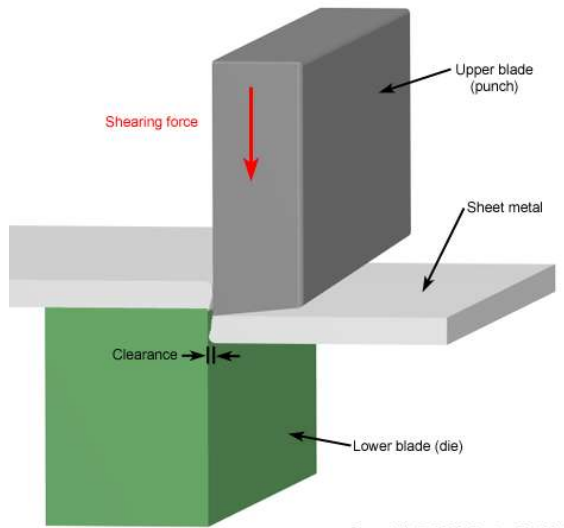
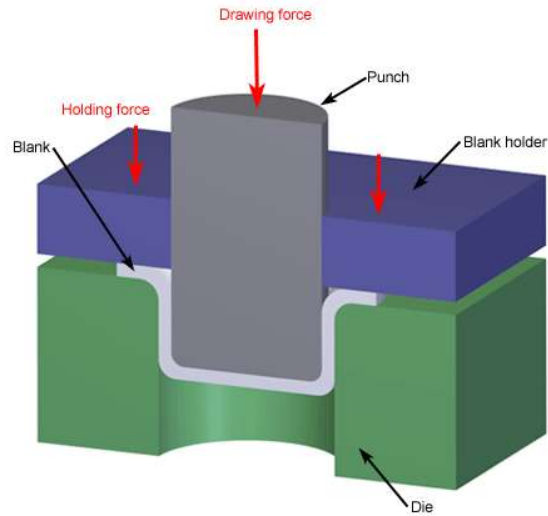


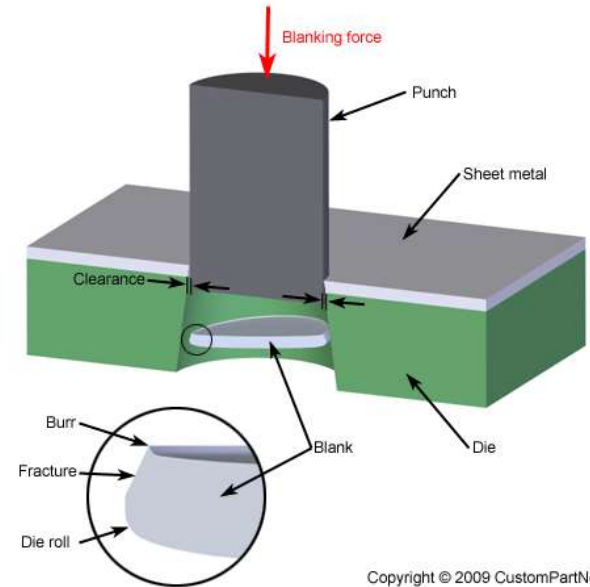
SHEET METAL process



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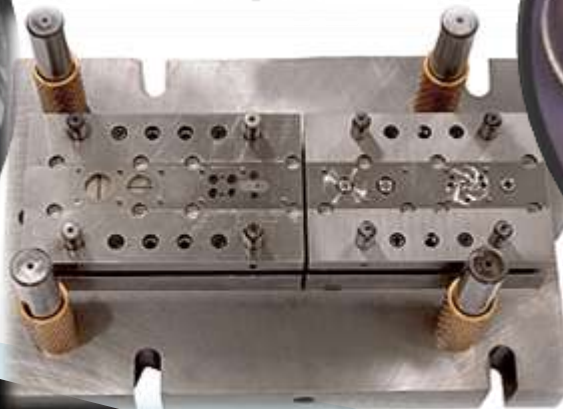


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SHEET METAL FORMING PROCESSES



What is Sheet Metal?

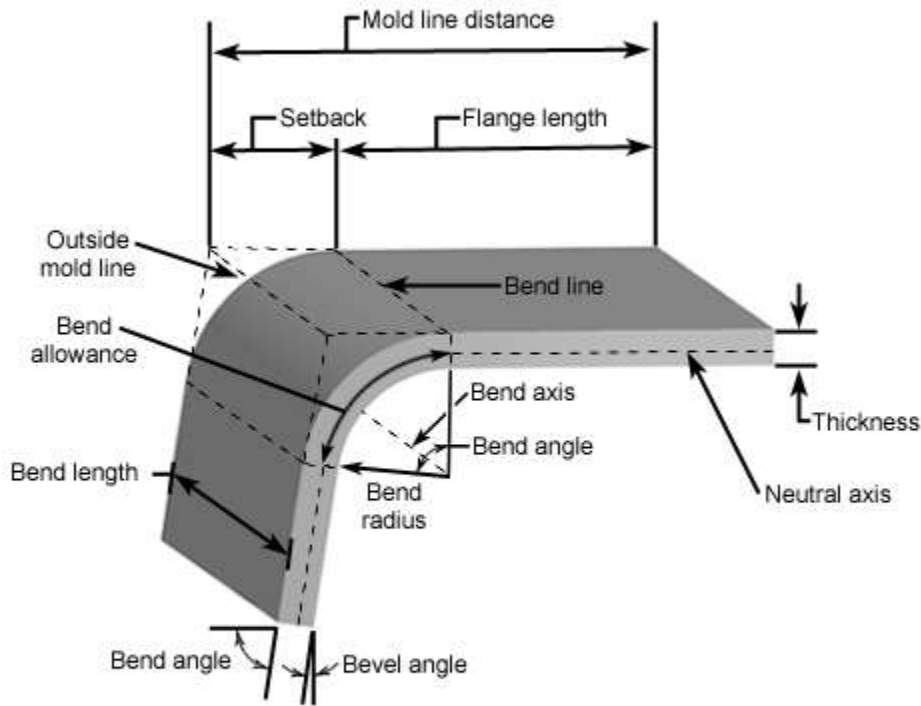
- ▶ A piece of metal whose thickness is between 0.006(0.15 mm) and 0.25 inches(6.35 mm).
 - ▶ Anything thinner is referred to as a foil and thicker is considered as a plate.
 - ▶ Sheet thickness is generally measured in gauge. Greater the gauge number, thinner the sheet of metal.
 - ▶ Sheet metal can be cut, bent and stretched into nearly any shape.
 - ▶ Generally two types of operations are performed- forming and cutting.
- 

Sheet Metal Operations: -

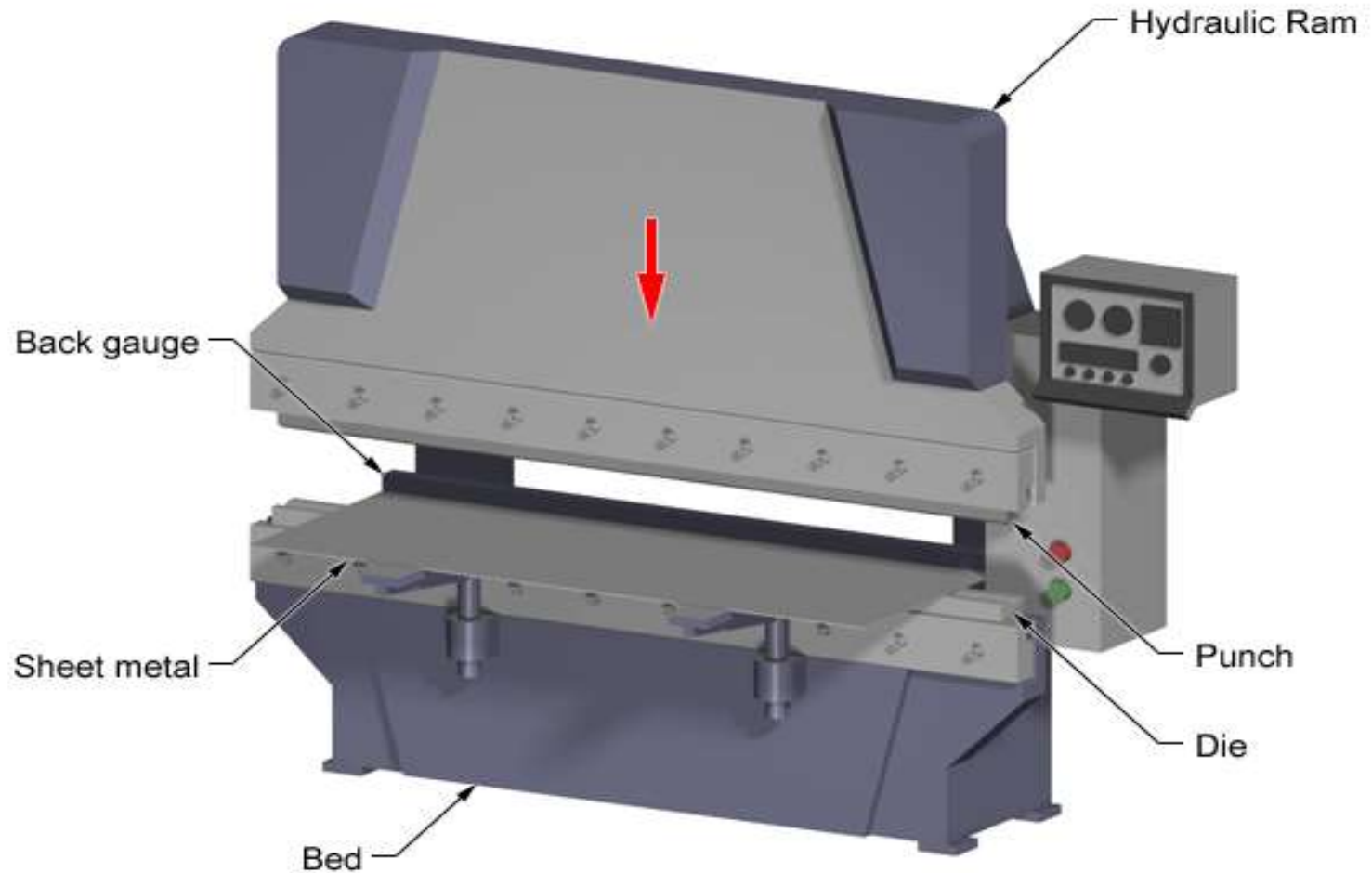
- **BENDING**
 - **SHEARING**
 - **BLANKING**
 - **PUNCHING**
 - **TRIMMING**
 - **PARTING**
 - **SLITTING**
 - **LANCING**
 - **NOTCHING**
 - **PERFORATING**
 - **NIBBLING**
 - **EMBOSSING**
 - **SHAVING**
 - **CUTOFF**
 - **DINKING**
 - **COINING**
 - **DEEP DRAWING**
 - **STRETCH FORMING**
 - **ROLL FORMING**
- 

Bending

- ▶ Bending is a metal forming process in which a force is applied to a piece of sheet metal, causing it to bend at an angle and form the desired shape.



Press Brake machine

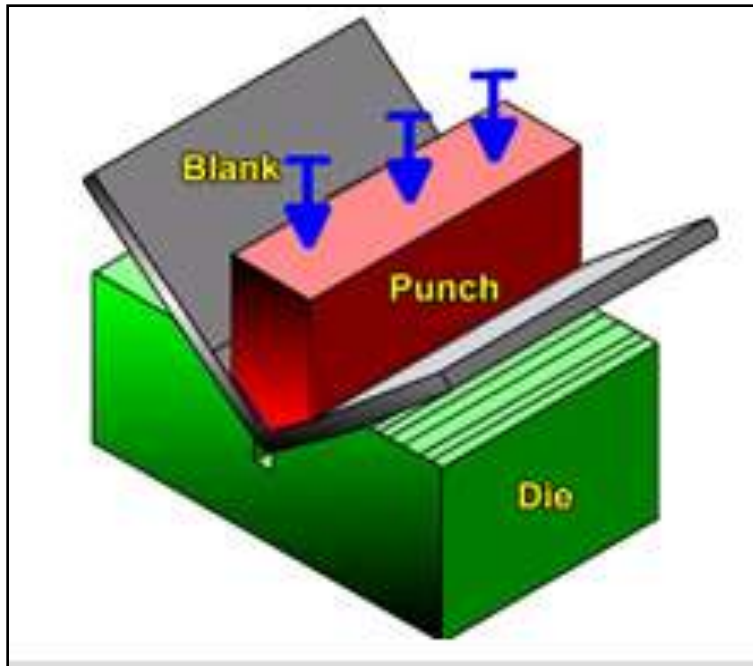


Bending types

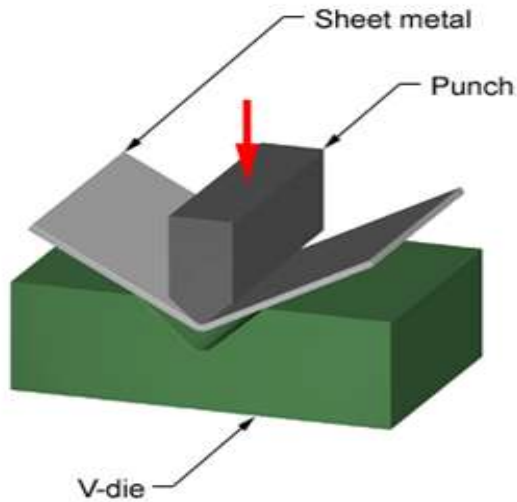
Two common bending methods are:

- ❖ **V-Bending**

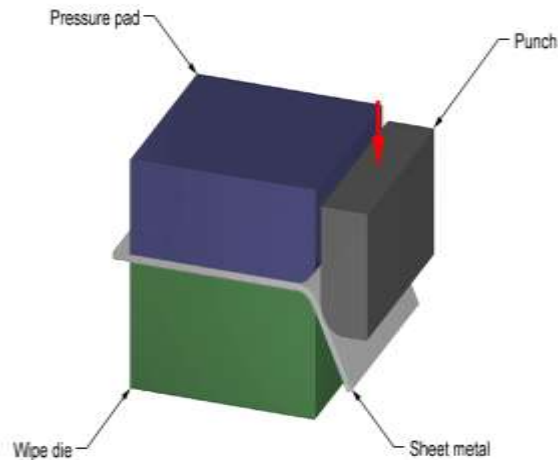
- ❖ **Edge bending**



- ❖ **V-Bending:** The sheet metal blank is bent between a V-shaped punch and die.
- ▶ **Air bending:** If the punch does not force the sheet to the bottom of the die cavity, leaving space or air underneath, it is called "air bending".

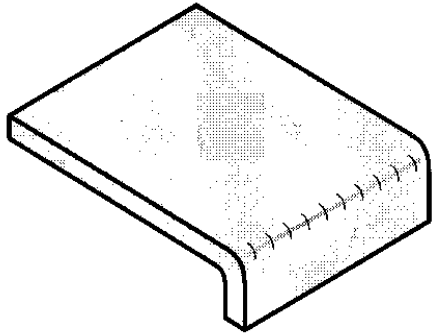


Air Bending

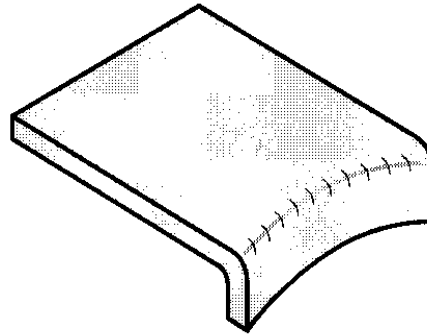


- ▶ **Edge or Wipe Bending:**
Wipe bending requires the sheet to be held against the wipe die by a pressure pad. The punch then presses against the edge of the sheet that extends beyond the die and pad. The sheet will bend against the radius of the edge of the wipe die.

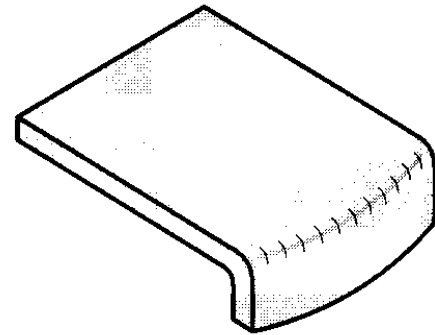
Bending Operations



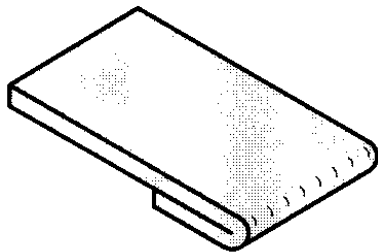
Straight flanging



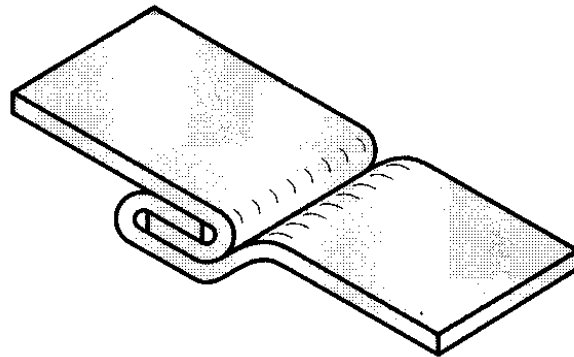
Stretch flanging



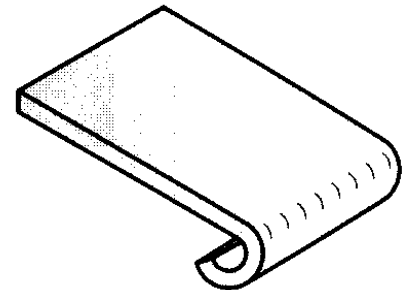
Shrink flanging



Hemming

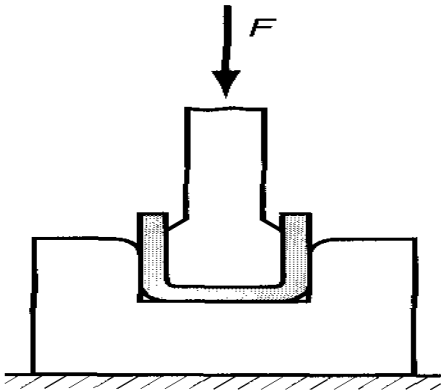


Seaming

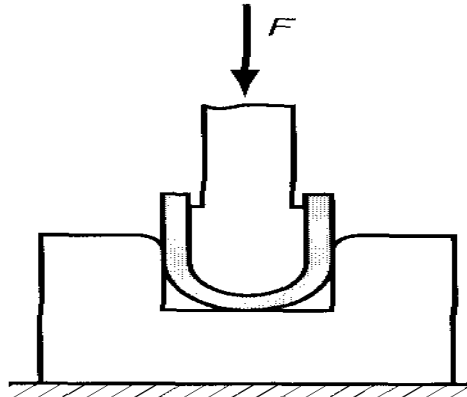


Curling

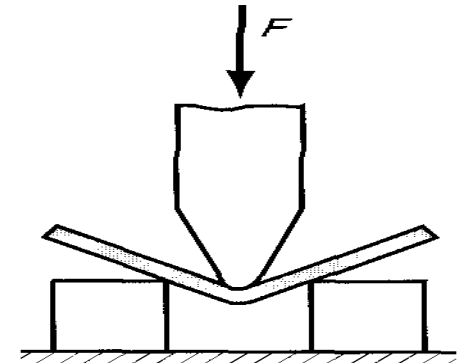
Bending Operations



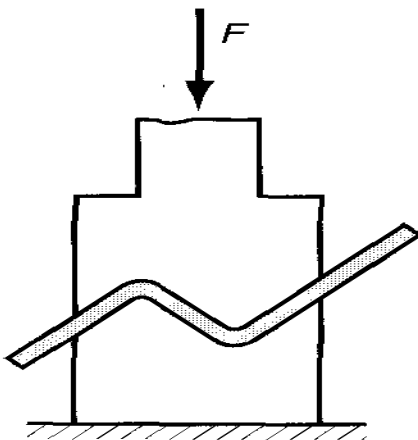
Channel bending



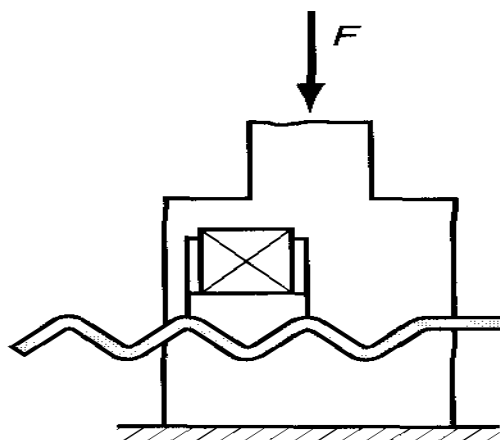
U-bending



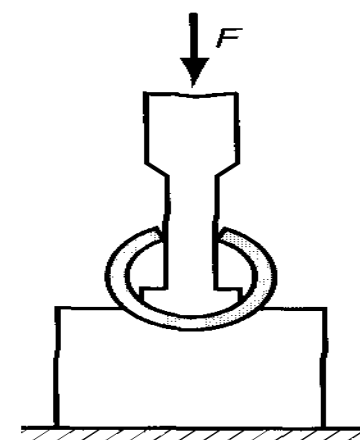
air-bending



Offset-bending

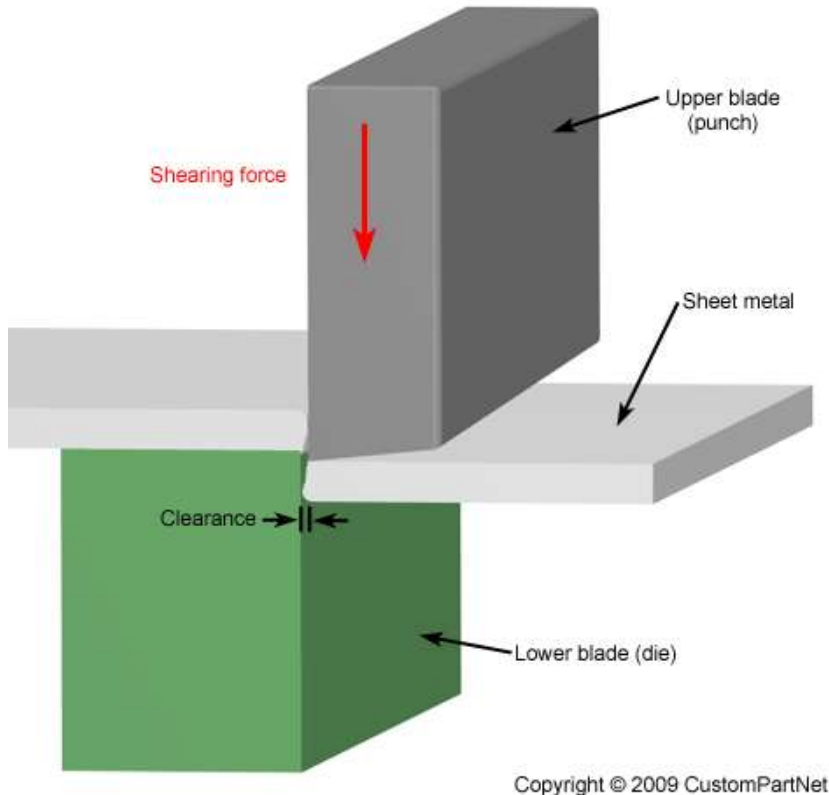


Corrugating



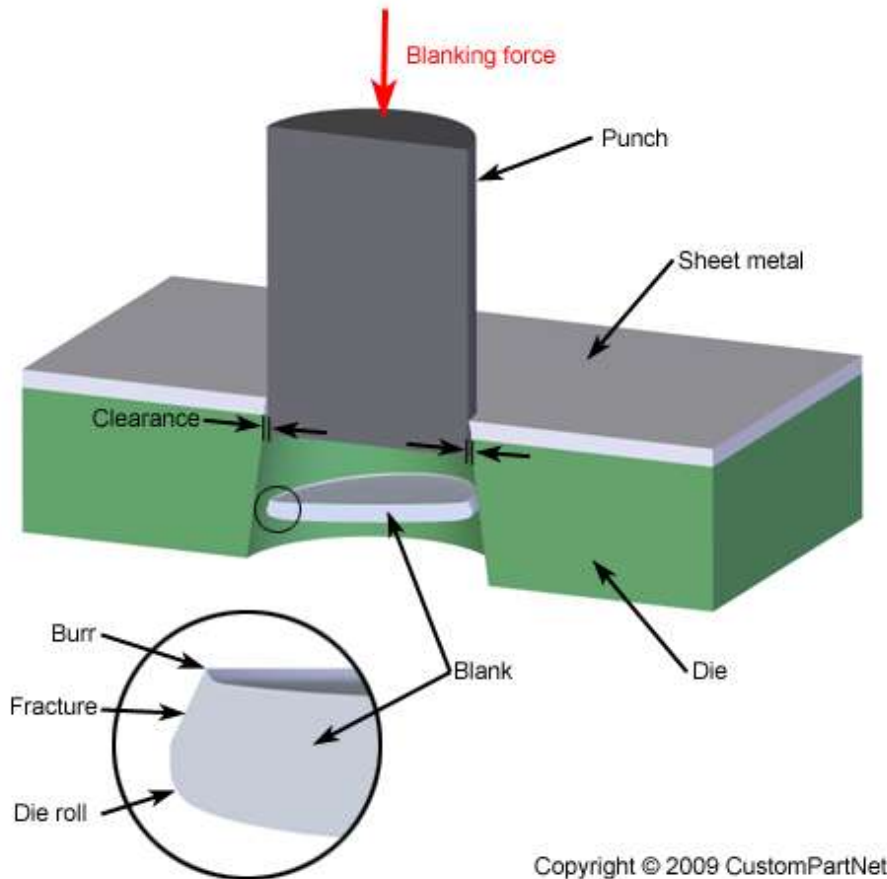
Tube forming

Shearing



- ▶ Shearing is defined as separating material into two parts.
- ▶ It utilizes shearing force to cut sheet metal.

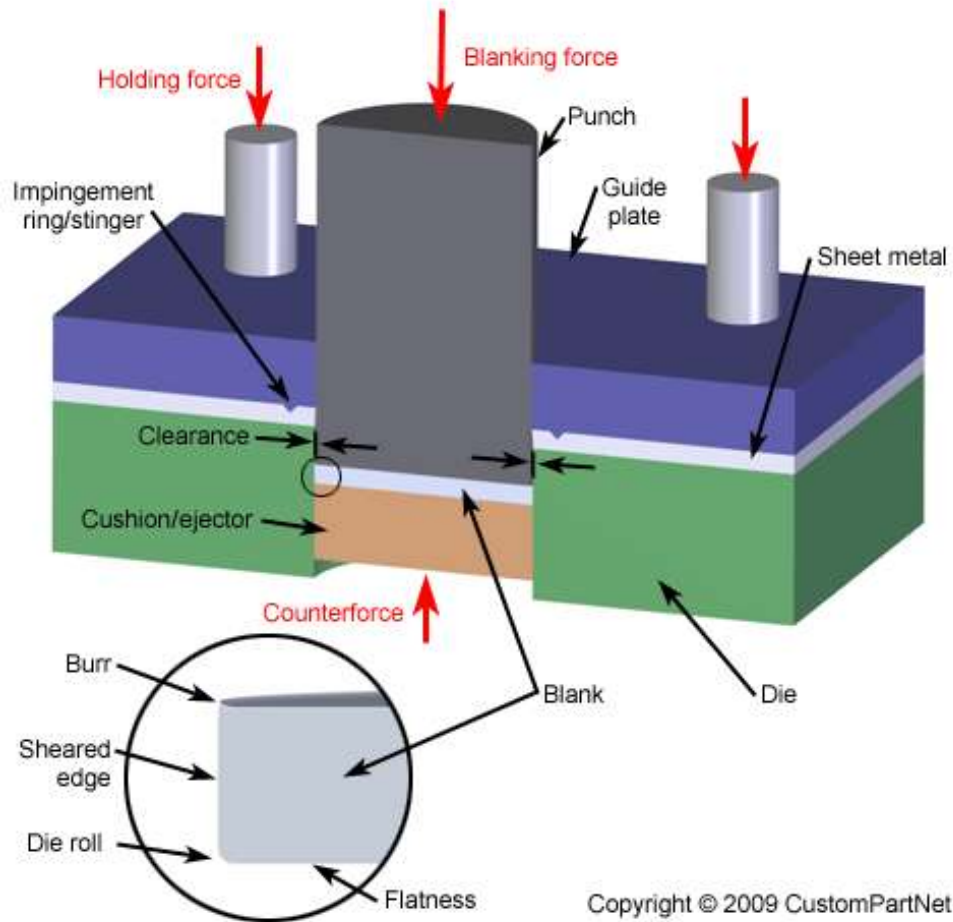
Blanking



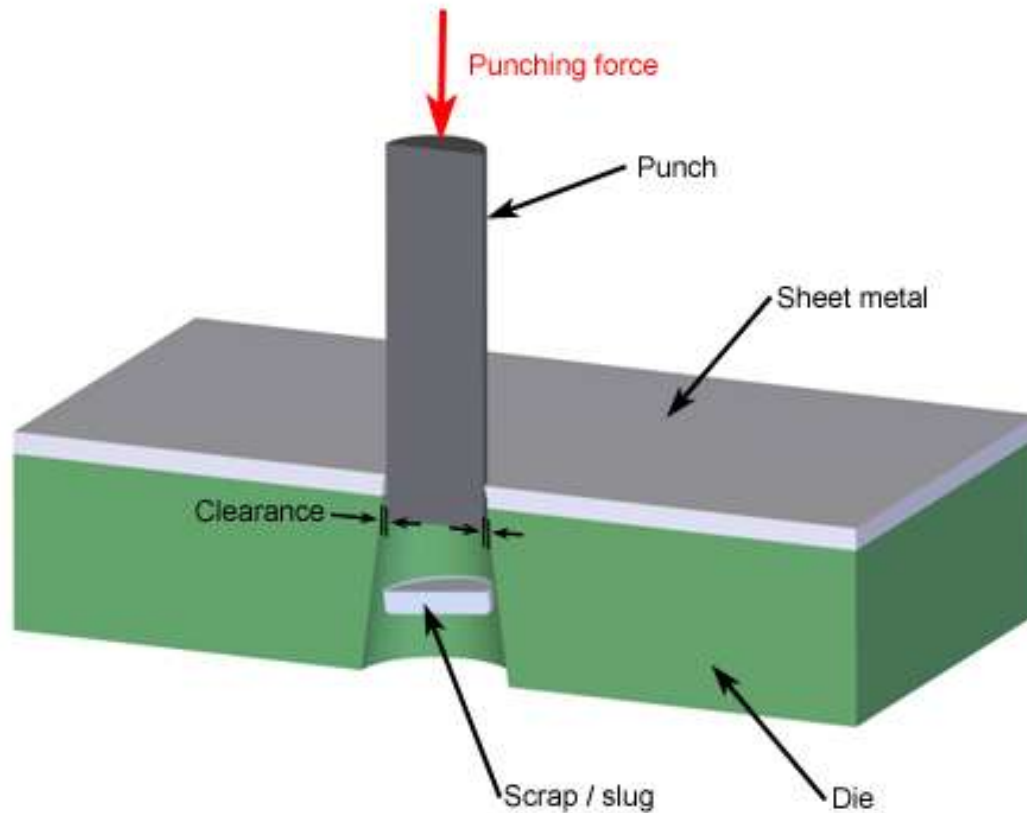
- ▶ A piece of sheet metal is removed from a larger piece of stock.
- ▶ This removed piece is not scrap, it is the useful part.

Fine Blanking

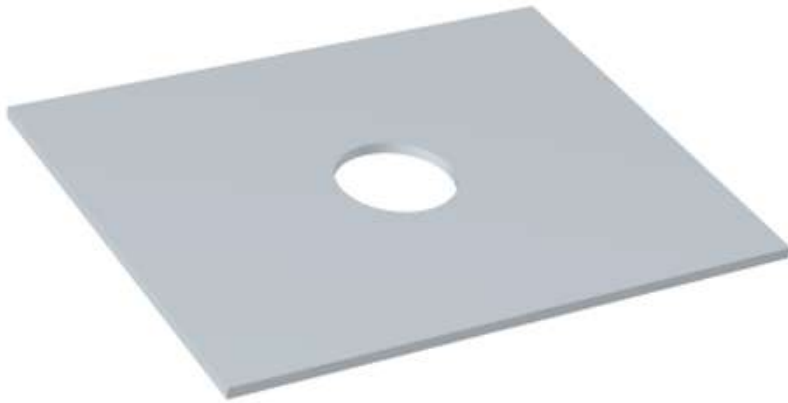
- ▶ A second force is applied underneath the sheet, directly opposite the punch, by a "cushion".
- ▶ This technique produces a part with better flatness and smoother edges.



Punching Operations

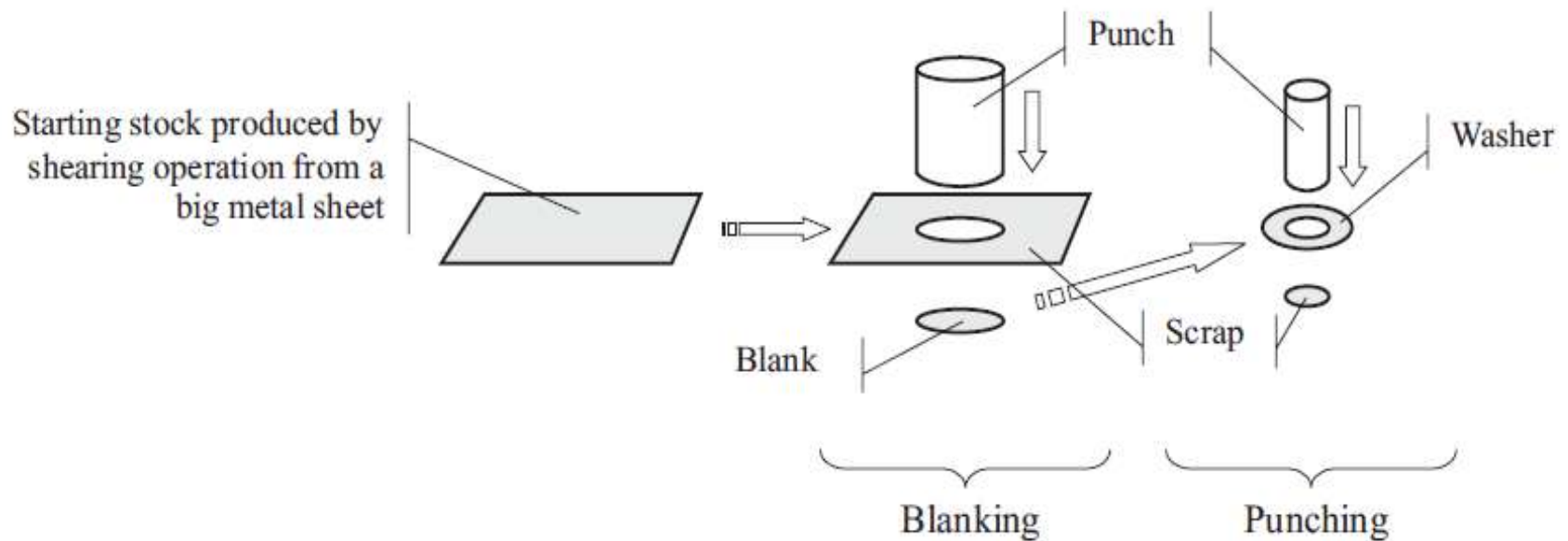


Punching or Piercing



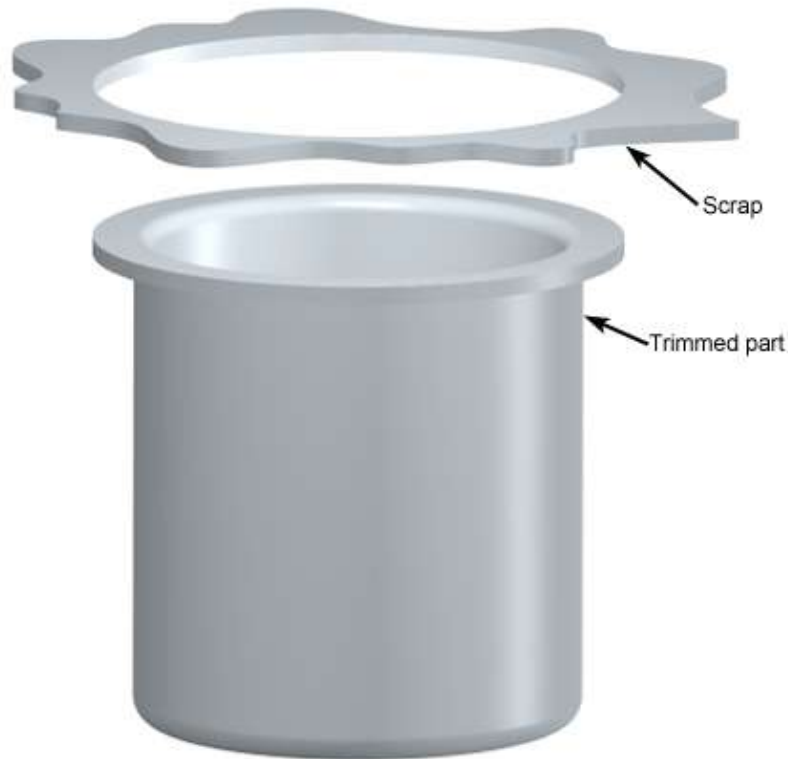
- ▶ The typical punching operation, in which a cylindrical punch pierces a hole into the sheet.

Blanking & Punching example



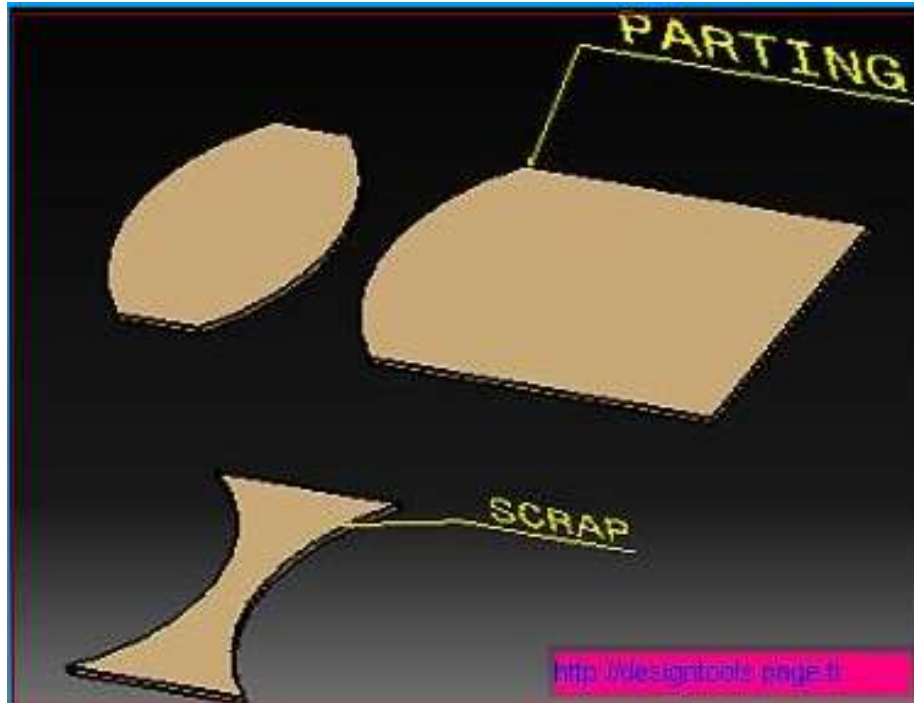
Steps in production of washer

Trimming



- ▶ Punching away excess material from the perimeter of a part, such as trimming the flange from a drawn cup.

Parting



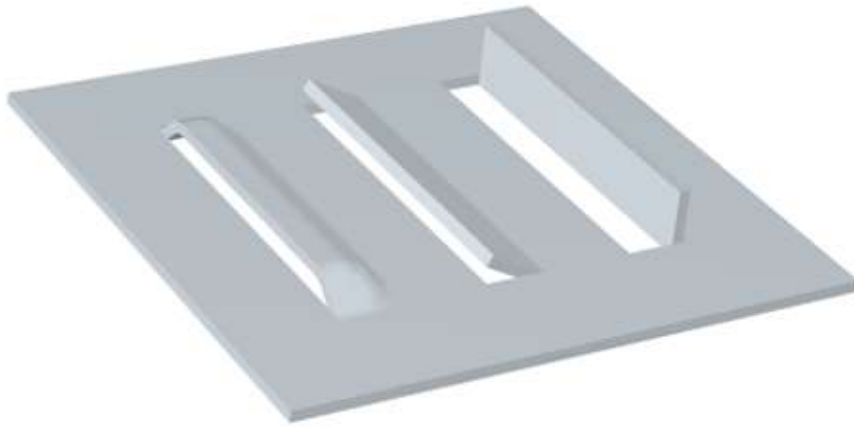
- ▶ Separating a part from the remaining sheet, by punching away the material between parts.

Slitting

- ▶ Cutting straight lines in the sheet. No scrap material is produced.

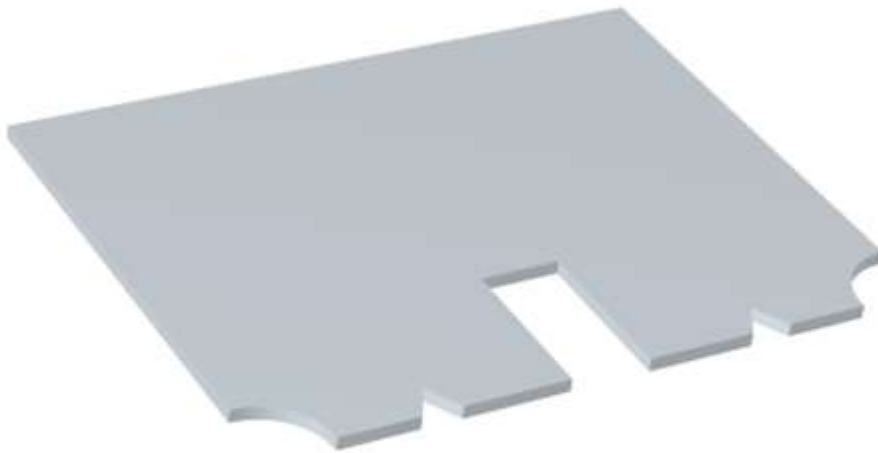


Lancing



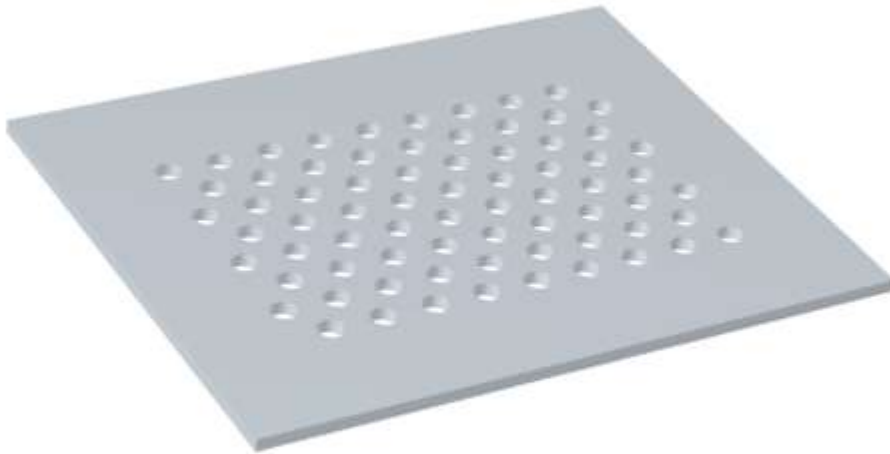
- ▶ Creating a partial cut in the sheet, so that no material is removed. The material is left attached to be bent and form a shape, such as a tab, vent, or louver.

Notching



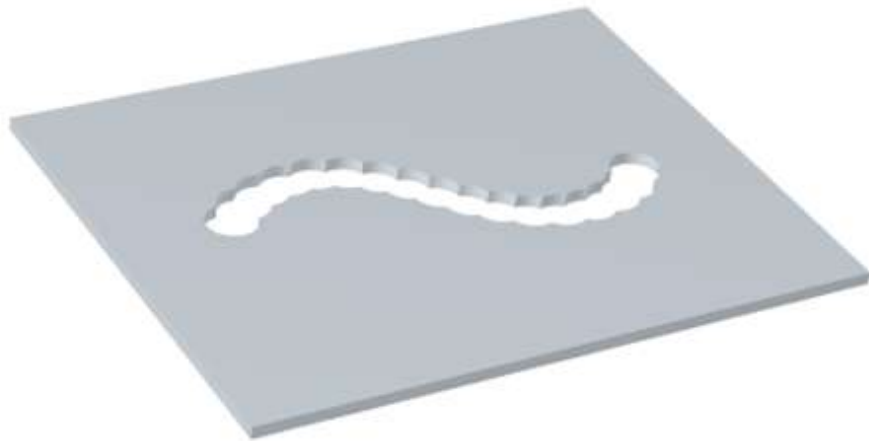
- ▶ Punching the edge of a sheet, forming a notch in the shape of a portion of the punch.

Perforating



- ▶ Punching a close arrangement of a large number of holes in a single operation.

Nibbling



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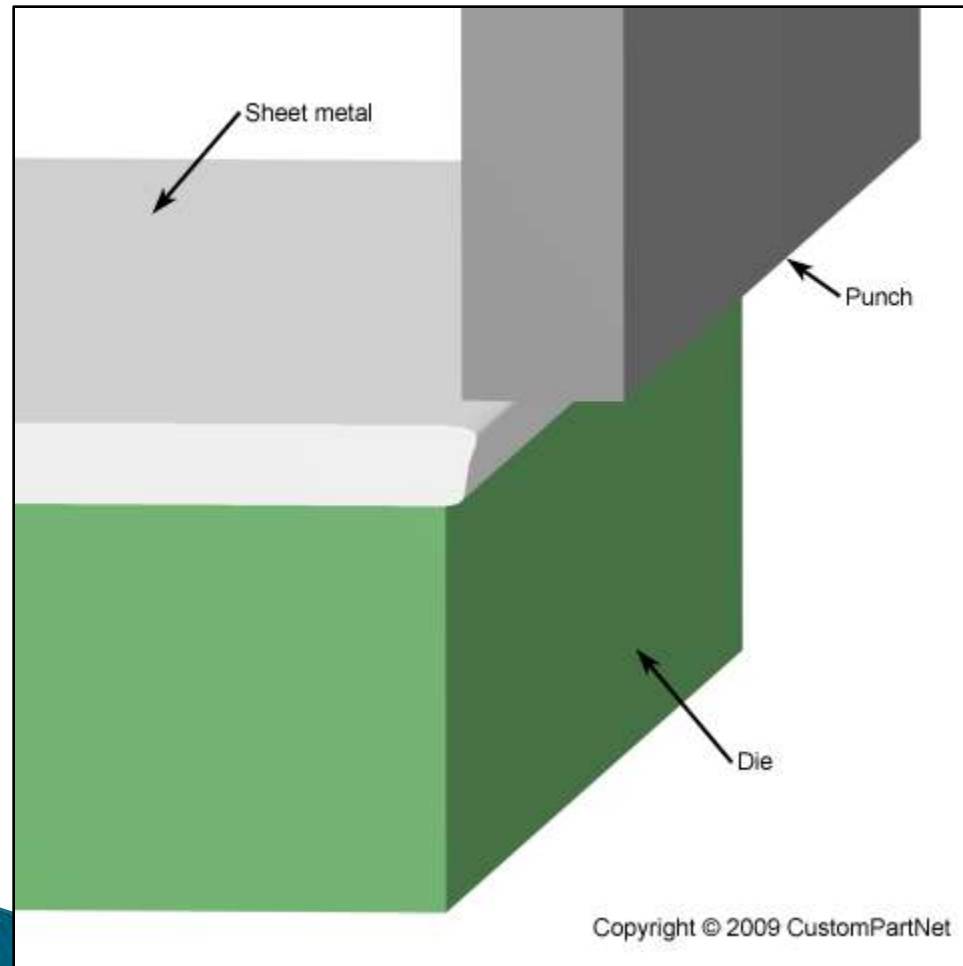
- ▶ Punching a series of small overlapping slits or holes along a path to cut-out a larger contoured shape.

Embossing



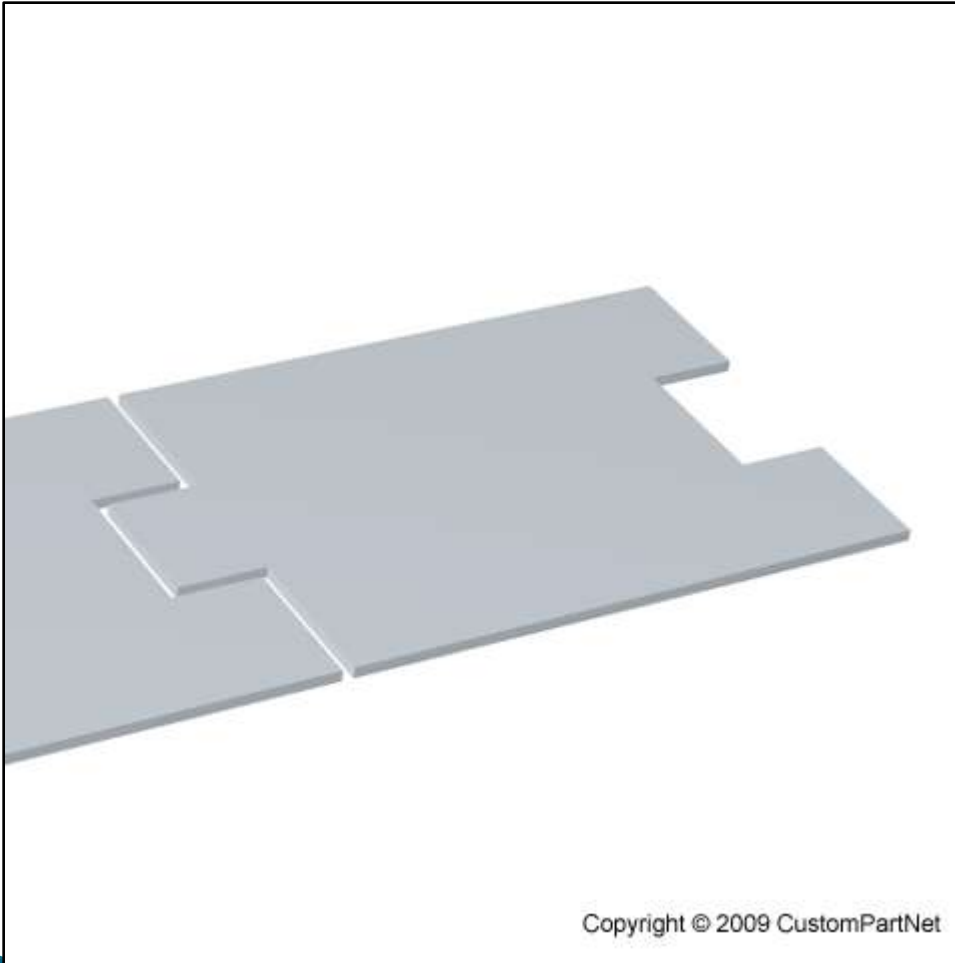
- ▶ Certain designs are embossed on the sheet metal.
- ▶ Punch and die are of the same contour but in opposite direction.

Shaving



Shearing away minimal material from the edges of a feature or part, using a small die clearance. Used to improve accuracy or finish. Tolerances of ± 0.025 mm are possible.

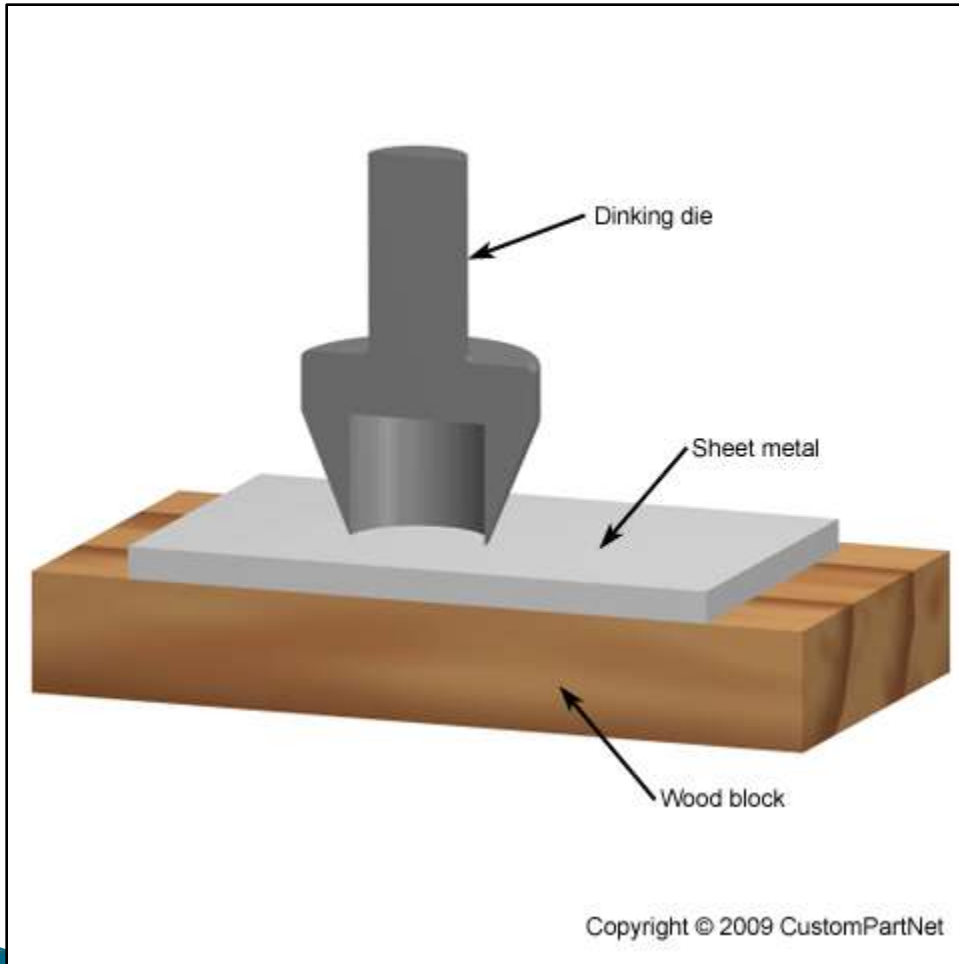
Cutoff



Cutoff – Separating a part from the remaining sheet, without producing any scrap.

The punch will produce a cut line that may be straight, angled, or curved.

Dinking



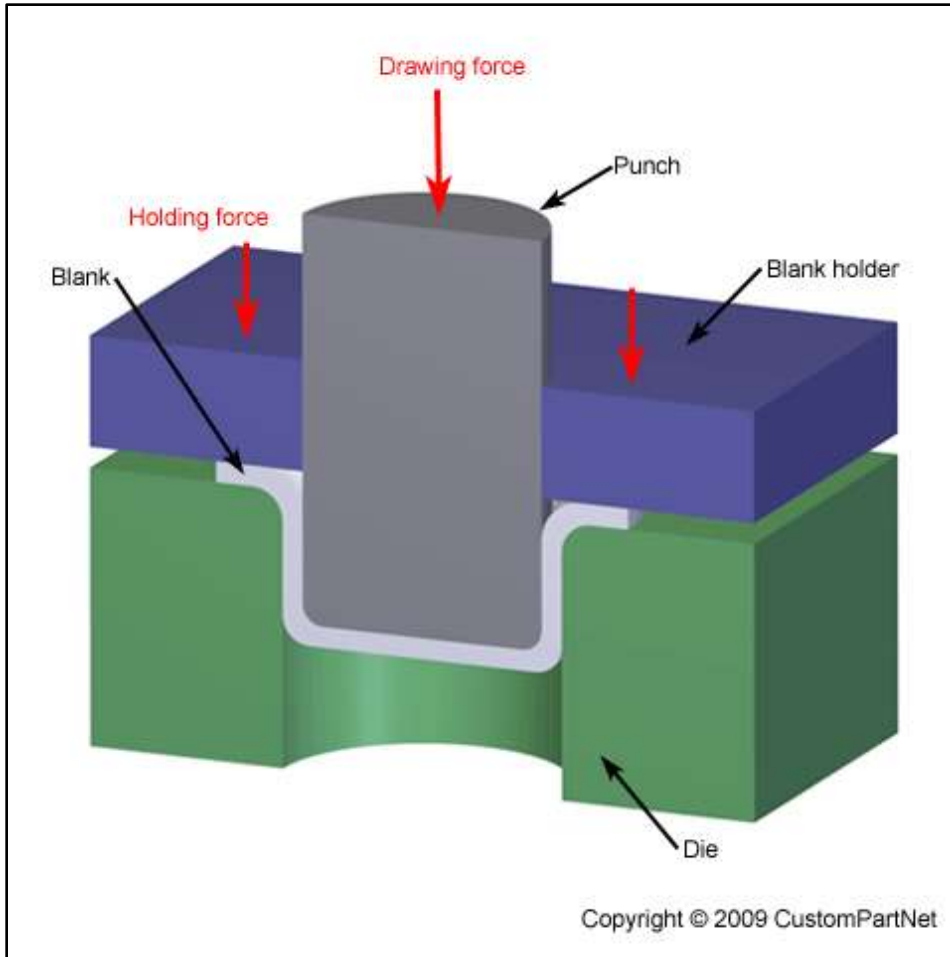
Dinking – A specialized form of piercing used for punching soft metals. A hollow punch, called a dinking die, with beveled, sharpened edges presses the sheet into a block of wood or soft metal.

Coining



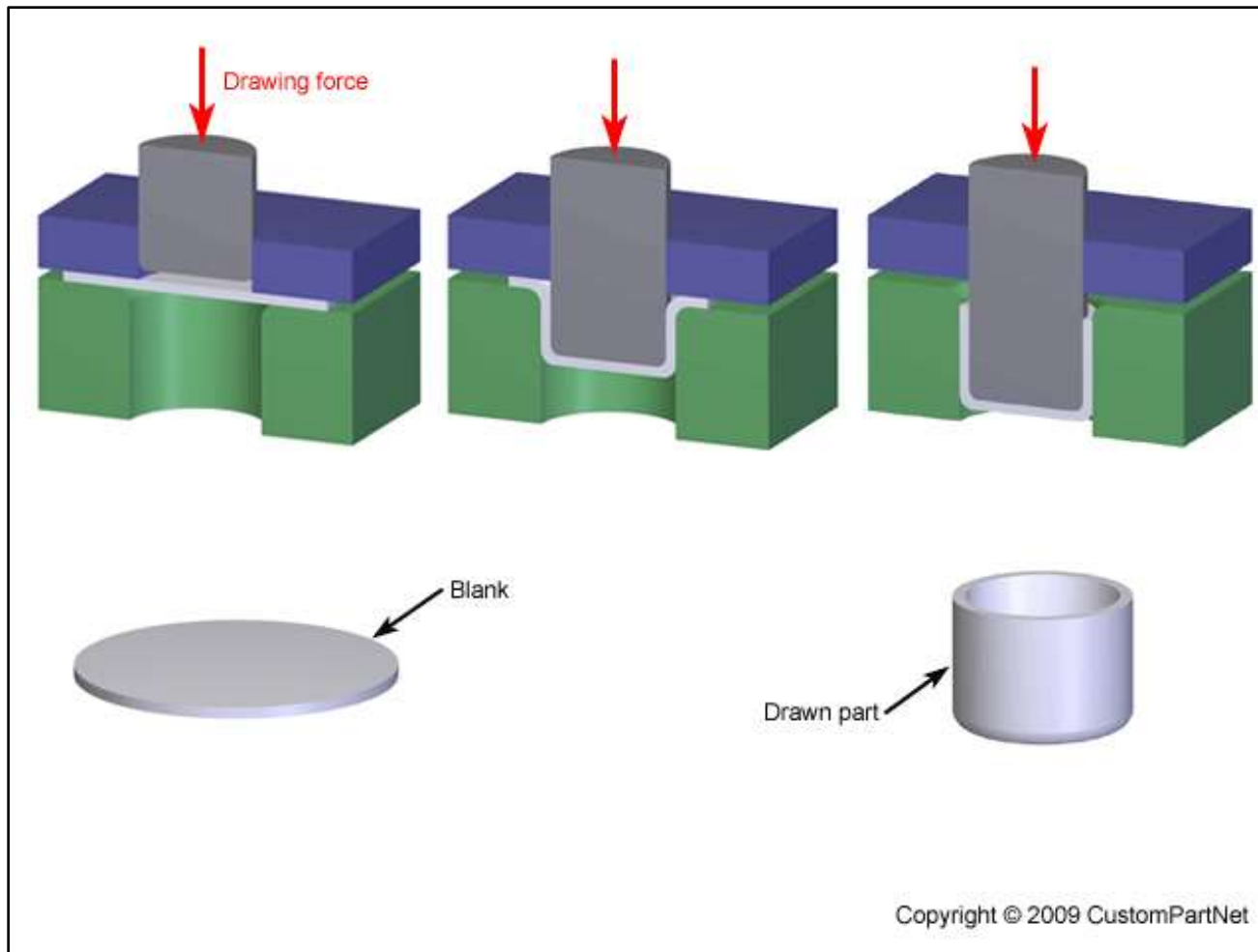
- ▶ Similar to embossing with the difference that similar or different impressions are obtained on both the sides of the sheet metal.

Deep Drawing

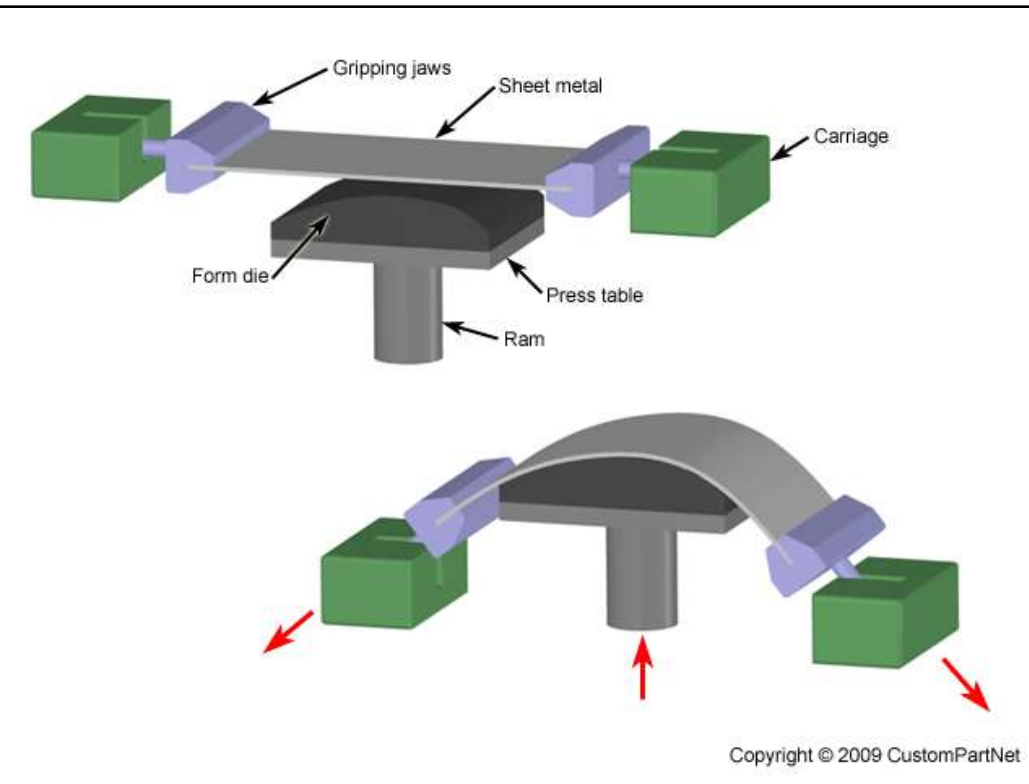


- ▶ Deep drawing is a metal forming process in which sheet metal is stretched into the desired shape.
- ▶ A tool pushes downward on the sheet metal, forcing it into a die cavity in the shape of the desired part.

Deep Drawing Sequence

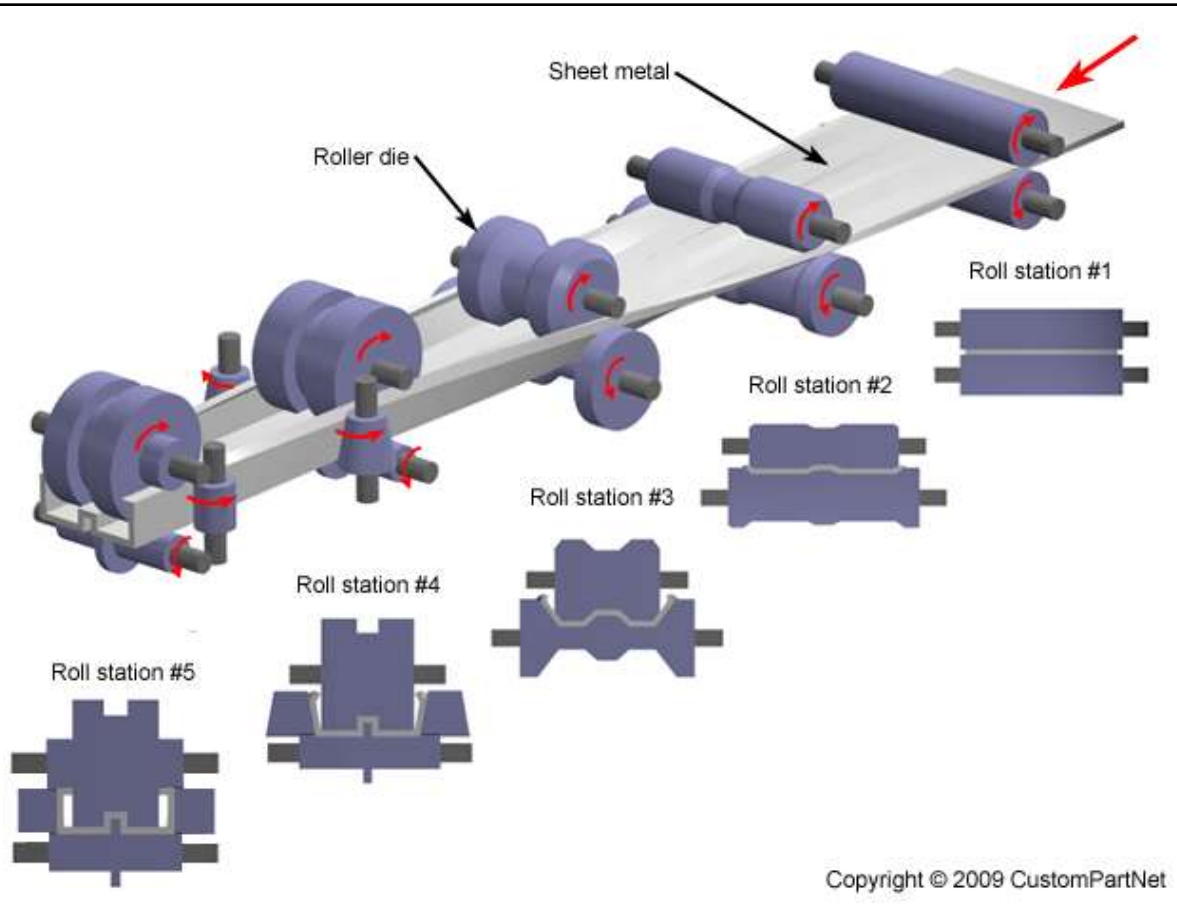


Stretch Forming



- ▶ Stretch forming is a metal forming process in which a piece of sheet metal is stretched and bent simultaneously over a die in order to form large bent parts.

Roll Forming



Roll forming is a continuous bending operation in which a long strip of sheet metal is passed through sets of rolls mounted on consecutive stands, each set performing only an incremental part of the bend, until the desired cross-section profile is obtained.

Roll forming is ideal for producing constant-profile parts with long lengths and in large quantities.

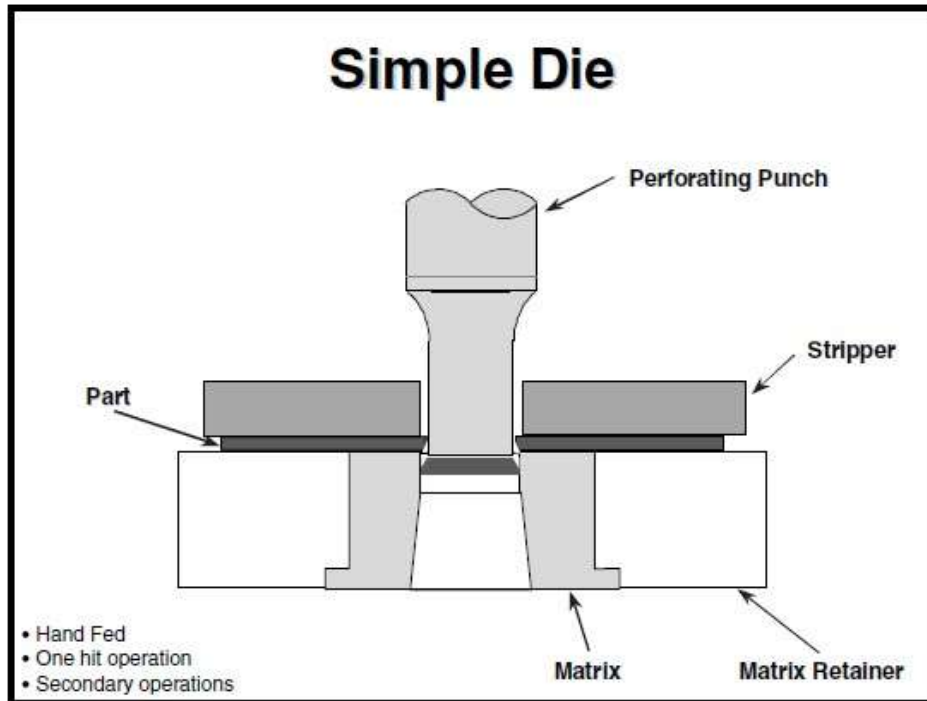
Dies: -



Made up of tool steel and used to cut or shape material.

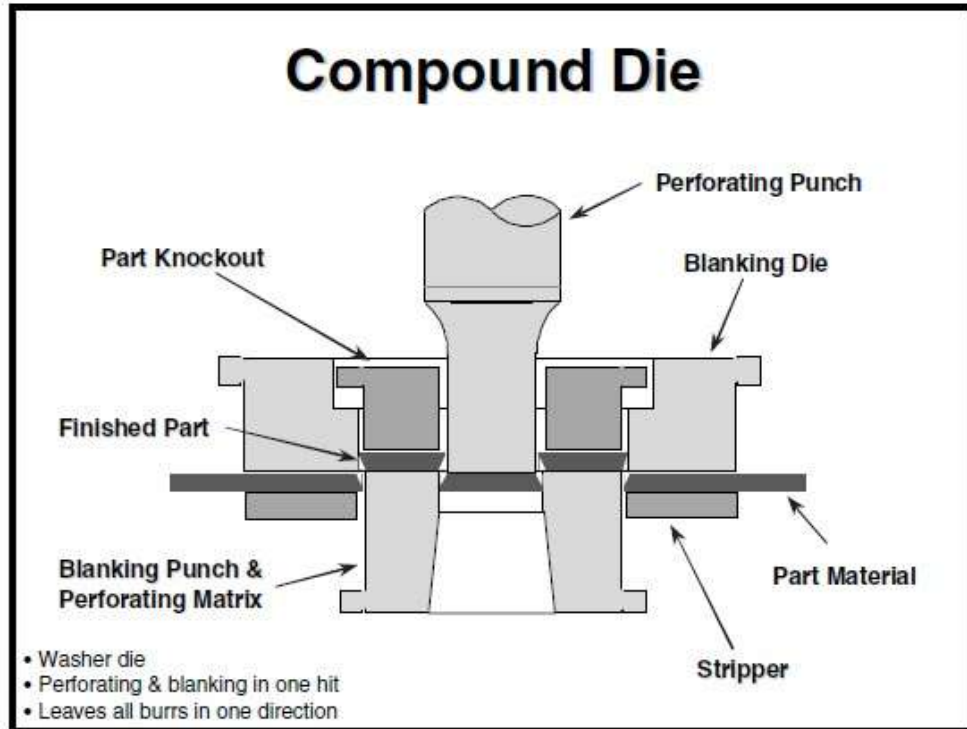
1. Simple die
2. Compound die
3. Combination die
4. Progressive die

Simple Die



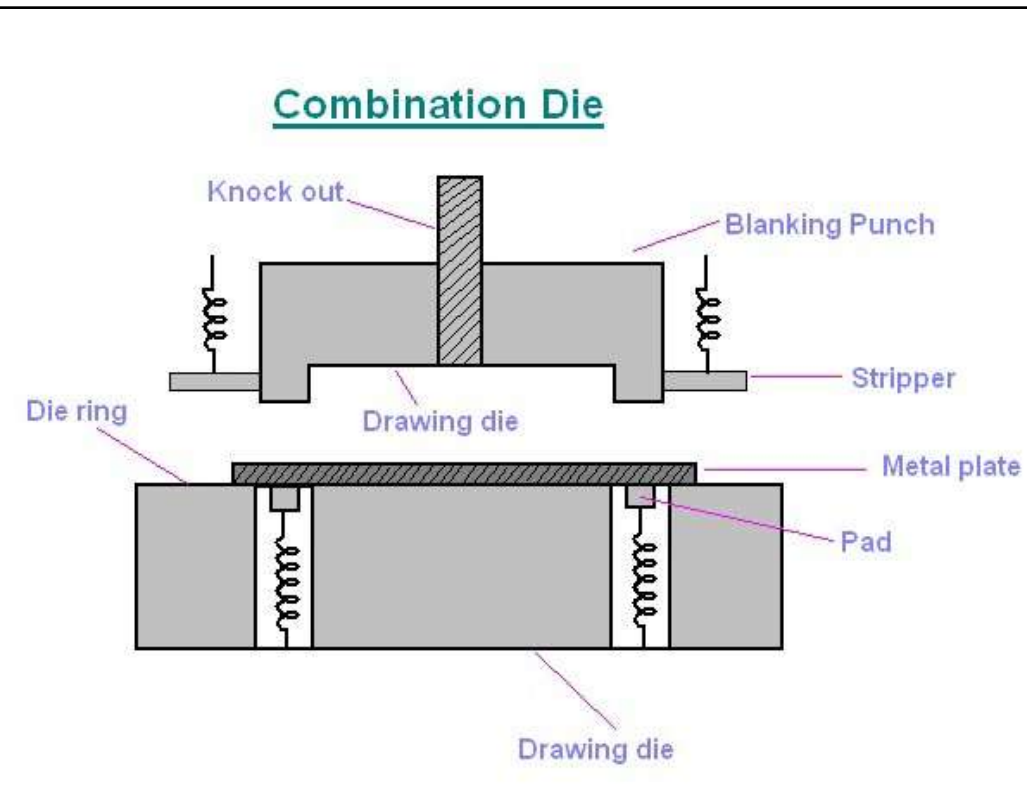
- ▶ Simple dies or single action dies perform single operation for each stroke of the press slide.
- ▶ The operation may be one of the cutting or forming operations.

Compound Die



- ▶ In these dies, two or more operations may be performed at one station.
- ▶ Such dies are considered as cutting tools since, only cutting operations are carried out.

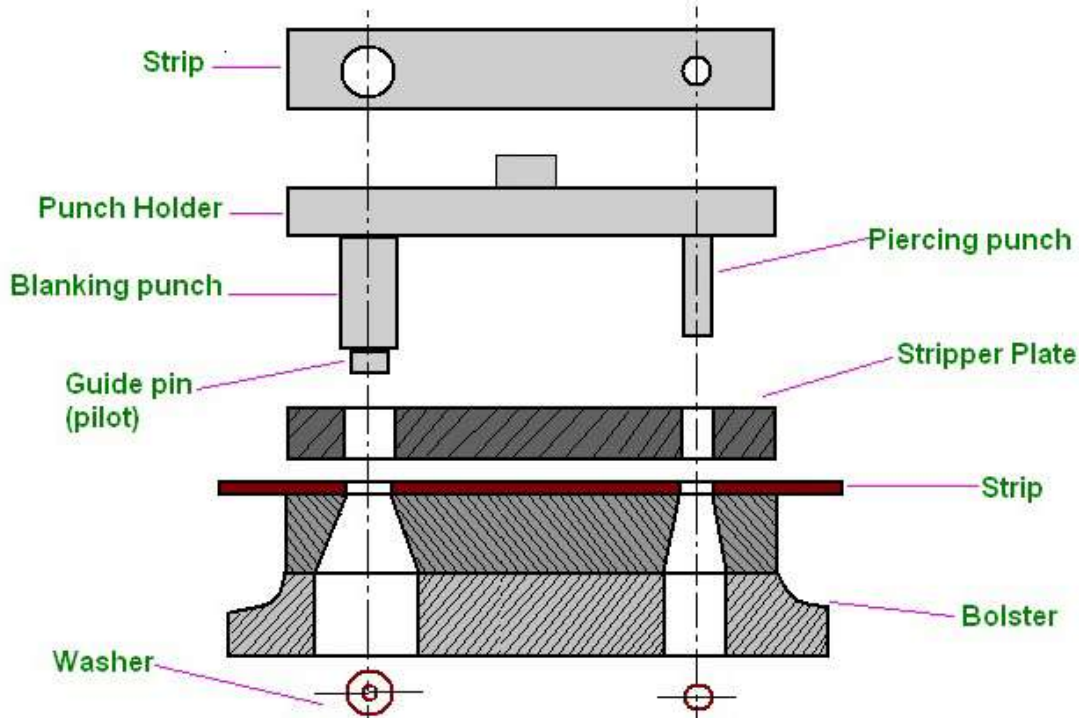
Combination Die



- ▶ In this die also , more than one operation may be performed at one station.
- ▶ It is different from compound die in that in this die, a cutting operation is combined with a bending or drawing operation, due to that it is called combination die.

Progressive Die

Progressive Die



- ▶ A progressive has a series of operations.
- ▶ At each station, an operation is performed on a work piece during a stroke of the press.

Progressive Die

