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Design of Progressive Press Tool for Mobile Stand

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Abstract - *Design procedure for developing Blanking and piercing progressive tool for Gasket component. Press tool manufacturing is one of the customarily pop up vogue in production area. Sheet metal components are produced using press preset force. The components manufactured using this process is having high dimensional accuracy therefore most industries depends mostly on press tools. Mobile stand is a part which is used in general by maximum mobile users, benefit of use of sheet metal stand is its durability, aesthetic appearance, single product (no any other assembly like in plastic stands available in market) Sequence of operation is planned initially and then press tool is designed. The design will made in AUTO CAD 2016, Solid Modeling on CATIAV5 R18.*

Key Words: Blanking, Piercing, press tool.

1. INTRODUCTION

Press Tool is the operation which is used to produce the sheet metal components. Operations like Blanking, piercing, bending, forming etc. can be performed using press tool process. The pivotal operation that is accomplish using press tool is blanking and piercing. Both blanking and piercing activity includes shearing of the sheet metal, consequently to start with the shearing strength of the sheet metal material has to be set on. In this paper we limit our scrutiny only regarding blanking and bending operation. Blanking is the shearing activity in which the sheet metal is compresses between a punch and die. Because of the aloft cutting force of punch the want profile of the sheet metal come by set apart from the strip. The Set apart piece of sheet metal is called Blank.

2. OBJECTIVE

Main objective of project is to:
1. Design of blanking and piercing tool (Progressive tool)
2. Strip Layout
3. Calculation of economy factor and punch and die clearance
4. Selection of standard material for tools.

3. MODEL STUDY AND MODELLING OF COMPONENT

Model study includes identifying the criticality in component, following are the criticality involved in component.

- Proper operation are required to manufacture the component.
- Proper safety measures is to take while carrying out the cutting operation

Component is modeled using the software AUTOCAD 2016.

Component has a rectangular like structure with dimensions:
Pitch= 125 mm
Width of the strip= 132 mm
Area of the component= 9921.88 mm
Perimeter of the component= 972.57 mm.

2. Other details of model are given below
Component name: Mobile stand
Component Material: Mild steel
Sheet thickness= 1 mm
Ultimate Shear strength= 360 N/mm^2

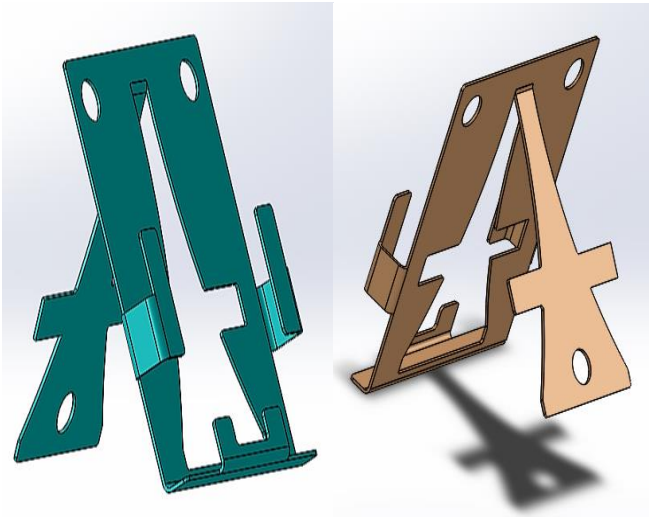

Fig -1: Auto Cad view of mobile stand.

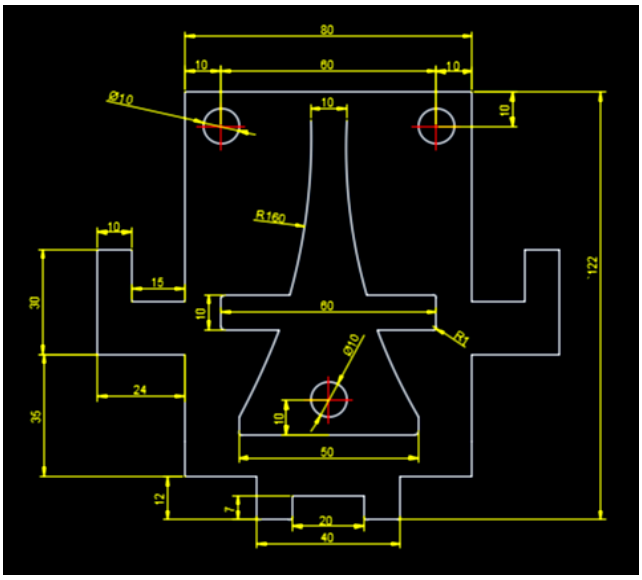

Fig -2: Drafting of component unfolded view. All dimension are in mm.

4. DESIGN OF TOOL

Design of any press tool involves following steps:-

1. Read the drawing carefully to understand customer requirements.
2. Identify operations performed.
3. Select the required tool.
4. Strip layouts and economic factor calculations.
5. Cutting clearance calculations.
6. Punch and die sizes calculations.
7. Cutting force and press tonnage calculations.
8. Stripping force calculations and fasteners selection.
9. Die plate and other plate thicknesses.
10. Working area calculation.

4.1 Design Calculation

Numeric calculation to be carried out to predict the scrap bridge, economy factor, cutting clearance, cutting force, stripping force, selection of fasteners, press selection, calculation of flat blank length, total force, and calculation of different part size.

i. Scrap Bridge =1.2 x t
=1.2 x 1
=1.2 mm

ii. Economy Factor

= Area of blank X no of rows X 100
Width X pitch

= 9921.88 X 1 X 100
132 X 125

= 60.13%

iii. Cutting Clearance

c=Constant (0.005 or 0.01)
S=Sheet thickness = 1mm
τmax =360 N/mm^2 (for mild steel)

Cutting clearance

$$= c \times s \times \sqrt{\frac{\tau_{max}}{10}}$$

= 0.01 X 1 X $\sqrt{360}$ / $\sqrt{10}$

= 0.06 mm/side

iv. Cutting Force = L x S x τmax (S=Sheet thickness)

Shear force (F_{sh}) = 972.57 x 1 x 360

= 350125.2 N

= 35.01 Tonns

Press tonnage =1.2 X F_{sh}
= 1.2 * 35.01
= 42.01 Tonns

v. Stripping Force

It is taken as 10% of cutting force (Shearing force),

= (F_{sh}) x 10%

= 350125.2 x 0.1

= 35012.52 N

vi. Selection of Fasteners

8 bolts used hence strength required for one bolt is given by,

= 35012.52 / 06

= 5835.42 N

From technical table (Page no. 361, table no. 13.17.0 strength of threads) (Press Tool Design & Construction - P.H.JOSHI) we come to know M12 X 1.75 bolt has safe load which is suitable for our requirement.

Similarly 4 no. of dowels of same size are used for this tool.

vii. Press Selection

Press tonnage = 1.2 x cutting force
= (1.2 x 35.01)
= 42.012 Tons

viii. Calculation of different part size

a) Die plate thickness $T_D = 3\sqrt{F_{sh}}$
$=3\sqrt{35.01}$
=3.27 cm
=32.71 mm ≈ 35mm

b)Thickness of top bolster $=1.25\ T_D$
=1.75 x 35
=61.25 mm

c)Thickness of bottom bolster $=1.75\ T_D$
=1.75 x 35
=61.25 mm

d)Thickness of punch holder plate $=0.8\ T_D$
=0.8 x 35
=28 mm

e)Thickness of stripper Plate $=0.8\ T_D$
=0.8 x 35
=28 mm

f)Thickness of thrust plate = 10 to 15 mm
= 10 mm

ix. Calculating the flat blank length

Bending allowance

$A = \frac{2\pi\theta}{360}(R+Kt)$

Where, K=1/3 when R< 2t
K=1/2 when R≥2t

$A=\frac{2 \times \pi \times 90}{360} \times (15+\frac{1}{3} \times 1)$

= 2.88 mm

1st Bending Force

$Vbv = \frac{K \times l \times Ft \times T^2}{w}$

Where, k=1.33 for V bending
k=2.66 for u bending

$Vbv1 = \frac{1.33 \times 70 \times 360 \times 1^2}{8 \times 1}$

= 4189.5 N/mm²

2nd Bending Force

$Vbv = \frac{K \times l \times Ft \times T^2}{w}$

Where , k=1.33 for V bending
k=2.66 for u bending

$Vbv2 = \frac{1.33 \times 110 \times 360 \times 1^2}{8 \times 1}$

= 6583.55 N/mm²

Total Bending force= Vbv1+ Vbv2
=4189.5+6583.5
=10773 N/mm²

x. Total force =Cutting force + Non cutting force
=35.01+1.077
= 35.548 Tons

5. Tool Assembly

Tool assembly is done in modeling software, includes the fixing of, bottom plate, die plate, stripper plate, punch holder, thrust plate, top plate, plotting punches, blanking punches , guide bush and guide pillar after assembly 3D models are converted into the 2D drawings for manufacturing process.

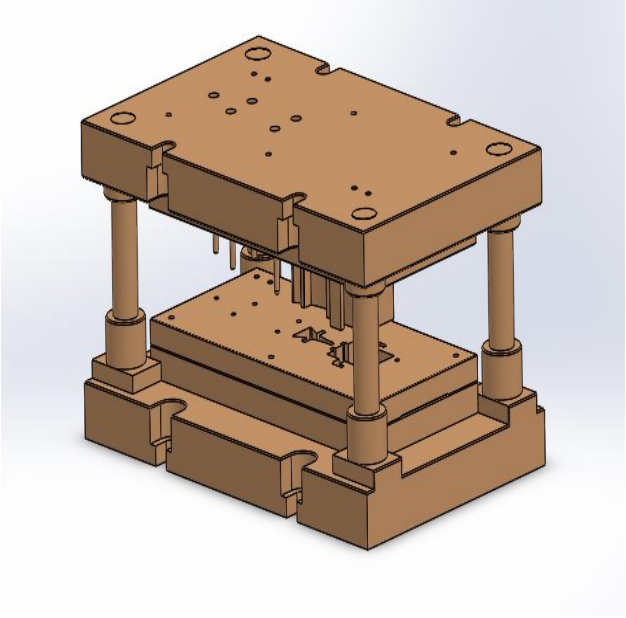

Fig -3: Assembly of Tool.

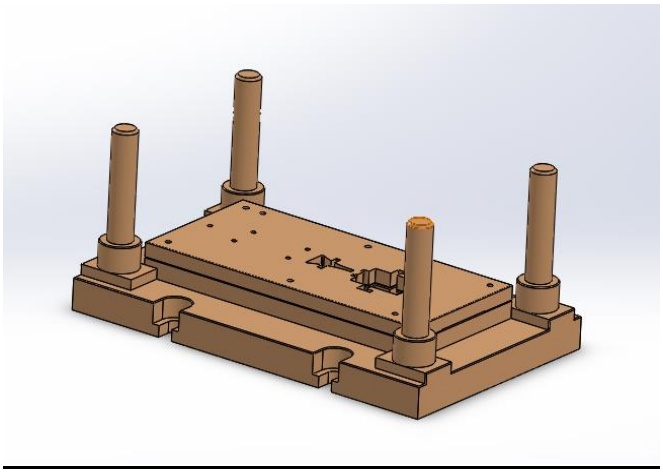

Fig -4: Bottom Half View.

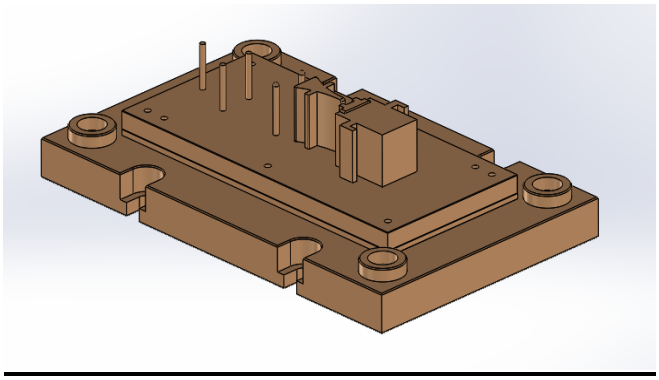

Fig -5: Inverted Top View.

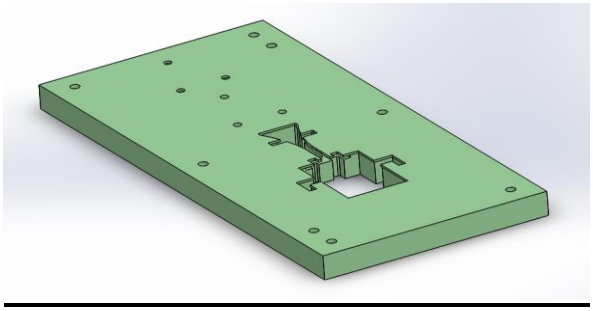

Fig -6: Die Plate.

6. CONCLUSIONS

All the Design of progressive press tool for Blanking and Piercing are made by following the fundamental die design principles for sheet metal component. It is also reported that the design procedure adopted gives correct dimensions of the press tool element.

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