

Sheet Metal Forming

Manufacturing by Metal Shaping and Joining



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Sheet Metal Forming

- **Sheet metal forming processes** are those in which force is applied to a piece of **sheet metal** to modify its geometry rather than remove any material.
- Sheet metal refers to metal that has a high surface area to volume ratio.
- A distinction needs to be made between sheet metal and plate metal. Sheet metal is 1/4 inch or less in thickness, while plate is over 1/4 inch in thickness.
- Basically- (a) Forming
- (b) Cutting

- **The raw material for sheet metal manufacturing processes is the output of the rolling process.**
- **Typically, sheets of metal are sold as flat, rectangular sheets of standard size. Therefore the first step in any sheet metal process is to cut the correct shape and sized ‘blank’ from larger sheet.**
- **Sheet metal processing is an important process for many industries, producing home appliances (fridge, washer, dryer, vacuum cleaners etc.), electronics (DVD- and CD-players, stereos, radios, amplifiers etc.), toys and PC’s. Most of these products have metal casings that are made by cutting and bending sheet metal. We look at some of the basic sheet metal cutting and forming processes.**

Metal forming operations

- In metal forming operations, the sheet metal is stressed below the ultimate strength of the metal
- In this operations, no material is removed hence there is no wastage
- Metal forming operations include following operations
 - i. Bending
 - ii. Drawing
 - iii. Embossing
 - iv. Forming
 - v. Coining

Bending

- It is a metal forming operation in which the straight metal sheet is transformed into a curved form
- In bending operations, the sheet metal is subjected to both tensile and compressive stresses
- During the operation, plastic deformation of the material takes place beyond its elastic limit but below its ultimate strength
- Bending methods which are commonly used are
 - i. U-bending
 - ii. V-bending
 - iii. Angle bending
 - iv. Curling

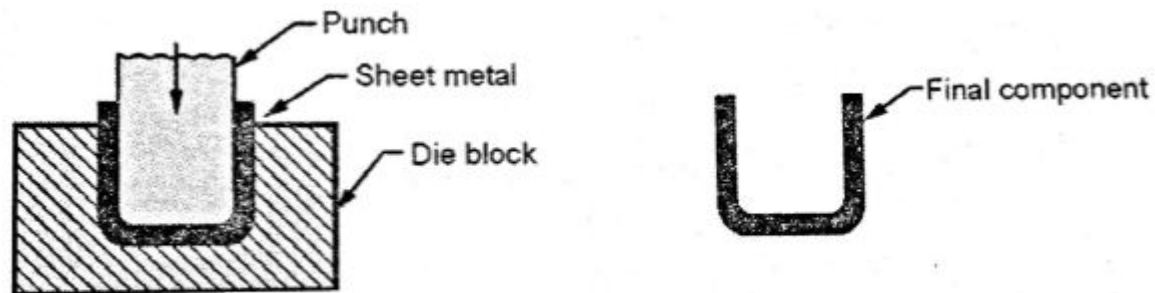
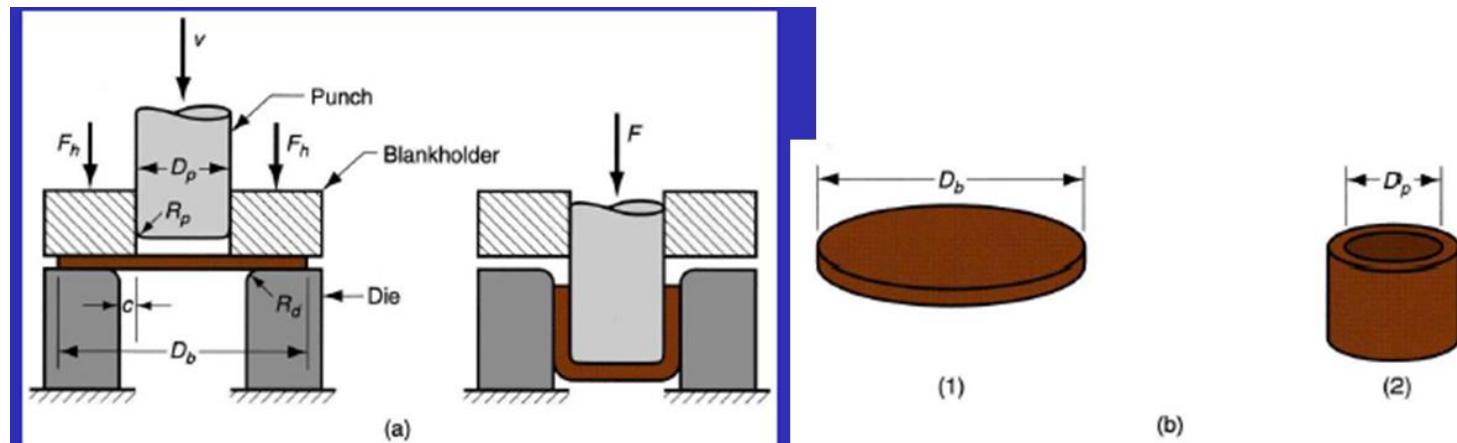


Fig. 2.12 : U-bending

Deep Drawing

- It is a process of making a cup-shaped parts from a flat sheet-metal blank
- To provide necessary plasticity for working, the blank is first heated and then placed in position over the die or cavity
- The punch descends and pushes the metal through the die to form a cup, hence this process is called as cupping
- To obtain cup shaped pieces of desired size and wall thickness, the process may be continued through a series of successively smaller dies and punches.



Embossing

- With the help of operation, specific shapes of the figures are produced on the sheet metal
- It is used for decorative purposes or giving details like names, trademarks, etc on the sheet metal

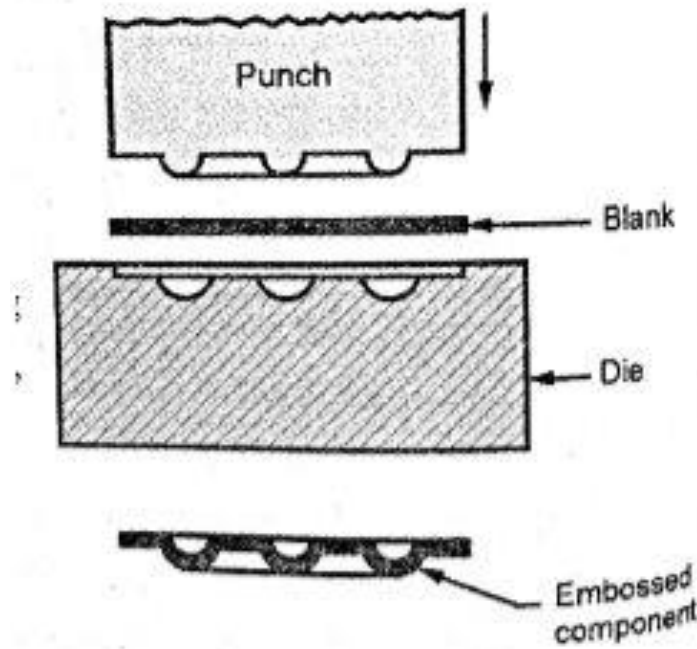


Fig. 2.20 : Embossing

Coining (squeezing)

- In coining operation, the metal having good plasticity and proper size is placed within the punch and die and a tremendous pressure is applied on the blank from both ends
- Under severe compressive loads, the metal flows in the cold state and fills up the cavity of the punch and die
- The operation is used in the manufacturing of coins, ornamental parts etc.

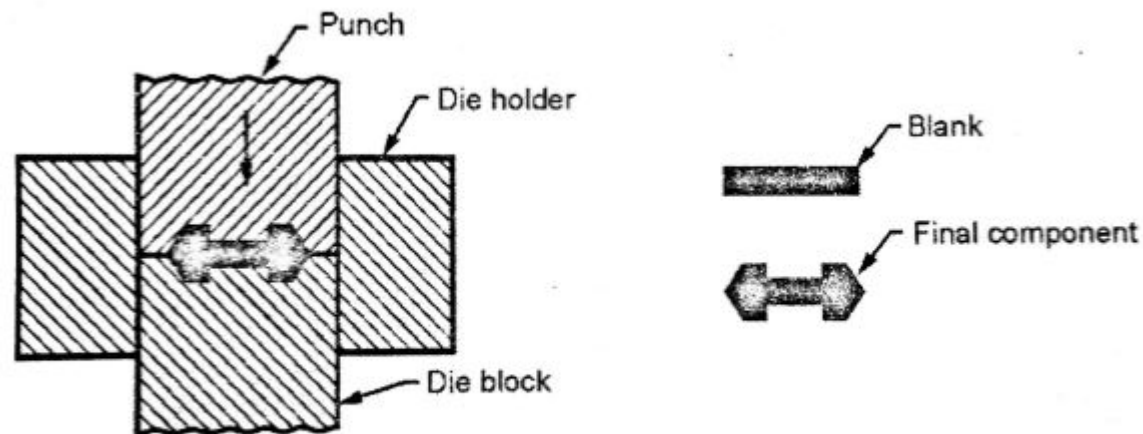
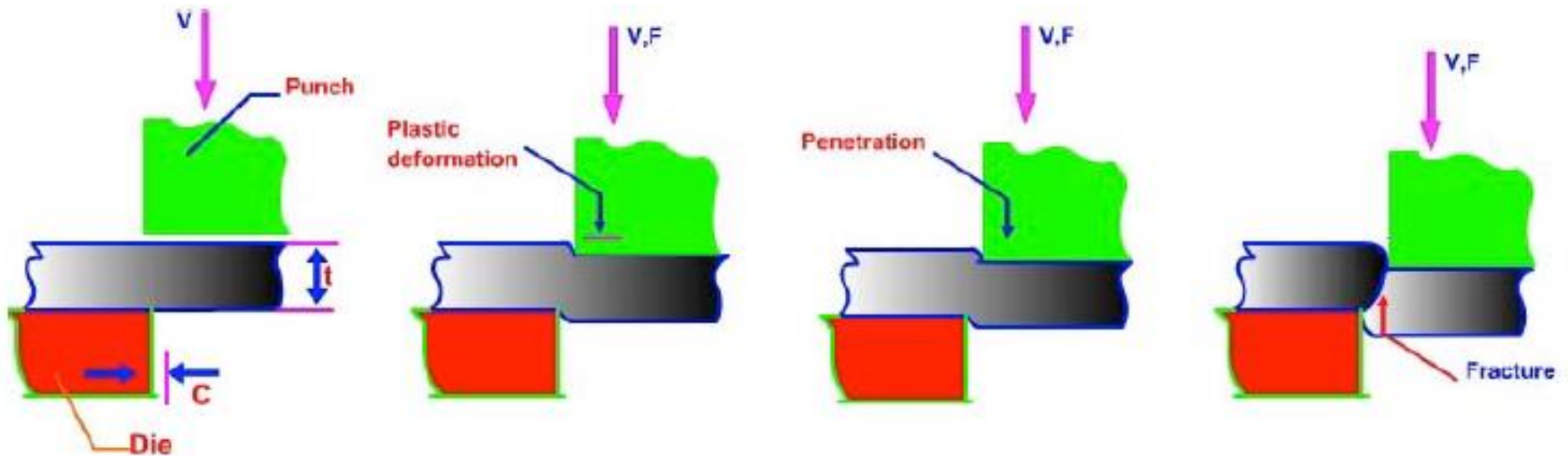


Fig. 2.22 : Coining

Sheet Metal Cutting

- Cutting is an operation by which we can separate a work piece into parts. In this processes, force is applied above ultimate limit of material which cause it to fail. It mainly involves shearing force, hence sometimes it is known as sheet metal shearing processes.

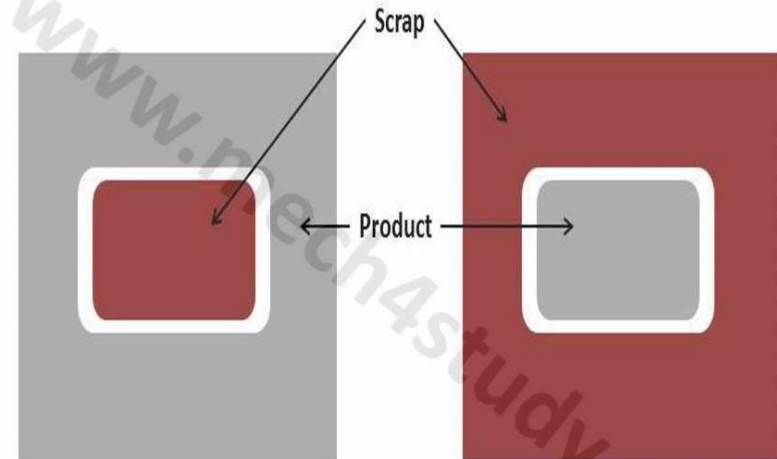


Blanking:

- Blanking is an operation of removing a piece of metal from a large sheet by punching with a predefined shaped punch. The removed part is called blank and it is the useful part and rest sheet is scrap. This process is used to cut gears, jewelry and complex parts.

Punching:

- It is similar operation like blanking except, the desired part is sheet and the blank is scrap. This process takes place on a punching press. The negative allowance is provided on the punch which gives positive tolerance on the sheet.



Punching

Blanking

Piercing:

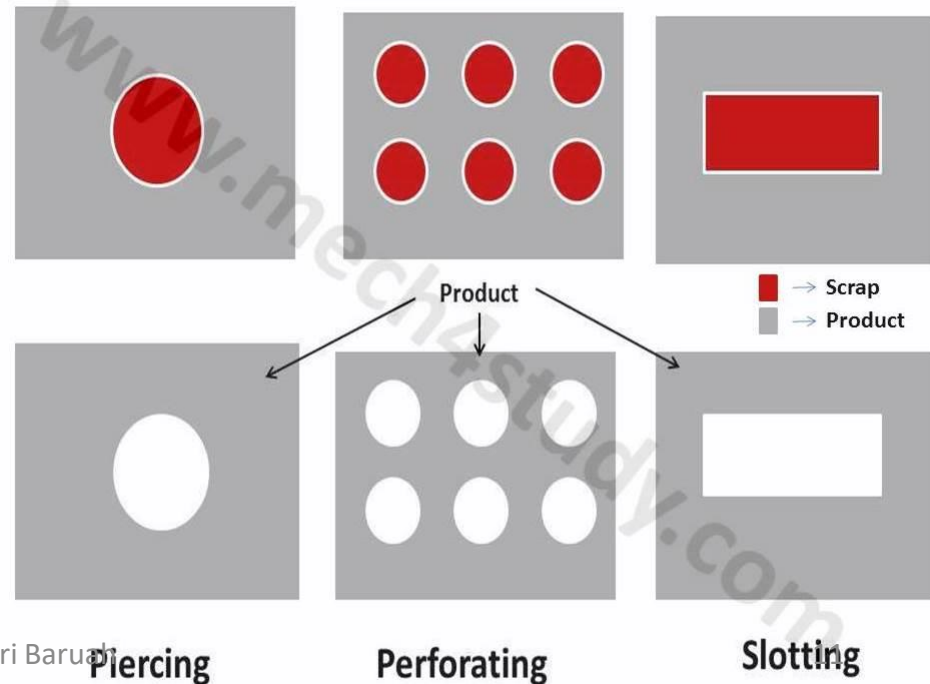
- It is a punching process in which a cylindrical hole cut from the sheet.

Perforating:

- More than one holes cut on a sheet is known as perforating.

Slotting:

- It is an operation of cutting rectangular hole on a sheet.

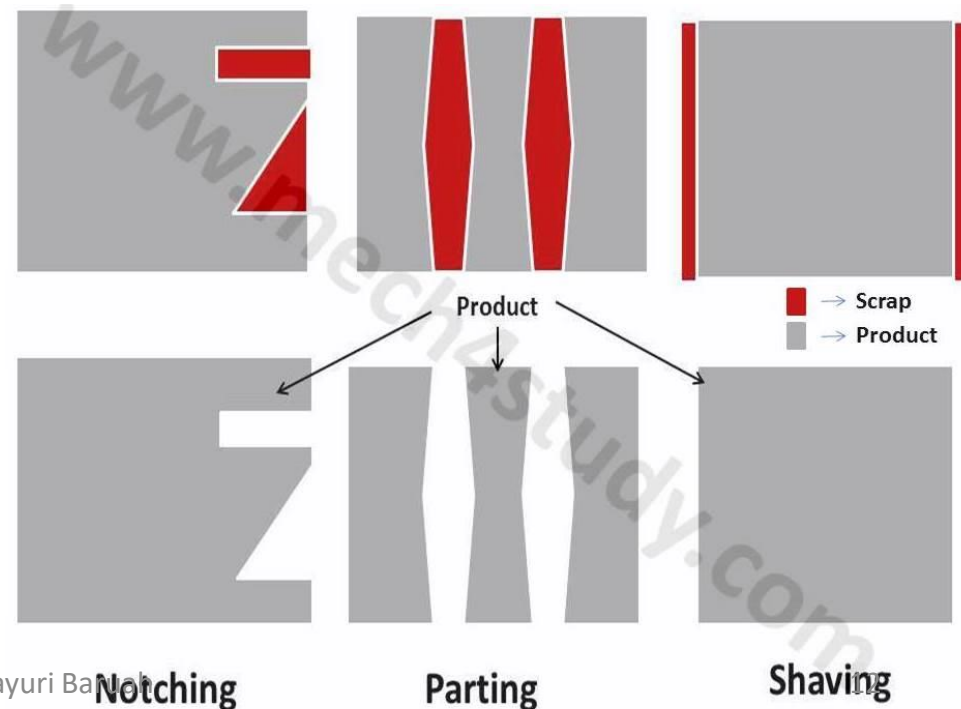


Notching: It is a process of removing various shapes on edges. It creates notches at edges, hence named notching.

Shaving: Shaving is a finishing operation in which a minimum layer of metal is removed from edges using punch and die system.

Parting: It is a shearing operation in which the sheet is converted into two or more piece by removing small blank from the sheet.

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Lancing:

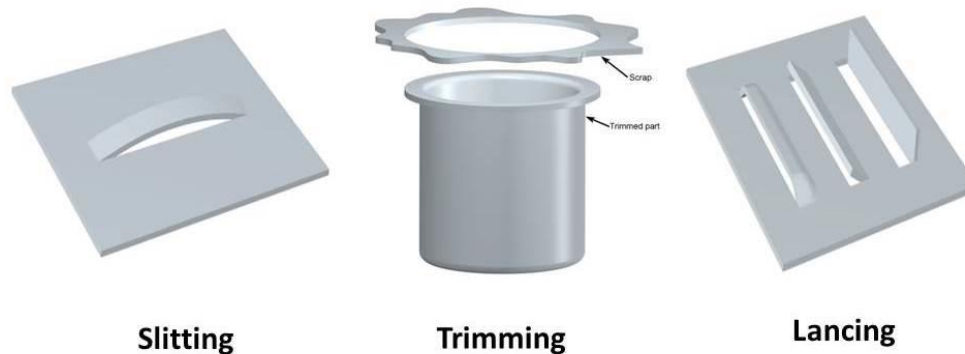
- This is an operation in which punch is formed without removing the blank part. No metal removal takes place. The blank remain attached in bent form.

Slitting:

- Slitting is a process of cut straight line without removing any material as shown in figure.

Trimming:

- Trimming general meaning is removing excess material from work piece. In this process metal is removed from edges by using punch and die.



Advantages of Sheet Metall Parts

- **High strength**
- **Good dimensional accuracy**
- **Good surface finish**
- **Relatively low cost**
- **Economical mass production for large quantities**