Design and Analysis of Punch and Dieof Blanking tool for Hinge Butterfly

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***Abstract*— The Prediction of this paper is to show a analysis configuration of blanking tool to make hinge butterfly component. The approach is made to think about the procedure to be taken after to acquire an exact clear part to produce a hinge butterfly component. The methodology is connected to the Aluminum sheet metal of 2mm in thickness. The outcomes are watched for the stress, strain and the displacement on the punch and die in the blanking tool. On the other hands of the outcomes the HCHCR material taken for the outline is said to be as the best appropriate material for punch and die.**

Keywords: **Hinge Butterfly, Aluminum, HCHCR**

1. Introduction

Press Tool is the procedure which is utilized to deliver the sheet metal parts. Operations like Blanking, piercing, bending; forming can be performed utilizing press tools. The fundamental operation that is performed utilizing press apparatus is blanking. Blanking process incorporates shearing of the sheet metal. In this paper we confine our concentrate just with respect to blanking. Blanking is the shearing operation in which the sheet metal is crushed between a punch and die on as appeared in fig.1. Because of the high cutting power of punch the wanted profile of the sheet metal gets isolated from the strip. The isolated part of sheet metal is called Blank.

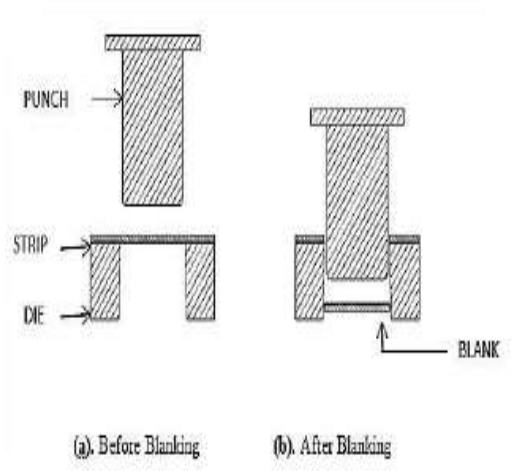

Figure 1: Blanking Process

2. Component Study

Name of the component: Hinge butterfly
Material: Industrial grade aluminum
Thickness: 2mm
Shear Strength: 147.15N/mm^2

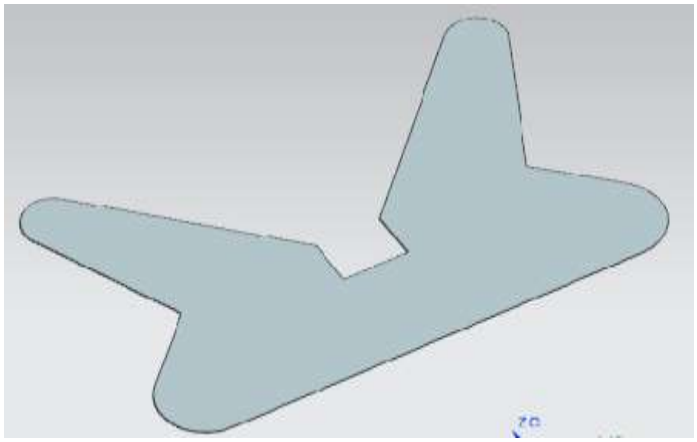

Figure 2: 3D Model of Hinge Butterfly After Blanking

At first the 2D drawing got and it is redrawn by using unigraphics to distinguish the missing measurements, and after that vital inputs will be joined. The designed drawing of the device is done the bill of material is readied and material is requested. Process is begun to make blanking operation. The properties of the ALU material are given below.

Table No.1

Chemical composition	
Magnesium	0.8 to 1.2
Silicon	0.4 to 0.8
Iron	0.7
Copper	0.15 to 0.40
Zinc	0.25
Titanium	0.15
Manganese	0.15

Table No.2

Mechanical properties	
Shear Strength	147.15 N/mm^2
Tensile Strength	1736N/mm^2

3.Tool Design

Before designing the tool there are sure plan focuses on the design which is to be followed. Thickness of the component, Material, Machine to accommodate the process, Critical measurements of the component is studied. On the bases of the study made some essential design ideas to be taken after to get the component with the exact measurements, accuracy, strength, durability, quality and economy is maintained.

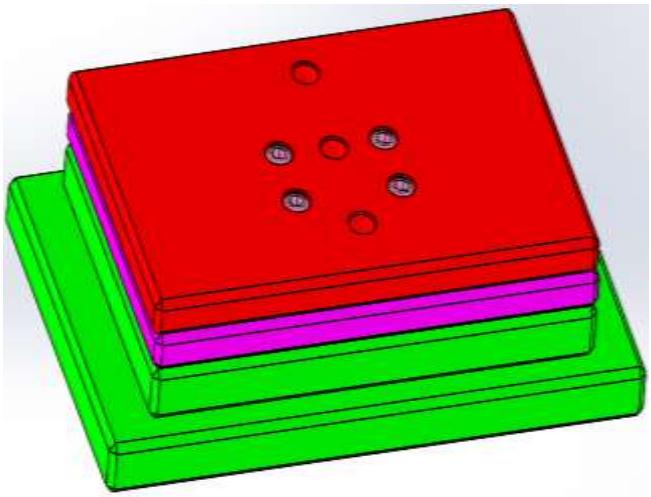

Fig 3. Blanking Tool

Table No 3

Chemical Composition of HCHCR				
C	SI	C_r	M_O	V
1.50%	0.30%	12.00%	0.80%	0.90%

Tool steels are utilized as a part of the assembling of the press tools. The material utilized as a part of the production of press devices depends on the application and the load acting up on the materials. The process like blanking, piercing, cutting off, separating off, perforating and so on require unique material in view of their application. There are different plates in a press tool and the material utilized for the every plate varies with their application and the load acting. The material used in the manufacture or the press tool are Mild Steel, OHNS (Oil Hardened Non Shrinking Die Steel), High Carbon High Chromium Die Steel (HCHCr)

4. Tool Calculations

Shear force

$Fs = L \times S \times Tmax$ (1)

$= 244 \times 2 \times 147.15$

$F s = 71809.2N$

Where,

L – length of cut L = 244mm

S – Thickness of sheet S = 2mm

Tmax – shear strength Tmax = $147.15N/mm^2$=15N

Stripping Force

Stripping Force = 20% of total shear force (2)

= 71809.2x (20/100)

= 14361.84N

Press Capacity

Total Press Capacity = Total Shear Force + Stripping Force(3)

= 71809.2+ 14361.84

= 86171.04 N

Press Tonnage = (Total ShearForce + Stripping Force)/70%(4)

(The efficiency of the machine is taken as 70%)

= 86171.04/0.7

= 123101.486 N

=123101.486/1000

=123.101486KN/9.81

=12.5485715Tons

Clearance

Clearance = $C \times t \times \sqrt{T_{max}}$ (5)

= 0.01 x 2 x √147.15/9.81

= 0.077459mm (per side clearance)

Where,

C = 0.01 constant

t = thickness of sheet t = 2mm

T_{max} = Shear strength T_{max}= $147.15N/mm^2$

5. Punch And Die Analysis

The punch and die analysis is done in SOLID WORK 2015 software. Static analysis is done to find out the stress distribution and the displacement on the punch and die.

Fig 4. Meshing of Punch

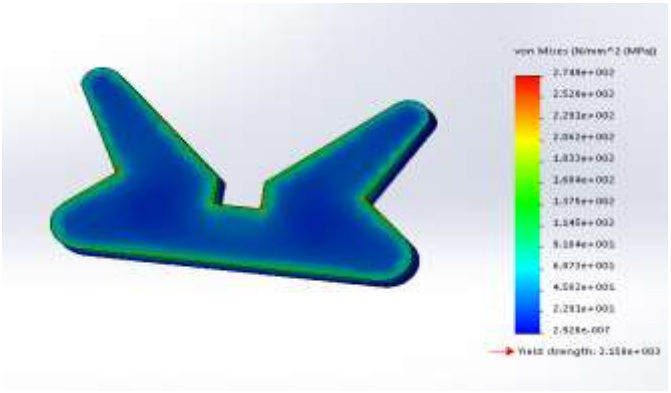

Fig 5. punch Stress Analysis

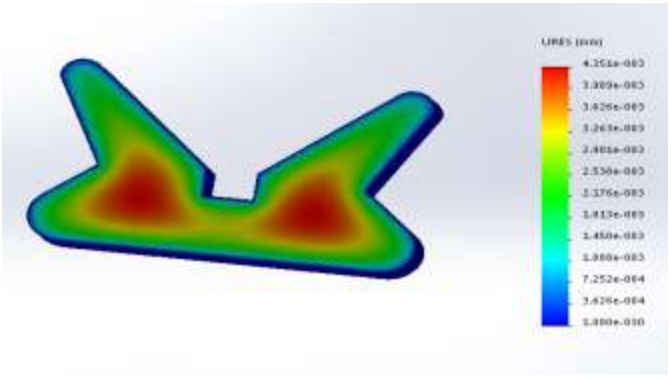

Fig 6. punch Displacement Analysis

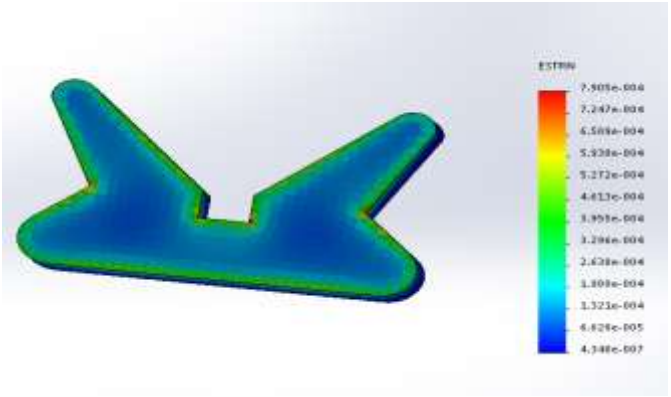

Fig 7. Punch Strain Analysis

Fig 8. Meshing Of Die

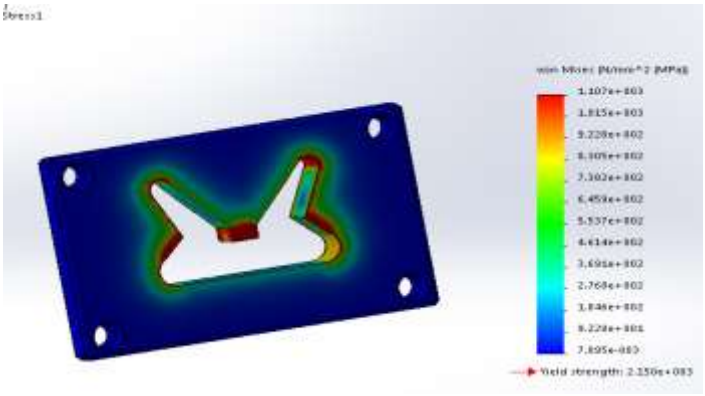

Fig 9. Die Stress Analysis

Fig 10. Die Displacement Analysis

Fig 11. Die Strain Analysis

6. Results and Discussion

From the analysis results the graph scale on the figure showed the Stress and deformations results of the die and the punch which are less than the limit value. So the component is produced to the required size and shape with a thickness of 2mm. But the variation of the component thickness is 0.001 to 0.003mm.

Result of Blanking Tool

Table 4 Maximum stress distribution of Punch and Die Of Blanking Tool

Si No	Type	Value	Limit value	Unit	
1	Die	1.107×10^{3}	2150	N/mm^2	
2	Punch	2.749×10^{2}	2150	N/mm^2	

Table 5. Maximum Displacement of Punch and Die Of Blanking Tool

Si No	Type	Value	Unit
1	Die	0.0493	mm
2	Punch	0.004351	mm

8. Conclusion

In this work some important parts of press tool design for hinge butterfly is predicted about further more detail study and examination were done. Punch and Die examination of the tool were completed and the design was observed to be protected. Both in punch and die maximum stress developed is very less compared to yield stress value. Through analysis it is confirms that the material chose for both punch and die is safe. By consolidating limited component strategy general creation design is advanced. The outcomes uncover that by incorporating CAD/CAE will be exceedingly gainful. By the usage of CAD in design, exactness of configuration is enhanced and plan process time is decreased radically than by conventional strategy. Numerous design issues which are entangled to dispense with by traditional methods are disposed by utilizing CAD software.

9. References

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