

MANUFACTURING PRACTICES BETP 1303

SHEET METAL FABRICATION

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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
4. Perform pattern of heating, ventilation, and air conditioning
5. Develop radial and parallel lines as well as triangulation pattern

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Introductions

- There are **three major categories of sheet metal processes**. These are cutting, bending and drawing. Cutting is used to **separate larger sheets into smaller pieces, to cut out a perimeter or make holes in a part**. Sheet metal parts are formed into their final shapes using bending and drawing process.

Sheet Metal Cutting Processes

- Carried out using a shearing action between two sharp cutting edges, just like cutting a piece of paper using a paper using a pair of scissors. There are **two types of cutting processes, namely shearing and blanking**.
- In shearing operation, the sheet metal is cut along a straight line between two cutting edges. Shearing is used to cut larger sheets into smaller sections for subsequent presswork operations. Shearing is done on a machine called power shear.
- Blanking is an operation in which a sheet metal is cut along a closed outline in a single step to separate the piece from the main sheet. The piece that is cut out is called the blank. The punching operation is similar to blanking except that the piece that is cut out is the scrap metal, called slug.

Sheet Metal Bending Processes

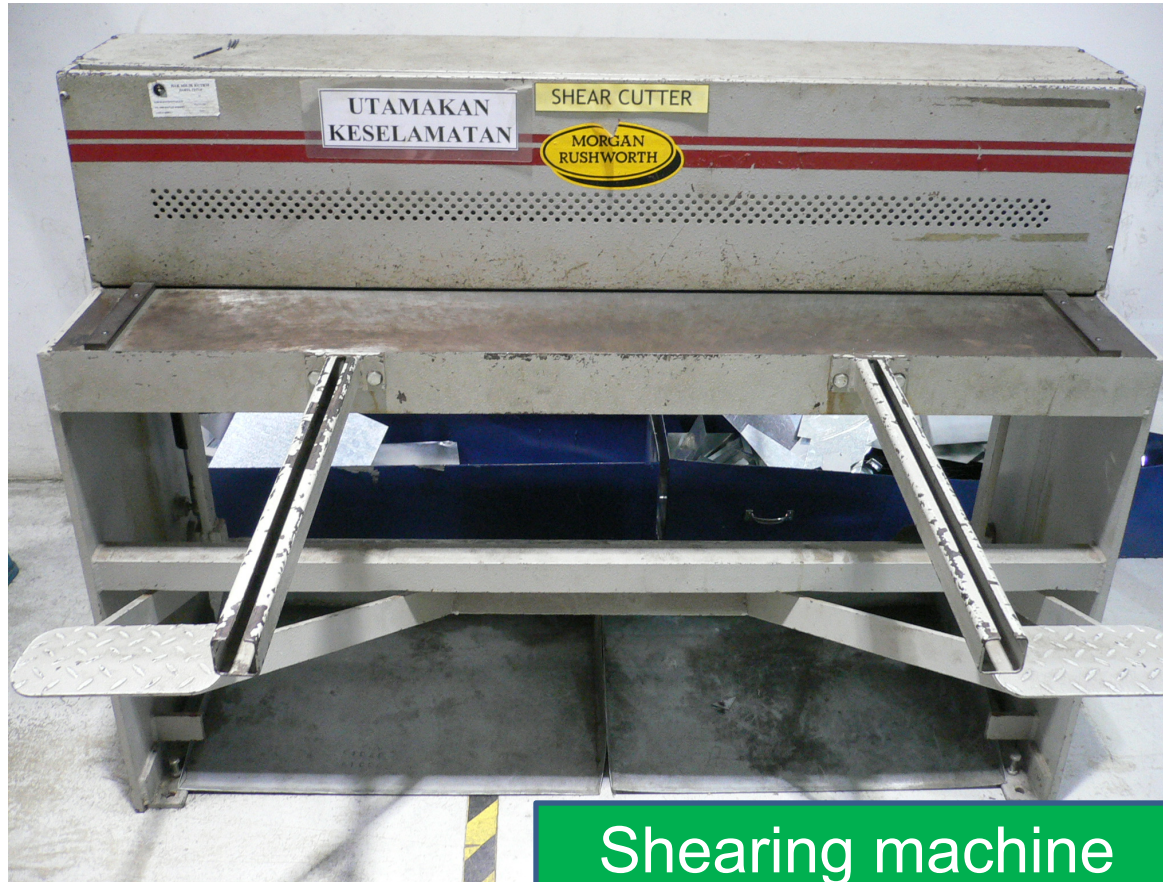
- **Bending** is simply defined as the straining of metal around a straight axis. During the bending process, the metal on the outside of the neutral plane is stretched, whereas the metal on the inside of the neutral axis is compressed.
- Bending is one of the most common sheet metal forming processes. Many products are made of sheet metals using this technique. Bending is also used to increase the stiffness of a part.

Sheet Metal Drawing Processes

- **Drawing** is carried out by placing a piece of sheet metal, known as the blank, over a die cavity and then pushing the metal into the cavity using a punch.
- You would have definitely come across many parts made from sheet metals that are cup-shaped, box-shaped or have other complex shapes. Cooking pots and pans, metal tumblers, kitchen sinks and metal food containers are some common examples. These parts are made using a process known as deep drawing or simply as drawing.

Equipment for Sheet Metal Fabrication

- Sheet metal fabrication using machines -

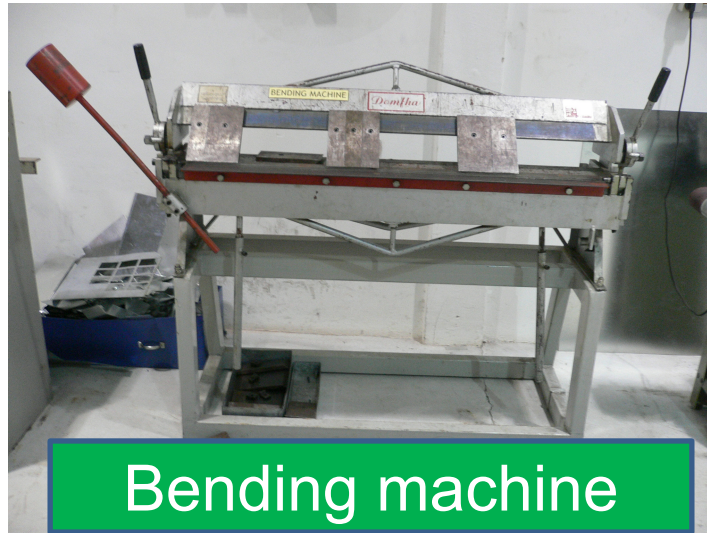


Shearing machine

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.

Equipment for Sheet Metal Fabrication

- Hand tools and cutting tools -

Scratch awl - A steel tool with a sharp point on one end.

It is used to scratch layout lines on sheet metal.
Some scratch awls have wooden handles.
A scribe may be used instead.

Divider - Most often used by sheet metalworkers.
They are used to scribe arcs and circles.

Equipment for Sheet Metal

Fabrication

- Hand tools and cutting tools -

Rivetting hammer - Used for setting solid rivets for bending or tucking in the edges of sheet metal. It is especially useful for setting the edges when making a single bottom seam.

Raising hammers - For producing curved sheet metal surfaces that cannot be made with forming machines. Usually, sheet metal is hammered to perform a shape, clip, seam and hem on an anvil.

Equipment for Sheet Metal Fabrication

- Bend allowance -

In order to make sheet metal products accurately to overall dimensions when they involve one or more bends, it is necessary to consider the bend allowance. The bend allowance is subtracted from the sum of the products' outside dimensions to obtain the overall length and width of the blank needed to make the part.

Because of differences in metal hardness, whether the bend is with or across the grain, and difficulty in making an exact bend radius, exact allowances can only be obtained by trial. The following table gives approximate bend allowances for 90° minimum radius bends in mild steel, and half-hard aluminum, copper and brass..

Practical pattern drafting

- Sheet-metal pattern drafting is founded upon those principles of geometry which relate to the surfaces of solids, and may be described as the development of surfaces.
- Sheet metal articles are hollow and are considered in the process of pattern drafting as though they were the coverings of solids of the same shape.
- The different methods for developing the patterns for forms with which the pattern draftsman has to deal may be divided into four general divisions:

Practical pattern drafting

- Heating, Ventilation and Air Conditioning Pattern Development-

This includes **square and rectangular fittings**. This layout section includes angles, elbows, ogee and transitional fittings with either square or radius throats.

Practical pattern drafting

- Parallel Line Development -

This is used in [developing patterns for moldings, pipes, elbows, regular continuous, or parallel forms.](#)

Practical pattern drafting

- Radial Line Development-

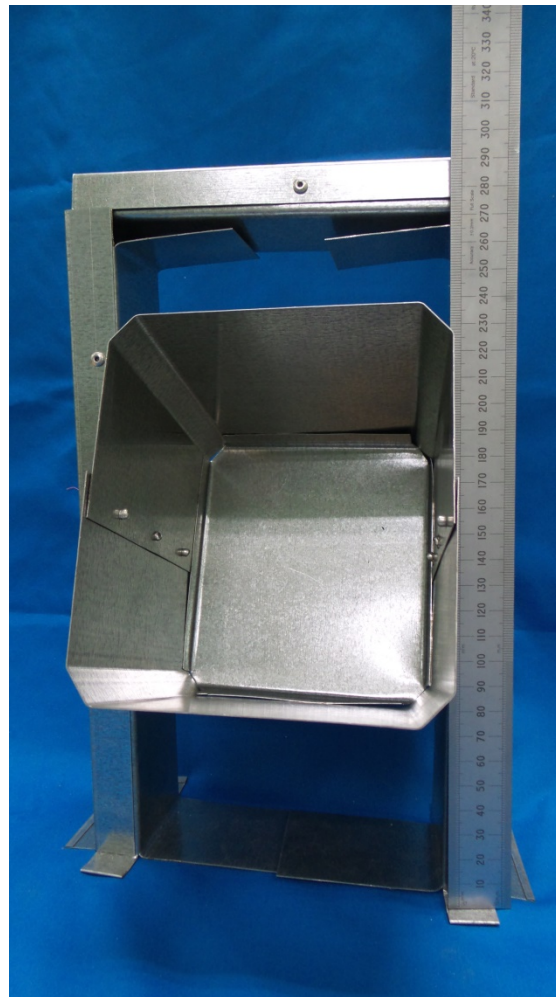
- This method is used in developing patterns for regular tapering forms by means of radial lines converging to a common center.
- The forms have for their base the circle, or any of the regular geometric figures which terminate in an apex.

Practical pattern drafting

- Triangulation -

This method is used in [developing patterns for irregular forms which cannot be developed by either the parallel or radial-line methods](#)

Examples products by fabrication



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

- ✓ 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.**