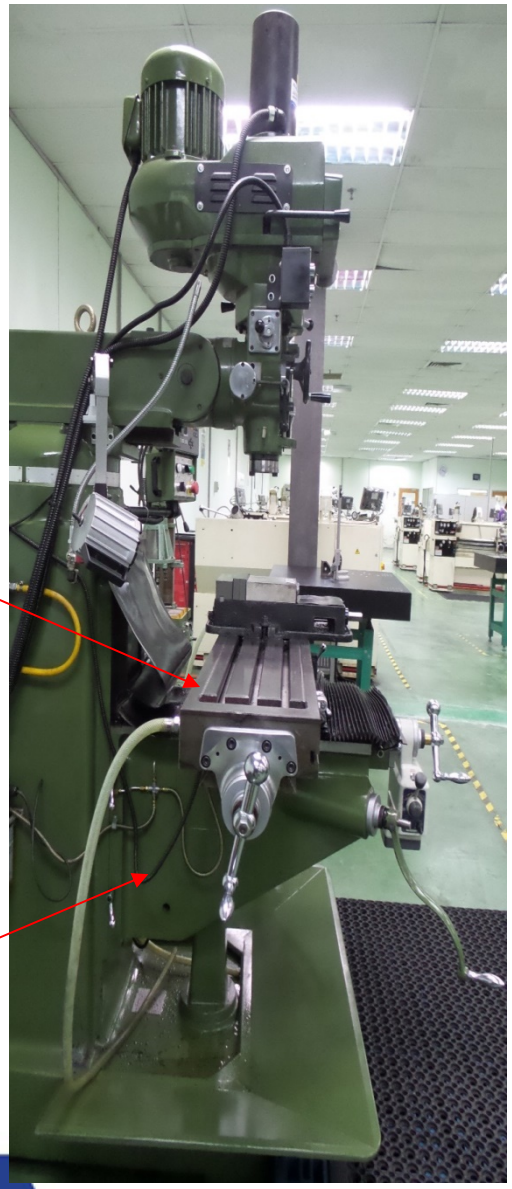
Spindle head – Contains cutter holders and the spindle. The head can be adjusted vertically or may be fixed in vertical machines. For cutting tapered surfaces it can be spinned in a vertical plane.

Milling nomenclature

- Main structure of milling -

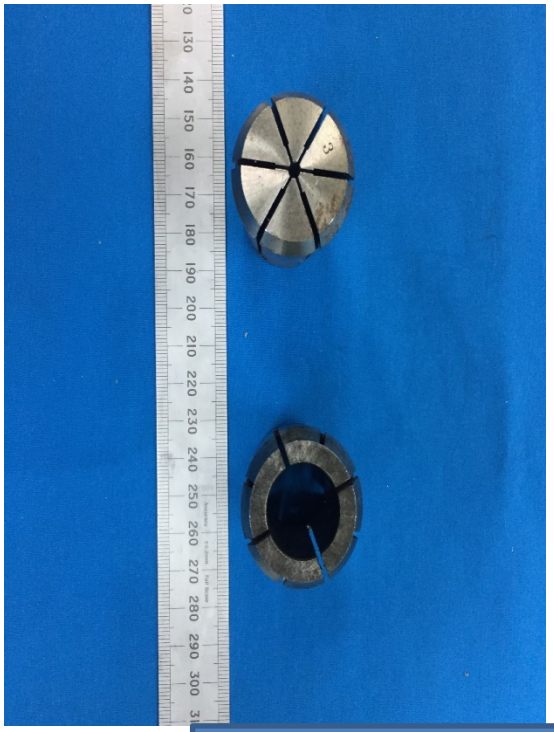
Worktable – The table moves longitudinally relative to the saddle on which the materials is clamping using T-slots.

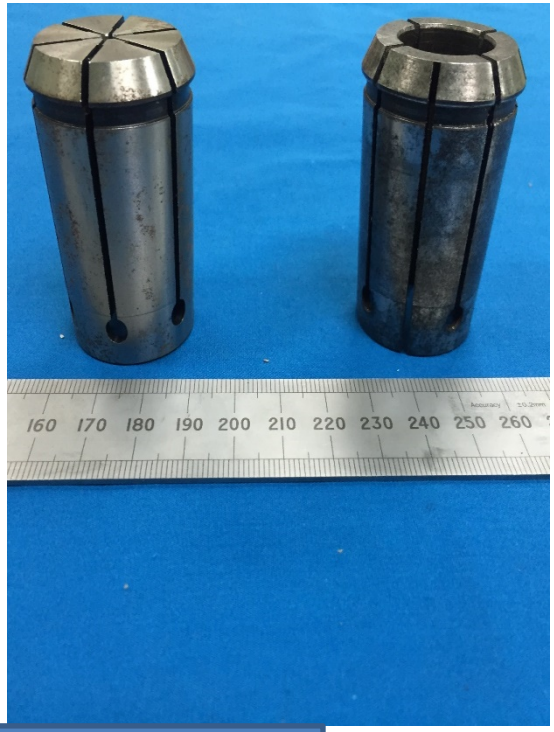
Knee – Gives the table vertical movement and supports the saddle so that the depth of cut can be adjustable.



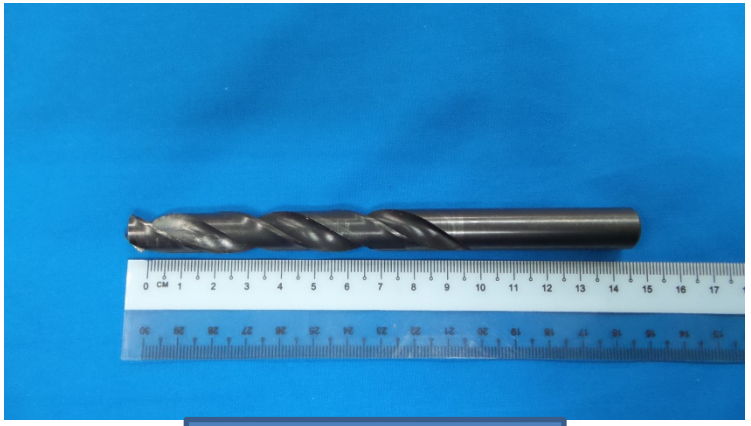
Milling nomenclature

-Types of cutting tools and tool holders -





Drilling tool holder



Drilling tool

Milling nomenclature

- Milling parameters -

- The **cutting speed, *V*** in peripheral milling is the surface speed of the cutter, or

$$V = \pi D N$$

where

D : the cutter diameter

N : the rotational speed of the cutter

Milling nomenclature

- Milling parameters -

- **For a straight-tooth cutter**, the approximate *undeformed chip thickness (chip depth-of-cut),* can be calculated from the equation

$$t_c = 2f\sqrt{\frac{d}{D}}$$

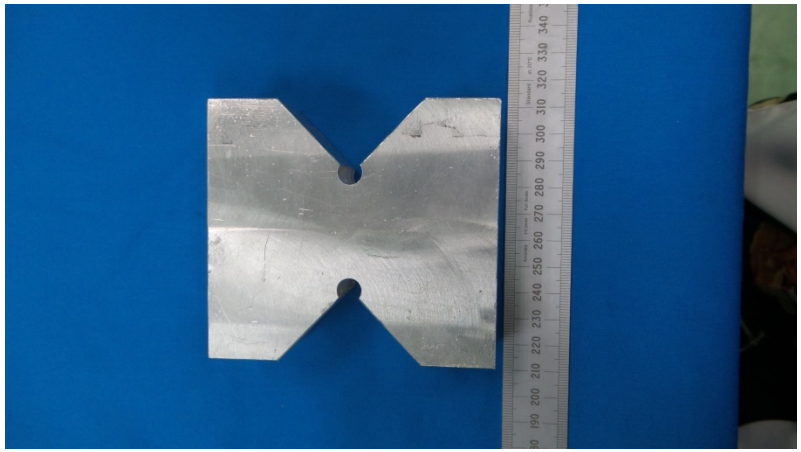
- **Feed-per-tooth** is determined from the equation

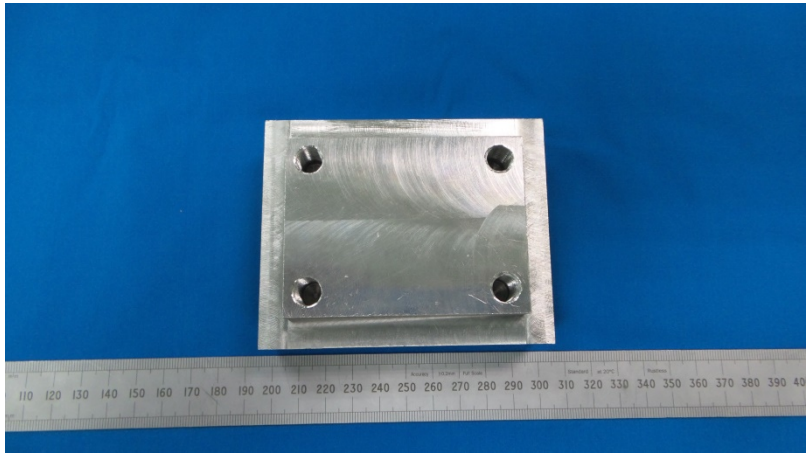
$$f = \frac{v}{N\,n}$$

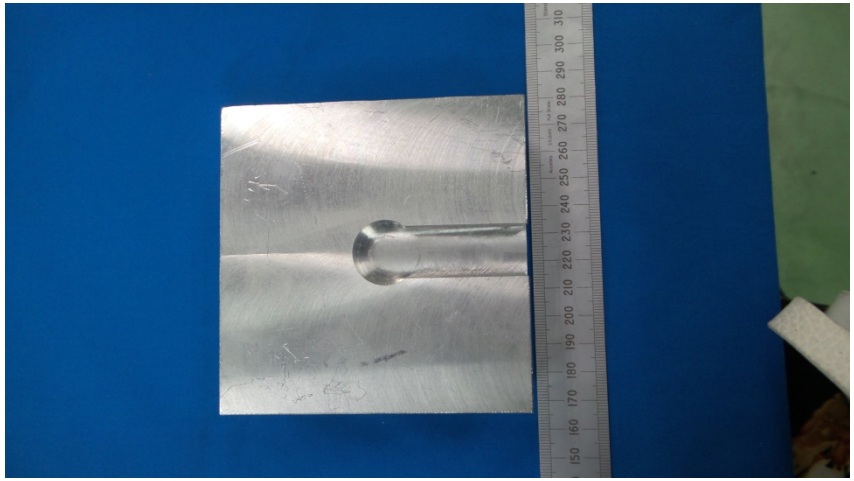
where
v : the linear speed (*feed rate*) of the workpiece
n : the number of teeth on the cutter periphery.

Milling nomenclature

Examples of products by milling

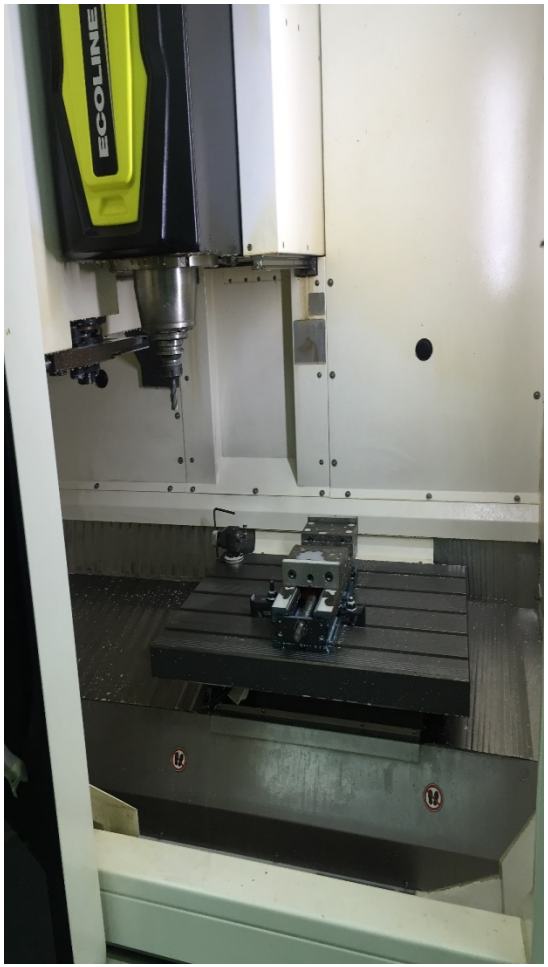






Milling nomenclature

Advance milling/CNC milling machine



Self-Test

1. Define what is milling?

2. Differentiate between conventional milling and climb milling.

3. Differentiate between end milling and facing process.

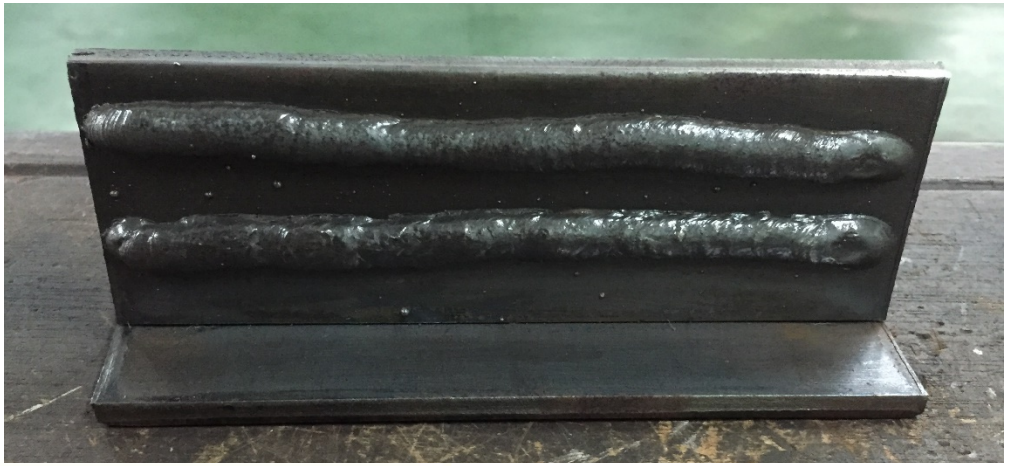
4. What is the formula to calculate cutting speeds?

5. What's the difference between conventional and advance milling machine?

Summary

- ✓ Introduction to milling machine which **cutting by moving back and forth and up and down.**
- ✓ Milling machine nomenclature which composed from **6 compounds; column, spindle head, worktable, base, spindle and knee.**
- ✓ Lathe operations included **facing, end milling, drilling etc.**

Examples products by welding



Self-Test

1. Define what is sheet metal processes?

2. Differentiate between sheet metal cutting, bending and drawing.

3. Explain types of fabrication machines.

4. What is the equipment for sheet metal fabrication?

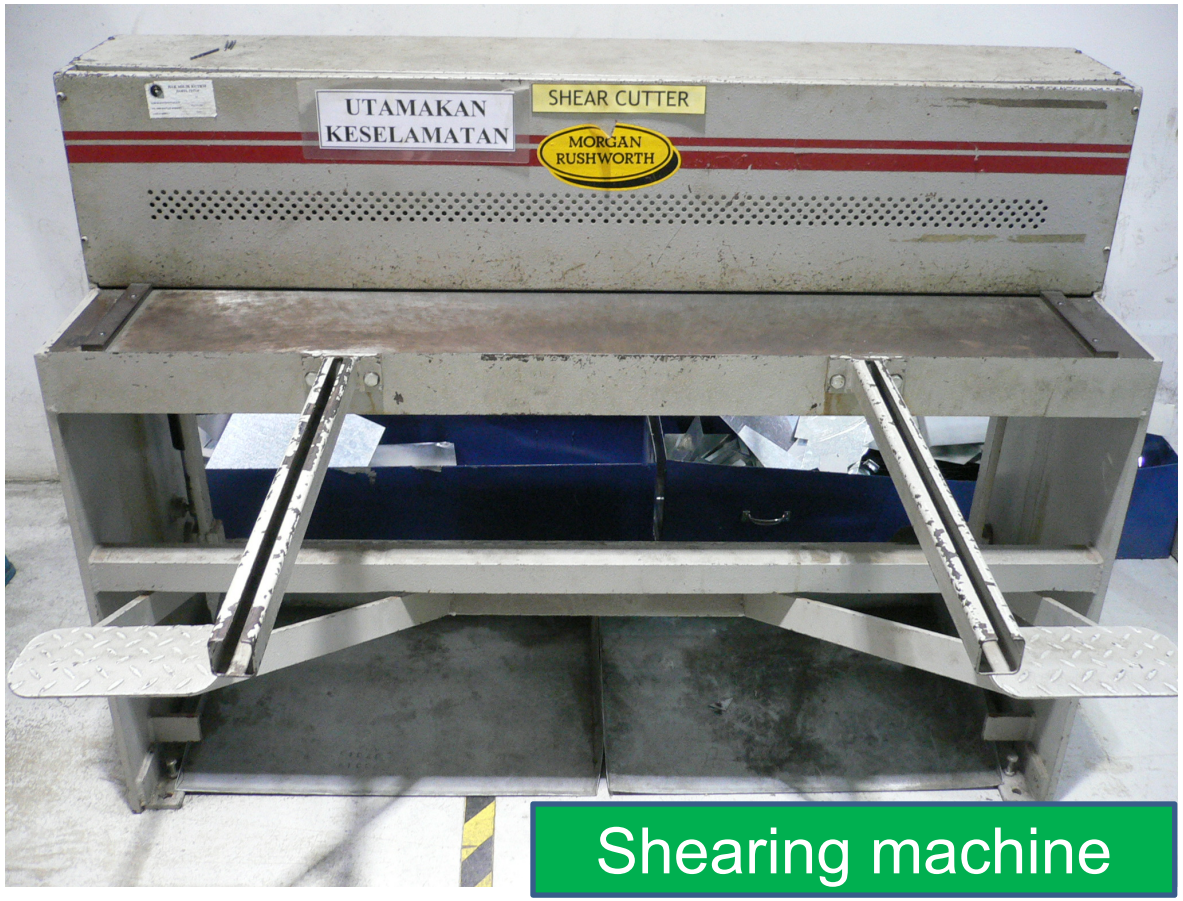
5. What's the different methods for developing the patterns for forms ?

Summary

- ✓ Observe the safety equipment and safety precautions in welding workshop
- ✓ Differentiate the various type of welding machines
- ✓ Explain the different usage of welding and manage to choose on it's applications

Equipment for Sheet Metal Fabrication

- Sheet metal fabrication using machines -

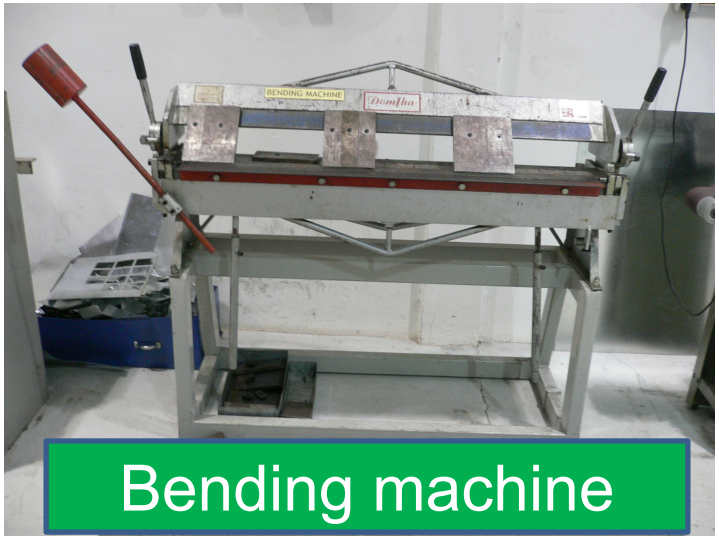


Shearing machine

A shearing machine is **used to cut along a straight line of sheet metal.**

Equipment for Sheet Metal Fabrication

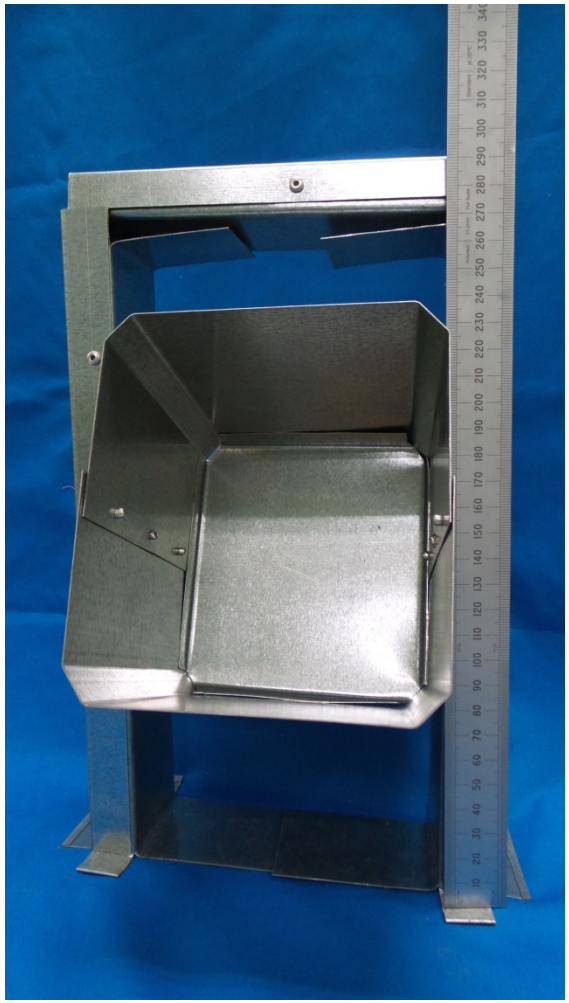
- Sheet metal fabrication using machines -



Bending machine

The bending machine or press brake **uses long dies in a mechanical or hydraulic press and it is suitable for low volume production.** The tooling is simple and can be made to suit a variety of shapes. The bending operation is carried out using a die and punch to perform V shape bending and edge bending.

Examples products by fabrication



Self-Test

1. Define what is sheet metal processes?

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3. Explain types of fabrication machines.

4. What is the equipment for sheet metal fabrication?

5. What's the different methods for developing the patterns for forms ?

Summary

- ✓ Introduction to **three major categories of sheet metal processes.**
- ✓ Fabrication machine included **shearing machine and bending machine.**
- ✓ Practical pattern drafting **founded upon those principles of geometry which relate to the surfaces of solids, and may be described as the development of surfaces.**