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"Design and analysis of press tool for bracket "

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Abstract: **Design and analysis procedure for developing Blanking and bending press tool for Bracket component. Press tool manufacturing is one of the widely emerging trends in production area. sheet metal components are produced using press tools. As the name itself suggests press tool means manufacturing the sheet metal components by applying the predetermined force. The components manufactured using this process possess high dimensional accuracy therefore most industries depends largely on press tools. bracket is a part which is used in fabrication industry. Sequence of operation is planned initially and then press tool is designed and analyzed. The purpose of carrying out analysis is to prevent the costly tryouts and thus optimize the quality and rate of production. The design will made in Auto Cad 2016, solid modeling on catiaV6 R18 and analysis of parts in ANSYS 2015 software.**

Keywords *analysis of parts in ANSYS 2015 software,blanking,bending and forming*

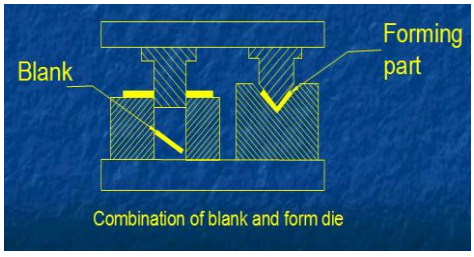
1. Introduction

Press Tool is the process which is used to produce the sheet metal components. Operations like Blanking, piercing, bending, forming etc. can be performed using press tool process. The basic operation that is performed using press tool is blanking and piercing. Both blanking and piercing process includes shearing of the sheet metal, therefore initially the shearing strength of the sheet metal material has to be determined. In this paper we restrict our study only regarding blanking and bending operation. Blanking is the shearing operation in which the sheet metal is squeezed between a punch and die. Due to the high cutting force of punch the desired profile of the sheet metal gets separated from the strip. The separated portion of sheet metal is called Blank.

2.LITERATURE REVIEW

Tool design is one of the most skill full job because almost all the components which are produced using press tool will be demanded high dimensional accuracy therefore at most care should be taken will designing the press tool.Design and Analysis of Blanking and Bending Press Tool to Produce Anchor Bracket Component.The selection of any multi-operation tool, such as progressive die or combination Die is justified by the principle that the number of operations achieved with one handling of the stock and produced part is more economical than production by a series of single operation dies and a number of handling for each single die

Combination or hybrid press tool Cutting and non-cutting operations are performed in a single tool.



In combination to two or more operations such as forming,drowing,extruding,embossing may be combine on component with various cutting operation like blanking ,piercing,broaching and cut off.

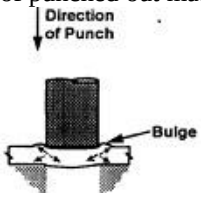
Theory of shearing

Shearing is the method of cutting sheets or strips without forming chips.the material is stressed in section lies parallel to the forces the forces are applied by means of sharing blades punch and die

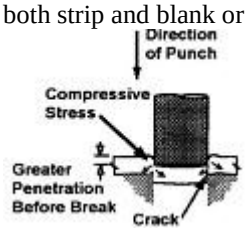
Stages in shearing:
1.Plastic deformation
2.Penetration

3.fracture

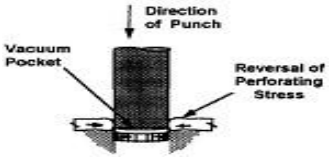
1.Plastic deformation: Pressure applied by punch on stock material tends to deform it into the opening when elastic limit is exceeded by further loading a portion of material will be forced into die opening in the form of embossed on the lower face of material and will result in corresponding depressionon its upper face.this stage imparts a radius on lower edge of punched out material.



2.Penetration : As load is further increased,the punch will penetrate the material to a certain depth and force an equally thick portion of metal into the die.this stage imparts bright polished finished on both strip and blank or slug.



3.**Fracture stage**:In this stage fracture will start from both upper and lower cutting edges.As the punch travels further ,these fracture extend toward each other and eventually meet.causing complete separation.this stages impart a dull fractured edge.

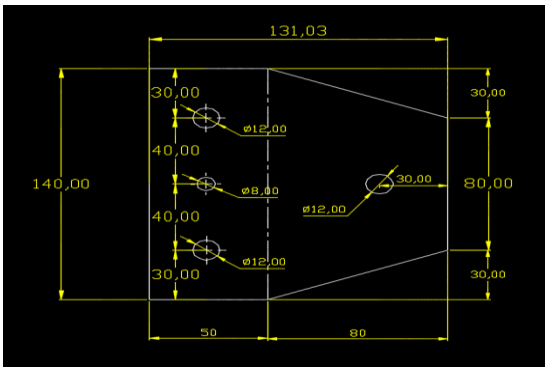


Methods Used in Creating New Tools

Tool making requires utmost precision for the creation of new equipment and parts. Standards are set to ensure that all the steps for the task are handled with the highest quality possible. Efficient and more effective machineries exist today to aid in the process. While these machines are used, it is still best to adhere to the rules and guidelines required in creating these tools.Designing the tool is often the first essential step to creat new parts for the machines. This is crucial, as the design becomes this holographic representation of how the machine should perform. Precise measurements are needed to make sure that the entire diagram will work according to the requirements of the machines. Otherwise, the results would not end

FLATENED VIEW, DIMENSIONS & MATERIAL PROPERTIES

Total area:1558127mm
Total perimeter:631.28mm
T=360N/mm2
U=Tensile strength=841mpa
THICKNESS=1.8mm
Material=mild steel



DESIGN AND CALCULATIONS:

Strip Layout Calculation :-

1} Scrap Bridge (B) = (1 to 1.25) T
= 1.25 x 1.8
= 2.25mm = 2.50mm

2} Margin (M) = (1.25 to 1.5) T
= 1.5x 1.8
= 2.70mm = 3.00 mm

3} Economy Factor = (Area of blank x No of Rows)/ (Width of Strip x Pitch) x 100
= (15581.27 x 1) / (146 x 133.50) x 100 = 80.00 %
Where ,Area of blank = 15581.27 mm
Pitch (P) = 133.50 mm
Width (W) = 146.00 mm

B) Force Calculation :-

1} Cutting Force = (Lx T x Tmax)/9810
= (631.28 x 1.8 x 360)/9810
= 41.69 Tonne
Where, L = Perimeter to cut = 631.28 mm
T = Sheet Thickness = 1.8 mm
Tmax = shear strength in N/mm2 = 360N/mm2

2} A/C Cutting Force = Cutting Force x Factor of Safety
= 41.69 x 1.2
= 50.03 Tonne

3} Stripping Force = 10 to 20% of cutting force
= 0.20 x 41.69
= 8.33 Tonne

4} Bending Force= $(0.333 \times S \times W \times T^2)/(L \times 9810)$
$= (0.333 \times 841 \times 146 \times (1.8)^2)/(2.7 \times 9810)$
= 5.00 Tonnes
Where, S = ultimate tensile strength = 841 N/mm2
w = sheet metal width = 146 mm
L = Span = 2.7mm
T = sheet thickness = 1.8mm

5} Total Force = Cutting Force + Stripping Force+ Bending Force

= 41.69 + 8.33 + 5
= 55.02 Tonne

B) Plate Thickness Calculation :-

1}Thickness of Die Plate (Td) = $\sqrt[3]{}$Cutting Force in Toone = $\sqrt[3]{}$41.69
= 3.47cm
= 34.7mm =35 mm

2} Thickness of Bottom Bolster / plate
= 1.75Td To 2Td
= 1.75x35 To 2x35
= 61.25 To 70 = 70 mm

3} Thickness of Top Bolster / plate
= 1.25Td To 1.5Td
= 1.25x35 To 1.5x35
= 43.75 To 52.5 = 50 mm

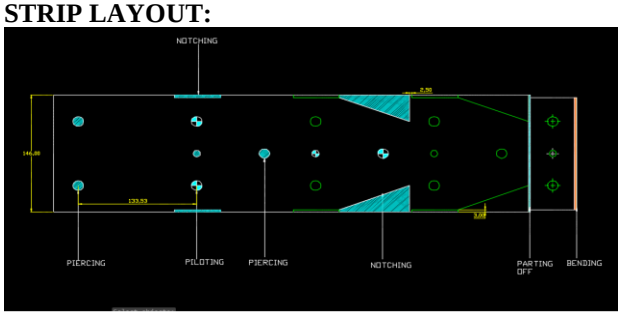
4} Thickness of Stripper Plate = 0.75Td
= 0.75 x 35
= 26.25 = 26mm

5} Thickness of Punch Plate = 1.2 Td
= 1.2 x 35
= 42mm

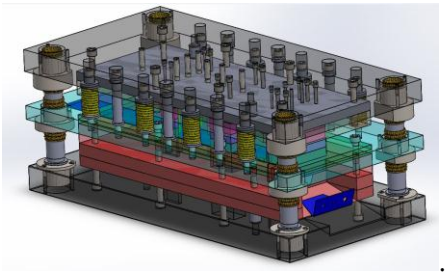
6} Thickness of Thrust Plate = 15 To 20mm
= 18 mm

7} Cutting Clearance = 0.01 x T x √Tmax/10
= 0.01 x 1.8 x √360/10
= 0.10 mm per side

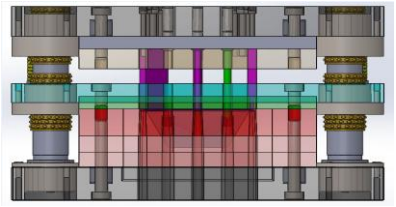
STRIP LAYOUT:



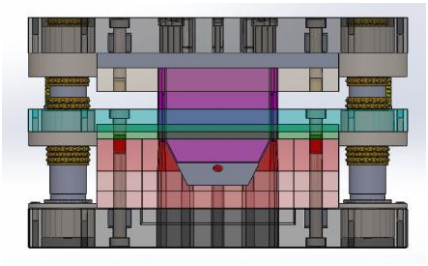
PRESS TOOL



2. RHIGHT HAND SIDE VIEW



3. LEFT HAND SIDE VIEW



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