"Designing and Manufacturing of Die for Rm-800 Oil Tank Cover"

Saksham Bahety, Yogesh Rathi,Vipul Gandhi, Darshak Pawar, Prof.S.M.Alage

Mechanical Department,SPPU,

Abstract

The main aim of this project is to design a new die with interchangeable punches also reduce the weight of material by means of changing the material of die set. Now a days sheet metal working processes are widely used in almost all industries like automotive, defence, mechanical industries. Also sheet metal working processes are predominantly used as various reasons not only for industrial purpose but also utilised for commercial purpose as well. For that many people are working in developing the new trends using their innovative ideas. Especially in die design, many die sets are made for different functions such as progressive die, compound die etc. This project is also based on new design of die punch. The main aim of this project is to design a new die with interchangeable punches also reduce the weight of material by means of changing the material of die set. The project mainly focuses on different operations done on single die set in a single stroke of press, presently these operations are done separately in five steps which includes four drills and one plasma cutting. These operations are leading to reduce the production rate and increasing the cycle time with cost as well. As per our new die set, this should constantly eliminating the loss in the production time and reduce the man power for loading and unloading of work piece. The parts of die sets, punch and die are designed and assembled in the Ansys Workbench Parametric.

Introduction

A die is a specialized tool used in manufacturing industries to cut or shape material mostly using a press. Like molds, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advance technology.

Forming dies are typically made by tool and die makers and put into production after mounting into a press. The die is a metal block that is used for forming materials like sheet metal and plastic. For the vacuum forming of plastic sheet only a single form is used, typically to form transparent plastic containers (called blister packs) for merchandise. Vacuum forming is considered a simple molding thermoforming process but uses the same principles as die forming. For the forming of sheet metal, such as automobile, body parts, two parts may be used: one, called the punch, performs the stretching, bending, and/or blanking operation, while another part that is called the *die block* securely clamps the workpiece and provides similar stretching, bending, and/or blanking operation. The workpiece may pass through several stages using different tools or operations to obtain the final form. In the case of an automotive component there will usually be a shearing operation after the main forming is done and then additional crimping or rolling operations to ensure that all sharp edges are hidden and to add rigidity to the panel.

Aim and Objectives

In universal manufacturing company, they are using different operations like drilling, plasma cutting on oil tank cover plate of RM-800 mixer.

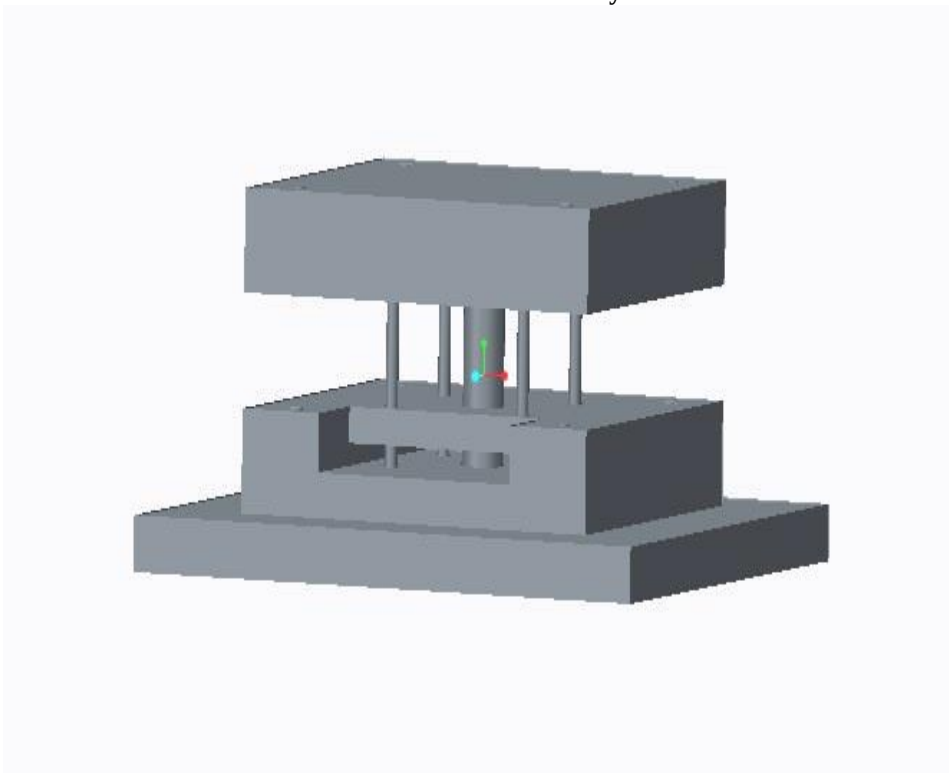
- These all operations are done individually so it takes more time to finish the component.
- So there is need to combine all operations in a single step of die punch.
- The monthly volume of component is near about 5000 to 6000 nos.
- Company needs cycle time reduction and cost reduction.
- The existing cycle time of operation is approximately 7 minutes. After implementation of this project we can expect this to 30 secs.

Scope and Limitations

The scope of the project includes :

- Collection of information from various references, paper presentations, company manuals, and journals about the press and press tools, also information of creo and its application in piercing operation.
- Design of all parts and accessories of press tools according to component drawing.
- Design parameters, part modelling and assembly drawing using Ansys Workbench.
- Manufacturing of the die.
- Cost analysis of die and punch.

Die and Punch Assembly



Design Parameters

Following design parameters are to be considered while designing die for stripping.

- Perimeter of the component.
- Total length of the component.
- Total width of the component.
- Press tonnage.
- Shear cut area.
- Vertical shearing force.

Cutting force calculations:-

The force required to penetrate the stock material with the punch is the cutting force. Ø8mm and two Ø25mm holes is to be pierced which is 3.15mm thickness.
Solution:-

F = S*P*T

Where,

F = cutting force.

S = shear strength of stock material. P = circumference of cutting edge. T = thickness of material

S = 25Tons/Inch^2 ..... (as per standardtable)

Cutting force for ø 25mm (ø 0.9842 inch)

$$P = \Pi * d$$

P = Π * 0.9842

1) **P = 3.0919 Inch.**

t = 0.124 Inch.

F = S*P*T

= 25 * 3.0919 * 0.124

F_1=9.5848 Tons .....(1)

For ø 8mm (ø 0.3149inch)

P = Π * d

P = Π * 0.3149

2) **P = 0.9892 Inch.**

t = 0.124 Inch.

F = S*P*T

= 25 * 0.9892 * 0.124

=**3.062 Tons** ……. (For singlehole)

= 4 * 3.062

= **12.248 Tons**……. (For double hole)

F_2 = 12.248 Tons……. (2)

From equation (1) and (2),

$F = F_1 + F_2$

F = 9.58 + 12.248

F = 21.8328 Tons.

∴ Total vertical shearing force =21.8328 Tons

$$\text{Factor of safety} = \frac{\text{Maximum stress}}{\text{Working or design stress}}$$

$$= \frac{100 \text{ Tons}}{}$$

21.832 Tons

∴**Factor of safety = 4.58**

Clearance Calculations:-

Clearance is defined as the intentional space between the punch cutting edge and the die cutting edge. Theoretically, clearance is necessary to allow the fractures to meet when break occurs.

Solution:-

S_{ut}=49200 psi

Ultimate shearstress:- $\tau_u = 0.82 * S_{ut}$

$= 0.82*49200$

$= 40,344$

τ_u=278.16209N/mm^2

Clearance(C):-

$C = 0.0032*t*\sqrt{\tau_u}$

$= 0.0032*3.15*\sqrt{278.1620}$

3) C = 0.168116mm.

Punching force calculations

$F_{maximum}$ = cross sectional area *ultimate shear stress

$= A_s * \tau_u$

$= \pi * 21 * 3.15 * 278.162$

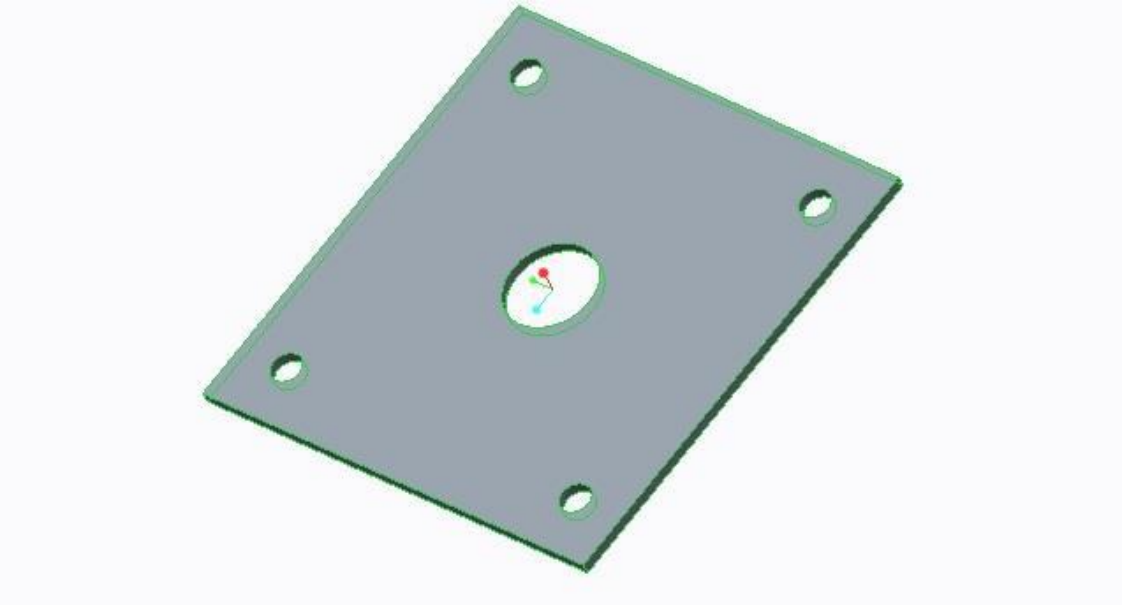
= 57806.61N

= 57.806kN Tons

=57.806/8.90

= 6.495Tons.

After Processing Work Piece



Conclusion

- Reduces the cycle time of operations.
- Reduces the manpower required for the operations.
- Increases the accuracy of operations.
- Increases the production.
- Increases the safety.
- Minimize component cost.
- Reduces labour cost.
- Minimize operational and processing cost.

Acknowledgement

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