

01/06/2020

Thermofforming

Thermofforming is process where thermoplastic polymer sheet is heated & deformed into desired shape.

Process - ① Heating plastic sheet to the temp. where it softens.

② stretching the softening polymer against a cold mold surface.

③ cooling the finished part and trimming excess plastic.

Steps of thermofforming - ① Heating - is accomplished by radiant electric heater which is located by at the distance of 125 mm (5 in) from the sheet.

② Forming - After heating, the polymer sheet is curved flat or formed into various either air pressure, vacuum or mechanical. So according to the forming techniques, thermofforming are 3 types -

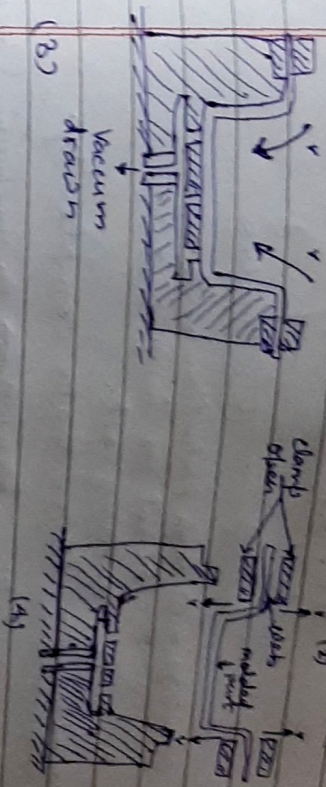
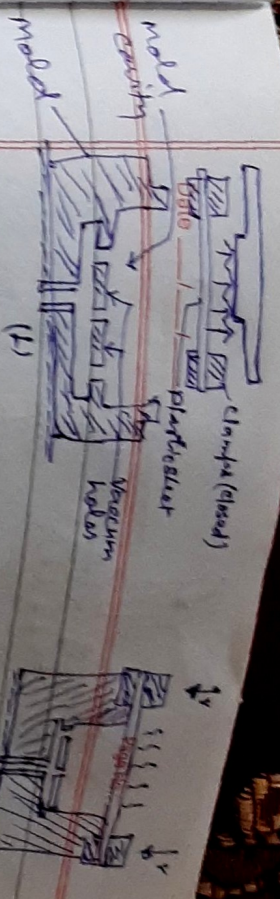
① Vacuum forming ② Pressure forming ③ Mechanical forming

→ It is the earliest method of thermofforming.

→ In vacuum forming, vacuum is created below the preheated plastic sheet to draw sheet into the cold mold cavity.

→ The basic steps of vacuum forming are,

1. A flat plastic sheet is heated by radiant heater, which is placed on one or either side of the plastic of 125 mm distance.
2. The softened sheet is placed over a concave cavity.
3. Vacuum draws the sheet to sheet to the cold cavity.
4. The product is cooled & extra plastic parts are trimmed.



Advantages → ① Operated comparatively, low vacuum pressure.

② Relatively cheap.

Disadvantages → ① Uneven wall thickness at corner of the product.

② Bad finishing or non-uniform plastic concentration.

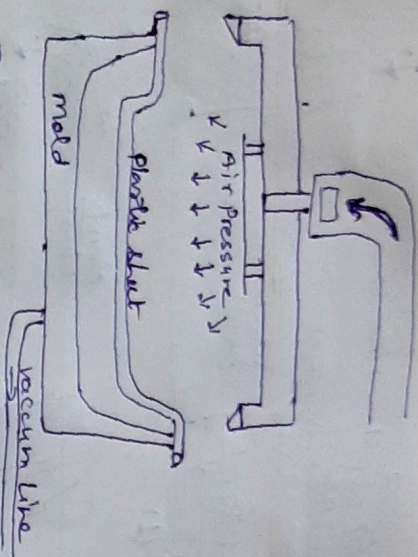
③ Therefore the thinnest area occur at the corner, near the clamp.

Pressure forming → Alternative to vacuum forming.

→ Here, the air press. is forced to the preheated sheet into cold mold. Here, the air press. of press. is much higher than the vacuum forming.

→ The basic difference b/w vacuum forming & the heated sheet is pressered from above the mold cavity.

→ Due to high press., the heated sheet can be deformed in fraction of second. (High production rate)



- Advantages -
- ① High production rate.
 - ② Efficient for large part.
 - ③ Low tooling cost.

Disadvantages - Limited shape complexity.

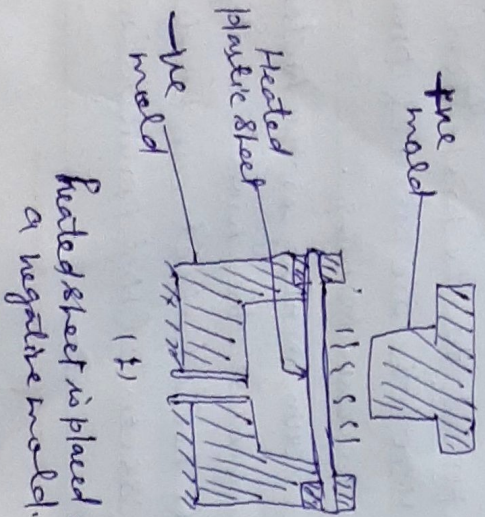
③ Mechanical thermofforming \Rightarrow On mechanical forming,

air pressure or vacuum press don't use to drag the plastic sheet.

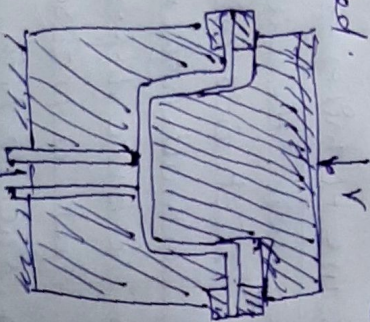
\Rightarrow Here, positive (male) & negative (female) mold are brought againsts heated plastic sheet, forcing it to the assumed shape.

\Rightarrow Air blw the die & sheet is evacuated by using vacuum pump, and sheet conforms to the mold ~~shape~~ shape.

\Rightarrow Formed part is cooled & ejected.



Heated plastic sheet
The mold
(1)



(2) Air escape
mold is ~~colored~~ colored
to shape to sheet

Advantages -

- ① Better dimensional control.
- ② opportunity for surface detailing of both sides of the parts.

Disadvantages \rightarrow ① Two mold halves are required.

② Relatively costly.

materials used -

- ① ABS (Acrylonitrile butadiene styrene)
- ② Cellulose acetate.
- ③ LDPE (Low density polyethylene)
- ④ HDPE (High density polyethylene)
- ⑤ PVC etc.

Applications \Rightarrow Thermofforming have many application like

1. Food packaging
2. Auto motive parts
3. Air craft windcreens
4. Vehicle doors etc.

Thermofforming \Rightarrow Advantages

- ① Flexible design.
- ② Rapid prototype development.
- ③ High production rate.
- ④ Low setup cost.
- ⑤ Less thermal stress.

Disadvantages -

- ① Not eligible for thermosets.
- ② All parts need to be trimmed.
- ③ Part may non uniform thickness.