

UNIT - IV

SHEET METAL PROCESS

1 **What is punching operation ?**

Ans : It is the cutting operation with the help of which various shaped holes are produced in the sheet metal. It is similar to blanking; only the main difference is that, the hole is the desired product and the material punched out to form a hole is considered as a waste.

2 **What is super plastic forming operation ?**

Ans: Superplastic forming is a metalworking process for forming sheet metal. It works upon the theory of superplasticity, which means that a material can elongate beyond 100% of its original size.

3 **What is press brake?**

Ans: Press brake (bending brake) is an open frame press used for bending, cutting and forming. Generally, it handles long workpieces in the form of strips. Usually press brake have long dies and suitable and suitable for making long straight line bends.

4 **Define hydro forming process.**

Ans : Hydro forming is a process which can be carried out in two ways:

1) Hydro - mechanical forming

2) Electro - hydraulic forming
Hydro - mechanical forming: In this method , the blank is placed over the punch whose shape is similar to inner of the final workpiece.

Electro - hydraulic forming : This method involves the conversion of electrical energy into mechanical energy in a liquid medium. Electric spark in a liquid produces shock waves and pressures which can be used for metal forming.

5 **Give the difference between punching and blanking.**

Ans:

Blanking : It is the cutting operation of a flat metal sheet. The article punched out is known as blank. Blank is the required product of the operation and the metal left behind is considered as a waste.

Punching: It is similar to blanking; only the main difference is that, the hole is the desired product and the material punched out to form a hole is considered as a waste.

6 **How is hydro forming is similar to rubber forming ?**

Ans : In both the sheet metal working processes sheet metal is pressed between a die and rubber block.

Under pressure, the rubber and sheet metal are driven into the die and conform to its shape by forming the part.

7 **What do you mean by minimum bend radius?**

Ans: It is the radius of curvature on inside surface of the bend. If the bend radius is too small, then cracking of a material on the outer tensile surface takes place. To prevent any damage to punch and die, the bend radius should not be less than 0.8mm.

8 **Define limiting drawing ratio.**

Ans : It is the ratio of finished shell diameter (d) to the radius of bottom corner(r).

9 **Define Embossing.**

Ans : With the help of this operation, specific shapes or figures are produced on the sheet metal.

It is used for decorative purpose or giving details like names, trade marks, specifications, etc. On the sheet metal.

10. What are the factors affecting shearing operation?

Shape and material of punch
Die, speed of punching, lubrication
Clearance between punch & die.

11. Define Blanking.

A finite shape of sheet metal is removed and blocked by shearing the entire contour using a die and a punch. The portion removed, which is the required part is called as blank and the operation is called as blanking.

12. What is meant by Dimpling.

First hole is punched and then it is expanded into a flange. Flange may be produced by piercing with a sharp punch when their bend angle is less than 90° , as in fittings with conical ends. This process is also called as **FLAIRING**.

13. Define Notching.

It refers to the removing pieces from the edge. In this process, the metal is removed from the side (or) edge of a sheet to get the desired shape.

14. Define Stretch forming.

The sheet metal is placed under a tensile load over a forming block and stretching it beyond its elastic limit and to the plastic range, thus cause permanent set to take place. This process is useful in making prototype models of aircraft and automotive parts.

15. Define Wrinkling

It is caused by compressive stresses in the plane of the sheet. It can be objectionable or can be

PART-B (16-marks)

1. Describe shearing operations in a sheet metal work with a neat sketch (16)

Sheet Metal Forming

Involves methods in which sheet metal is cut into required dimensions and shape; and/or forming by stamping, drawing, or pressing to the final shape

A special class of metal forming where the thickness of the piece of material is small compared to the other dimensions

Cutting into shape involve shear forces

Forming Processes involve tensile stresses

The Major operations of sheet Metal are;

- 1) Shearing,
- 2) Bending,
- 3) Drawing and
- 4) Squeezing

Shearing

The mechanical cutting of materials without the information of chips or the use of burning or melting for straight cutting blades: shearing for curved blades: blanking, piercing, notching, trimming, Lancing.

Slitting

shearing process used to cut rolls of sheet metal into several rolls of narrower width used to cut a wide coil of metal into a number of narrower coils as the main coil is moved through the slitter.

Blanking

during which a metal workpiece is removed from the primary metal strip or sheet when it is punched.

Notching

same as piercing

- edge of the strip or blank forms part of the punch-out perimeter

Nibbling

Produces a series of overlapping slits/notches

Shaving

finishing operation in which a small amount of metal is sheared away from the edge of an already blanked part

- can be used to produce a smoother edge

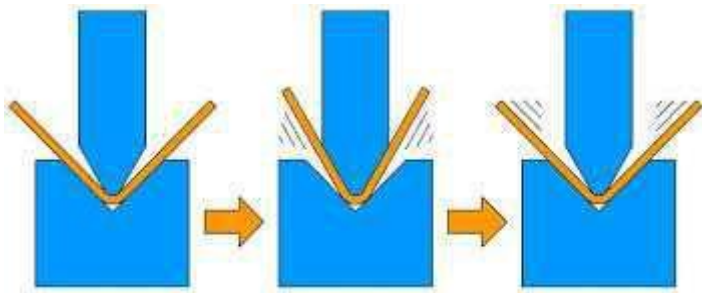
Dinking

Used to blank shapes from low-strength materials such as rubber, fiber and cloth

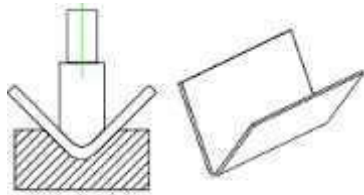
Springback

The elastic recovery of the material after unloading of the tools

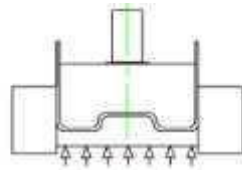
2. Describe the various sheet metal making operations with neat sketch.



1.Be



Bending



Bottom Forming

2. **Shearing.** (refer previous question)

3. **Drawing**

It is the process of producing hollow objects (ex.utencils) by using an semicircular punch and Die.

4. **Deep Drawing.**

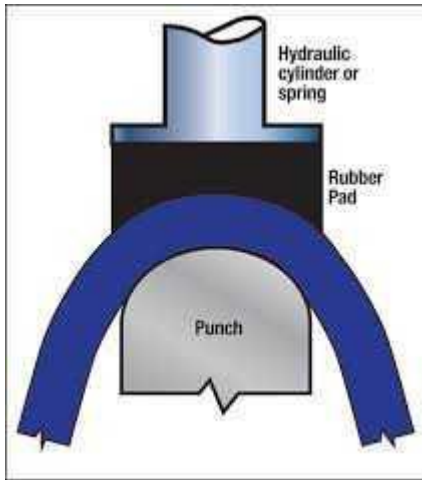
If the depth of the hole is greater than that of the diameter then the drawing operation is called deep drawing.

5. **Forming.**

Changing the shape of the sheet metals without cutting, shearing or drawing.

3. Explain any one method of stretch forming operation with a neat sketch

(16)



In this process, the sheet metal is clamped along the edges and then stretched over a die (OR) FORM BLOCK, which moves upward, downward (or) side ways, depending on the particular machine.

It is used to make aircraft wing-skin panels, automobile door panels and window frames. The desirable qualities in the metal for maximum stretchability are as follows.

1. Fine grain structure.
2. toughness.
3. LARGE SPREAD between the tensile yield and ultimate strength.

Working.

It consists of placing the sheet –metal under a tensile load over a forming block and stretching it beyond its elastic limit and to plastic range, thus cause a permanent set to take place.

Two Basic Forms of Stretch forming are,

1. Stretch forming,
2. Stretch – Wrap forming.

ADVANTAGES.

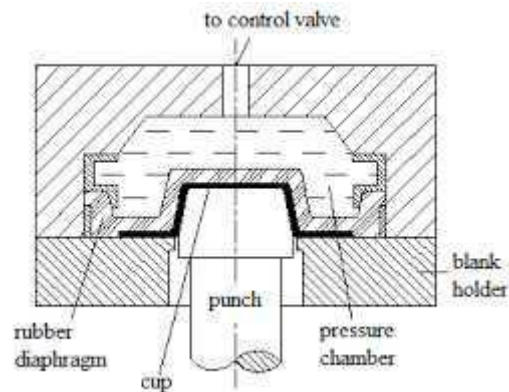
7. In a single operation, blanks can be stretched.
8. Heat treatment before and after stretching process is not required.
9. Spring back effect is minimized.
10. Tooling cost is low.

11. Direct bending is not introduced, and plastic deformation is due to pure tension.
12. It is suitable for low volume production.

DISADVANTAGES

- 1.uneven thickness of blank cannot be stretched.
- 2.The maintenance cost of the hydraulic cylinders is high.

4. Explain hydro forming process with its neat sketches. State their advantage and applications



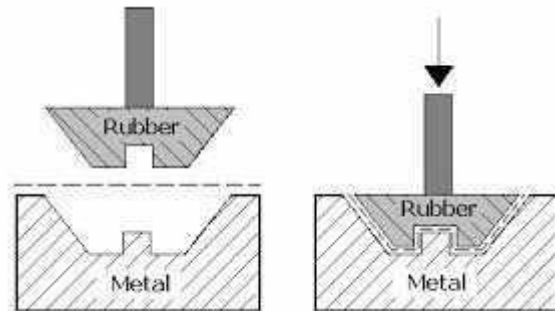
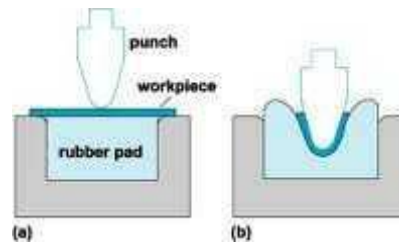
In this process the pressure over the rubber membrane is controlled throughout the forming cycle, with maximum pressure up to 100 MPa. This procedure allows close control of the part during forming, to prevent wrinkling (or) tearing. This process is called hydroform or fluid – Forming Process.

Hydro forming is a Drawing process.

Advantages of Hydro-forming Process.

- 1.It is used for Mass production.
- 2.Tools can be quickly changed.
- 3.Complicated shapes , sharp corners can be made by this method.
- 4.Spring back, Thinning of metals are removed.

5.Explain about Rubber Pad Forming.



One of the die material is made up of a flexible material (ex. Rubber) Or (poly-urethane material). In bending and embossing of sheet metal , the female die is replaced with a rubber pad. Pressure in the rubber pad forming is usually in the order of 10Mpa.

The blank is placed under the punch called male die. Then the ram (femal part) is moved so that punch touches the top surface of the work. Then the force is applied and gradually increased on the blank through the rubber pad.

The blank holder ring is used to distribute uniform pressure throughout the blank.

Thus the required shape is formed on the sheet metal between male and female parts.

ADVANTAGES OF RUBBER PAD FORMING.

- 1.Number of shapes can be formed on one rubber pad.
- 2.Thinning in metal blank does not take place.
- 3.setting time of the tool is less.
- 4.Wrinkle – free , shrink flanges can be produced.

DISADVANTAGES

- 1.Rapid wearing of rubber Pads is a problem in this process.

- 2. Accurate sharp corners cannot be made by this process.
- 3. Loss of pressure between hydraulic fluid and rubber pad which is a major problem

APPLICATIONS.

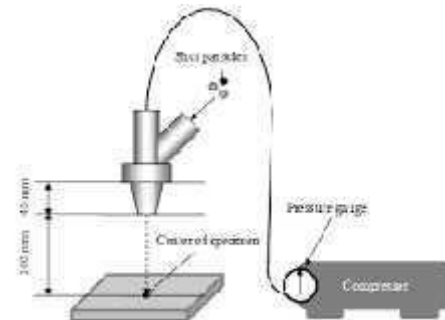
Flanged Cylinders.
 Rectangular cups,
 Spherical Domes.
 Unsymmetrical shaped components can be made.

6. Explain peen forming process with a neat sketch (Nov/Dec -2010) (16)

This process is used to produce curvature on thin sheet metals shot peening on surface of the sheet.

A stream of metal shots is blasted against the surface of the blank.

This process is also called as peen forming technique. Peening is done with cast- iron (or) Steel shot discharged either from a rotating wheel by an air blast made from a nozzle.



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ADVANTAGES OF PEEN FORMING

Complex shapes can be easily produced
 . Die and Punch is not used.
 Peening is used as a salvage operations for distorted parts (OR) correcting part.

DISADVANTAGES OF PEEN FORMING

This process requires longer time for forming the required shape. Requires additional devices for forcing out metal shots.

APPLICATIONS.

Specific portions on crankshafts , connecting rods, gears
 Honey comb panels like aircraft wings and large tubular shapes can be produced.