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Design and Manufacturing of Die

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Abstract: *Tool creating is one amongst the trades, which needs a close study, structural analysis and method coming up with before continuing with any sensible work. The success of any tool for the most part depends on the method analysis and style analysis of the tool. a scientific approach in tool creating is so terribly essential. This project report principally enlightens the assorted aspects of "Press Tool" .Press tools area unit accustomed turn out a selected element in lots of abundance, out of sheet metals wherever specific element achieved depends upon press tool construction and its configuration. totally different the various styles of press tool constructions ends up in different operations particularly blanking, bending, piercing, forming, drawing, setting apart, parting off, embossing, coining, notching, shaving, lancing, perforating, trimming, curling etc. usually metals having thickness but 6 mm is taken into account as strip. Metals having thickness bigger than 6 mm is taken into account as plate .In Piercing and notching the desired form fringe is cut within the work piece material. The press tool used is for Piercing operation is named as Piercing tool .The application of press operations area unit wide utilized in several industries like food process, packing, defense, textile, automobile, craft and plenty of except for producing trade.*

Keywords: Press Tool, Design, Pierce, Blanking

I. INTRODUCTION

Press tool be a device that aids production of huge amount of comparable flat solid element to the desired form, size and dimensional accuracy. The element could also be flat blank (Blanking tool) or shaped one (Drawing tool, Forming or Bending tool). A press tool consists in the main of die and punch, that area unit fitly formed to urge article of desired form. The flat solid strip is perforated on the die and therefore the punch is then lowered underneath a significant pressure. The metal is therefore ironed between punch and die and therefore the article of desired form is obtained. For making ready article with wide selection of form, pressing is to be dispensed in several stage. Press tools area unit helpful once an outsized variety of comparable articles area unit to be created.

II. LITERATURE REVIEW

With the advancement, CAD/CAM and computing (AI), some researchers [Schaffer 1971, Nakahara 1978, Nee 1986, Shirai 1989, Duffy 1991, Prasad 1992, Park 1999, Choi 2001 etc] began to exploit these techniques for the planning of stamping tools, particularly progressive dies.during this chapter, major revealed work on the utilization of CAD and knowledge-based systems within the space of checking of style options of flat solid components, strip-layout style, choice of progressive die parts, material choice for parts of progressive die and automatic modeling of progressive die parts are reviewed. Finally, supported conclusions drawn from literature review, this analysis downside has been developed.

The Cold Press Die style and producing system (CPDDMS) developed by Ying[Ying 1986] manipulates the digital illustration of blanks hold on in knowledge files to perform technology check of the blank pure mathematics. however the most limitation of this technique is that it's enforced on a main frame laptop with advanced knowledge base support and therefore it's on the far side the reach of the tiny and medium sized tool and die industries

II. PROBLEM STATEMENT

The aim of this project is to scale back cycle time of existing method of edge, blanking and drilling operation for element. These all operations want be combined in an exceedingly single setup of die punch with a correct tool style. The monthly volume of element is 4000 to 6000 nos. thus company wants cycle time reduction and price reduction yet on these hinges

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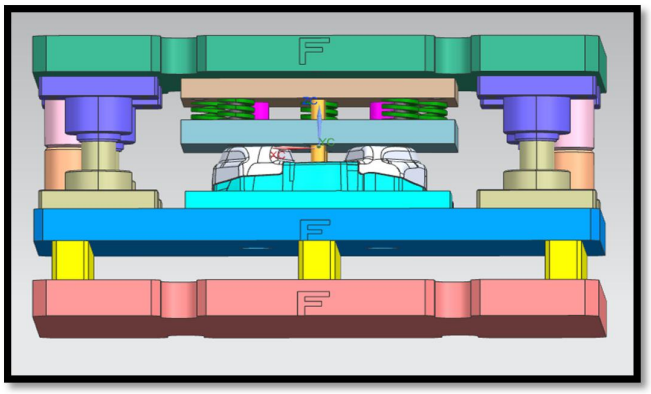
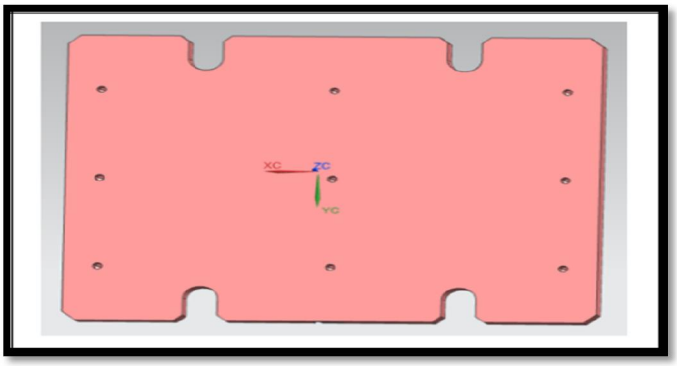
to satisfy world competition. the present cycle time of operations is some four minutes. when the implementation of this project we will expect this to thirty seconds.

III. Blanking and Piercing Die Punch



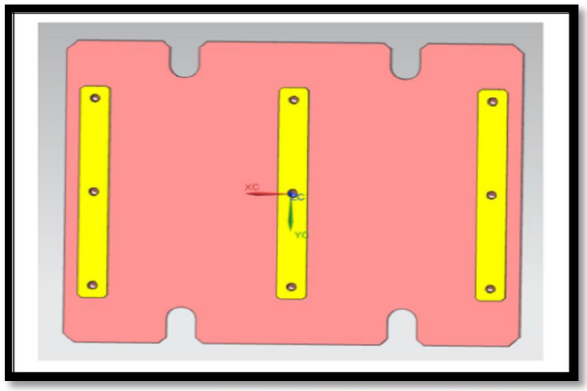
3D MODEL OF DIE PUNCH

DESIGN OF PIERCING TOOL



- Top Plate: Top plate of piercing die should strong enough to absorb thrusts from piercing punch. For that plate thickness is maintained at 45 mm according to calculations shown in design calculations section. Material selected is mild steel. Because it is tensile enough to absorb shocks and to provide durability. Mild steel is oil hardened.
- The clamping slots are placed in design according to press layout of customer (in this case Mahindra).
- Centre of die is also marked on each side of top and bottom plate.
- Top plate is slightly smaller in width and length than bottom plate.

Liners Placement



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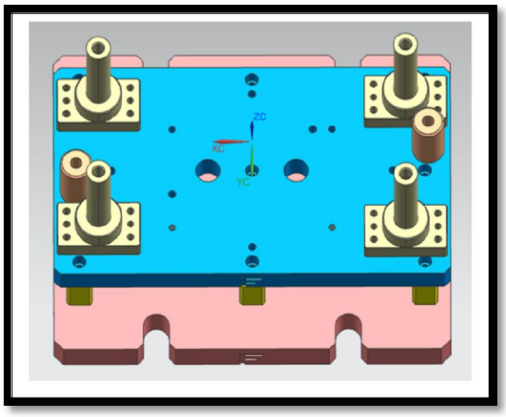
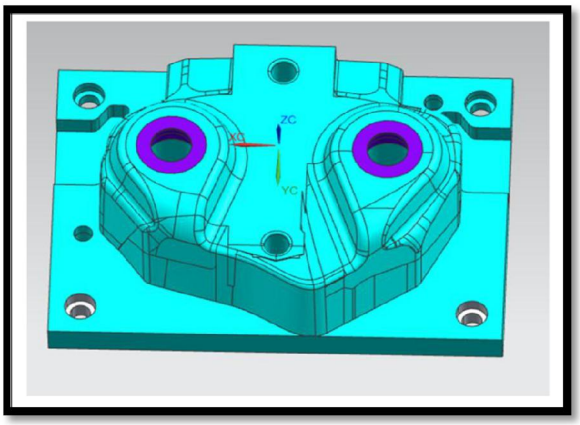
- Liners should be properly equidistant with each other. We can select 3 or 4 liners in case of this die. As die is of medium size 3 liners are suitable.
- While designing one important thing about liners is taken under consideration that no overlap of bolts with die back plate is done. Otherwise it might lead to weak liner.
- Another thing of liner is to provide some space to scrap collection tray. So placement of liner is according to position of hole and scrap should not overlap with liner. Otherwise it might jam scrap passage and fail the punch.

DESIGN OF DIE BACK PLATE



- Die back plate is used to support die block. Die back plate is holding die block on upper side and Simultaneously it is connected to liners from lower side. The bolts are passed from lower of base plate to the liners to back plate.
- Back plate should have relieve holes for scrap, the holes are more than 50% of size and shape of scrap.
- This back plate has tooling holes. Means they are master coordinates of lower die assembly.
- Back plate also houses the pillars of die. So this coordinates of dowel and bolts are given to them.

DESIGN OF DIE BLOCK



- In this die, as piercing operation is after draw and restrike operations the die block is in 3D shape.
- So die block should properly guide the job. It should have the exact shape as job. Besides this on this 3D shaped block position of hole should properly match to hole as per in customers model.

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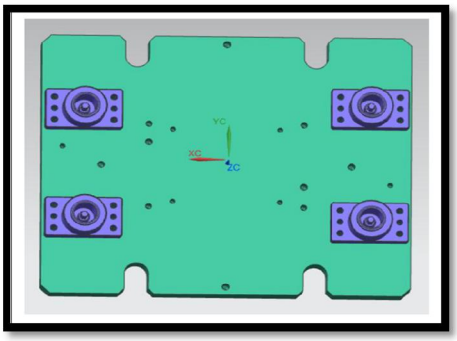
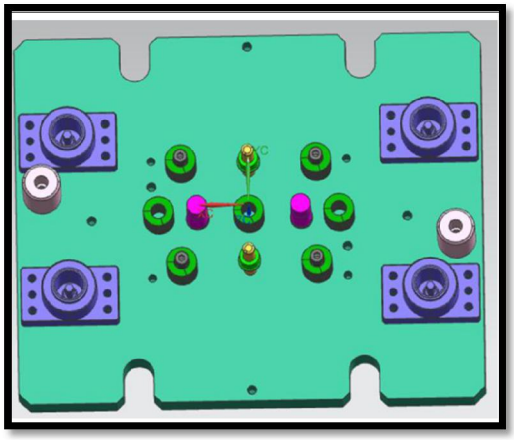
BUSH



- Bush are on top plate. They are concentric with opposite pillars. Pillars are used in this die are ball cage pillars. Because they provide perfect matching with pillar bush.
- Left side pillar set and right side pillar set are placed on different distances from each other.

PLACEMENT OF SPRINGS, GUIDE PIN, GUIDE BUSH



IV. CALCULATIONS IN DESIGN OF DIE

4.1 Die Clearance And Tool Life

The standard clearance among the die and punch cutting edges depend relay upon the metal properties. To avoid the drawn out of soft metal from gap, usually the die clearance for ductile material is less. But the blunting of the cutting edges of dies and punches gets accelerates. The recommended Die clearance is 8% to 10% of thickness. That is:-0.04 mm and 0.1 mm is the Minimum and maximum die clearance is to be taken. From this,

Size of Die hole = diameter of punch + 2*(per side clearance of die)

To increase the tool life the die clearance must be doubled from 5% to 10% (for sheet of mild steel) so that the tool life doubles.

Size of die hole = 26 + 2 x 0.1 = 26.2mm

Shearing Force (Fs.): To pierce a hole in part the shear force given as:

Fs = perimeter * t *τ

t- Thickness of part

τ– part material Shear strength

So the shear force is given by;

Fs1 = Perimeter of used punch 1* t * τ

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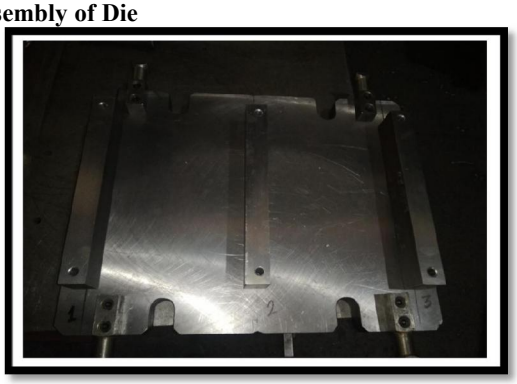
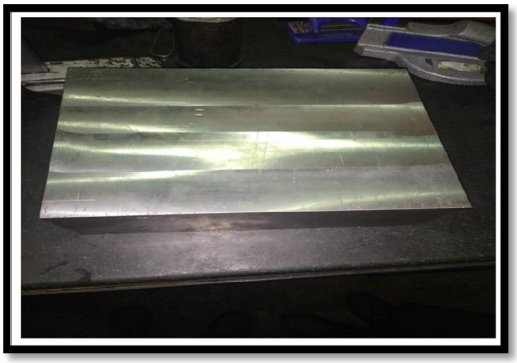
Here;
Perimeter of punch 1= 81.64 mm
Therefore, Fs1 = 21.71624 KN
Fs2 = Perimeter of used punch 2* t * τ
Fs2 =21.71624 KN

Stripping Force:
Stripping Force = 50 % of total shear force
= 0.5 x 21.71624 = 32574.36KN

Total Required Force:-
Total force ;
T.F. = T.S.F. + Stripping Force
= 65148.65KN
From the die design book, 20% of FOS is taken. Requirement of press capacity is = 120% of Total Force = 65148.65 KN= 66.6 Tone minimum
But the existing press machine capacity is suitable for the our requirement.

Thickness of various plates -:
Die plate (TD)= √F1TF in kg3 = √65.14872 =38 mm
Bottom plate = 1.5 TD = 57 mm
Stripper plate = 0.5 TD = 19mm upto 25 mm
Punch holder plate = 0.75 TD = 30 mm

4.2 Assembly of Die

- Very first step of this assembly starts with the marking of bolts, lifter position on both top and bottom plates.
- These all operations comes under 2D machining.
- After drilling holes on top and bottom plate, the lifter s are fitted on both plates because of manipulation of plates by crane.
- After fitting of lifters to the bottom plates, coordinates of liner holes are marked on base plate.
- holes of liner are passed along the plate because bolting from bottom of base plate is to be done
- Drilling machine used for this operation is radial type of drilling machine.
- Block of D2 is done under grinding of 2 adjacent sides which are going to rest on back plate. All sides of block should be perfectly in right angle with each other.
- After that block of D2 steel is to be drilled. 4 holes at each corner are to be provided
- Firstly, hole of 10.5 mm is passed through the block. And counter drill of 14 mm is passed up to ¾th of height of block. This is to ensure that no bolt is to be reason of failure of cutter during VMC operation.

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- After drilling of die block, back plate is taken under operation. Back plate is to be fitted on liners. So simply mounting back plate on liners and after that a drill of 10.5 mm dipped in blue color is passed through liner holes and then touches the surface of back plate. This gives coordinates of liner holes to back plate.
- This coordinates then drilled and tapped.
- Bolt of 12 x1 20 is fitted across liners and back plate, from bottom of base plate.
- After assembly of base die block is kept at center of back plate and drilled.
- On top plate punch holder is fitted as per 2d drawing. After fitting VMC is done on the punch holder to enlarge spring pockets and to provide position coordinate of two punches, guide pins.
- Stripper of the die is sent to the wirecut or VMC also can performed.
- At last stripper and punch holder with springs, punch between are joined with shoulder bolts.
- after that entry of the punch in die button is done. Clearance is checked by plastic inserted during entry. When plastic is not teared on perimeter then punch is in clearance with bush. After that first trial is performed.

V. RESULTS

Job before Operation:

VI. CONCLUSION

Final assembly of piercing die was accepted by customer with Inspection report acceptance percentage 95%.Understood the working function, design, assembly, calculations related to press tool. Involvement in buy off process helped me to understand the quality policies of customers during inspection of. We also understood static and dynamic check sheets by which customer rated our piercing die. From January the piercing die is going online at Mahindra production plant.

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