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DESIGN AND DEVELOPMENT OF PRESS TOOL

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ABSTRACT

YSM multislide machine is used to produce bi-metals required in MCB manufacturing. For this manufacturing, machine requires five different tools for five different specification bi-metals. After every two days or as per production schedule tool changeover occurs. It takes around 57 minutes for one tool changeover, which results in loss of 15 hours per month and 54000 bi-metals. So the main purpose of the project is applying SMED technique to reduce the tool changeover time by making changes in tool design, developing embossing insert and to recover the production loss by streamlining the production.

Keywords: *Press Tool, Tool Design, SMED.*

I. INTRODUCTION

Pressing is a operation of producing components by impact of plunger on sheet to produce a definite shape. Various operations such as Blanking, Bending, Pressing, Punching, Piercing, Embossing, Wiring, Coining, Notching, trimming, etc. are performed on this tool. Pressing operation is performed by Press tool. Press Tool can also be called as Blanking Tool, Pressing Tool, Bending Tool, etc.

II. LITERATURE REVIEW

As discussed in above Introduction that, Pressing is a operation of producing components by an impact of plunger on sheet to produce definite shape. Pressing is a sheet metal operation. Press tool is used to perform operations such as Blanking, Piercing, Bending, etc. Following are some research papers we took help of, to carry out this Literature Survey.

Mr. Subramanyam Pavulari et.al: He states the Process of Design of Press Tool and its Manufacturing. Also he discussed literature survey of press tool in this paper. Various specifications of Press Tool machines and their capacities, along with the basic principle of Press tool die is also stated. A short description of Methodology of manufacturing of Press Tool consists of selection of materials and its various composition of alloys, assembly and design calculations are included. Analysis of tool is performed on software named SOLID WORKS.[1]Mr. Anudeep S, et.al: The main aim of this paper as per author is designing and analysis of Press Tool to produce an anchor bracket. Basically the main Blanking operation, how actually it is carried out along with Tool Design is discussed. As there is a part of Tool Design there is also a part of material selection and design calculations. Punch and die analysis of blanking and bending tool is carried out and a basic animated model of these Press Tool are given for better understanding of these processes.[2]

Mr. Abhijit Tagade et.al: prescribes sheet metal forming processes for manufacturing and design of Press Tool for washer. Washer is a result of various combination of sheet metal processes. These processes are discussed in this paper such as shearing, drawing, bending, squeezing, etc. As per the strength of material selected in material selection, Press Tool is selected accordingly. Various basic design considerations are considered to design the washer. A 3-D view of developed Press Tool is snapped in this paper along with the Design calculations required to produce the tool of various capacities.[3]Mr. Yash Dave et.al: explains the feasibility required in the market, of various components to lead the market with better position. He explains a technique named SMED (Single Minute Exchange of Dies) which helps the company to be flexible in the market with variety of components produced. A Literature Survey is carried out by author in this paper explaining the quick changeovers which take less than 10

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minutes. A quick changeover improves the flow of process. The basic four steps of SMED and terms of SMED are explained by him in this paper.[4]

Mr. JaeckMucha: aims on the wear of tool on burr during Blanking of Generator sheets. He explains various types of metal coating to be used to avoid or decrease wear to a greater extent. Also he provides a clearance formula to be followed for keeping clearance between punch and die, according to different thickness of sheet. He also provides a proof of some materials to be effective for different wear conditions.[5]Mr. Siji Qin et.al: state a research on fine blanking process with a stepped edge punch. Analysis of blanking process with negative clearance is carried out by Finite Element Method. The fine blanking process is same as conventional blanking process. Burnish zone for three different materials as q235 steel, copper and industrial aluminium were observed. Also different conditions of Clearance would lead to failure of material and its proof of analysis is discussed in the paper. The reasonable process parameters were proposed for three different materials.[6]

III. METHOD

SMED is a technique used to reduce the breakdown time / changeover time of machine. In this technique, the time required to changeover is reduced to single digit minute i.e. between 1-9 minutes.

SMED is carried out in four following steps:-

- Observe the current methodology.
- Separate the internal and external activities.
- Convert internal activities into external activities.
- Streamline remaining activities.

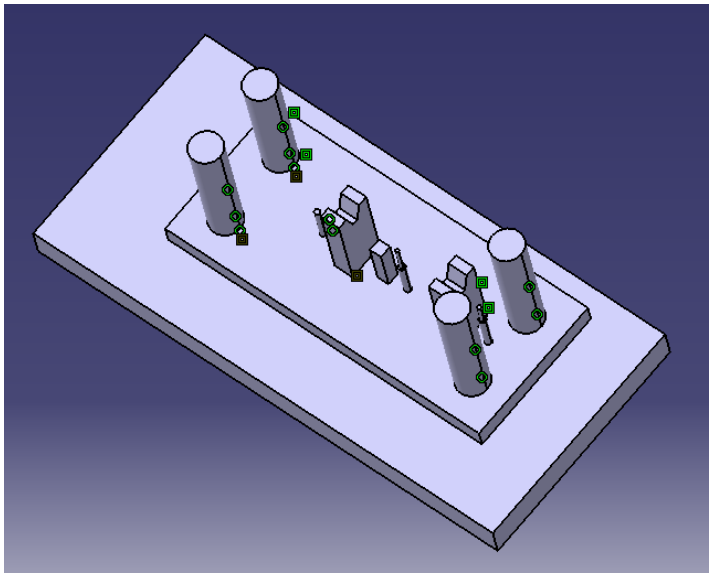
IV. PRESS TOOL

Design Considerations

- The size, shape, material and operations to be performed.
- Selection of tool such as simple, progressive, compound, combination, etc.
- Selection of proper strip layout.
- In Progressive tool the strip layout must cover all the stages at proper sequence, considering the rigidity of die.
- Considering the tonnage required and calculations related tool, such as economy factor, plate thickness, etc.
- Try to construct tool that can be easily modified in future.
- Shank location should be given at centre of the tool.
- Tool must be rigid considering its involvement in type of production such as mass, batch, etc.
- Re-sharpening allowance must be added to die and punch cutting edges.
- Tool must withstand all the lateral thrust acting on it during operation.

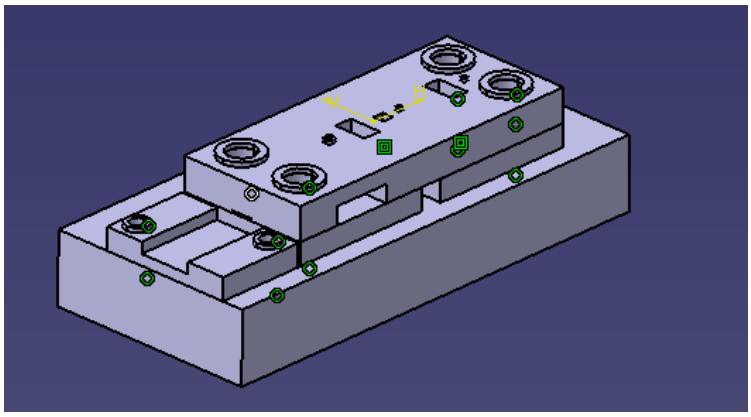
Design of various Components of Press Tool

1) Top Plate Assembly



CAD Model of Top Plate Assembly

2) Bottom Plate Assembly



CAD Model of Bottom Plate Assembly

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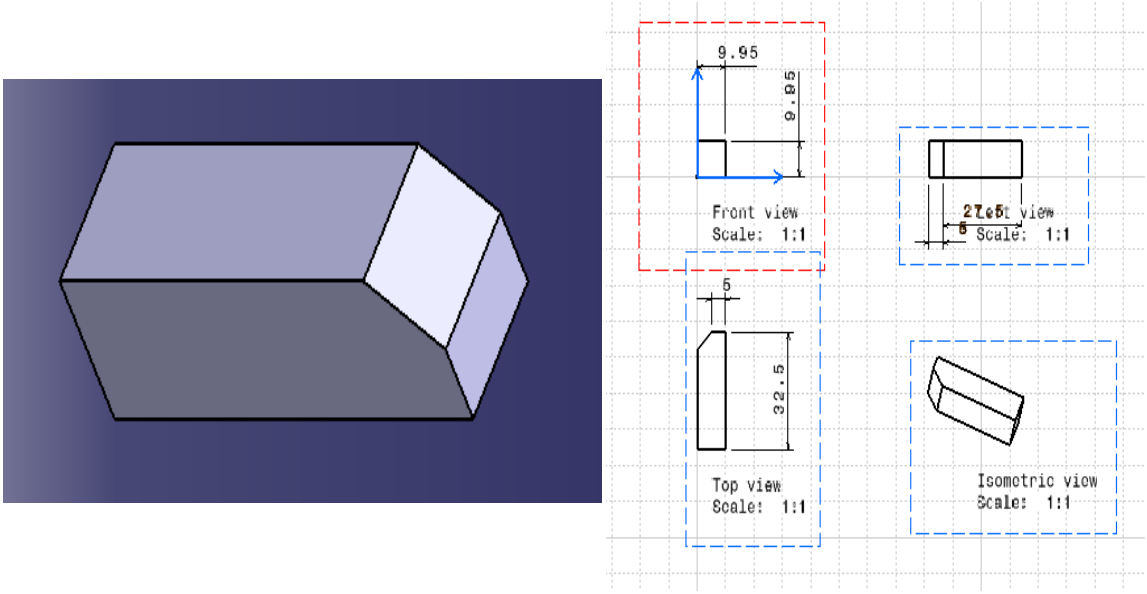
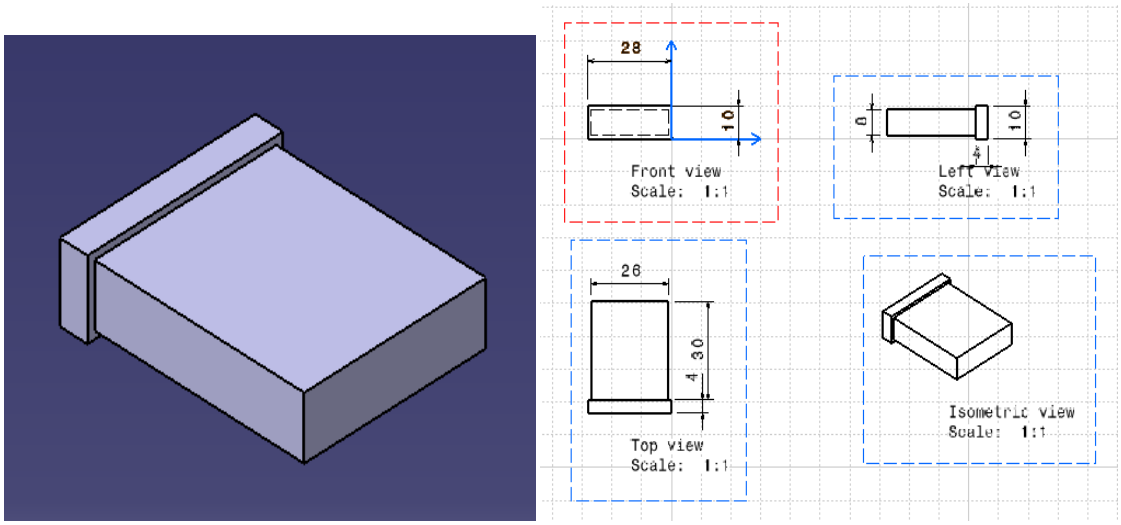
3) Insert



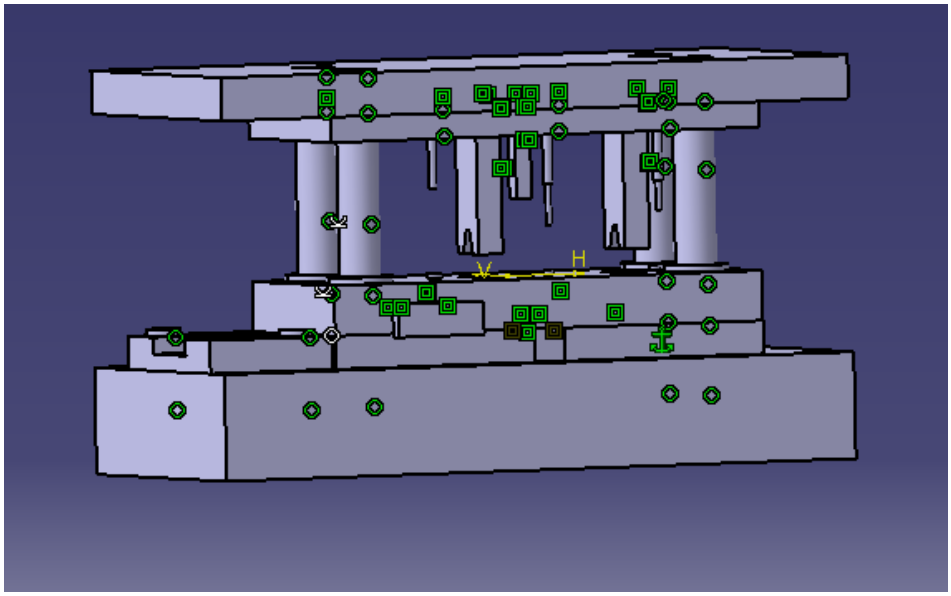
CAD and 2-D Model of Insert

4) Guide



CAD and 2-D Model of Guide

5) Complete Assembly



CAD Model of Complete Assembly

Material Selection

The life of tool, reliability and some other important properties mainly depend on the type of material used in the tool, therefore, material selection is the base of any tool to be manufactured. Generally D2 material is used in Die plate. Die plate should have enough strength to resist load of Punch plate and do not undergo bending. Accordingly the material D2 is selected for die plate. EN31 is also used for manufacturing of different parts of a Press Tool. Following are some materials used for different parts of Press Tool

Table 1 Materials of Press Tool

Sr. No.	Elements	Material
01	Pilot	Heat treated steel (56-60 HRC)
02	Bottom Plate	Mild Steel
03	Top Plate	Mild Steel
04	Stripper plate	OHNS (45-50 HRC) for higher production
05	Stopper	Hardened Steel
06	Dowels	Alloy Steel (case hardened 58 HRC)
07	Screws	Mild Steel
08	Die	D2
09	Punch Holder Plate	Cast Iron, semi steel, rolled steel
10	Thrust Plate	Hardened Steel (45-50 HRC)
11	Punch	Alloy Steel (hardened and tempered 58-60 HRC)

Table 2 Composition of D2

C	Si	Cr	Mo	V
1.50%	0.30%	12.00%	0.80%	0.90%

V. DESIGN CALCULATIONS

Formulae:

Shear Force

Shear Force = L x t x τ (1)

= 330 x 4 x 11.48

= 15.16 x 10^3 kg/mm^2

Stripping Force

Stripping Force = 20% of Shear Force (2)

= 0.2 x 15.16 x 10^3

= 3.03 x 10^3 kg/mm^2

Press Force

Press Force = Shear Force + Stripping Force (3)

= 15160 + 3030.72

= 18190.72 kg/mm^2

Press Tonnage

Press Tonnage = $\frac{\text{Press Force}}{70\%}$ (4)

$=\frac{18190.72}{0.7}$

= 26 x 10^3 kg

= 26 T

VI. RESULT & DISCUSSION

- Reduction in changeover time of Press Tool.
- Increase in production.
- Reduction in cost of bi-metal.
- More reliable to change the embossing punch.

VII. CONCLUSION

At last of this paper we conclude that the project on Design and Development of the Press Tool was carried out successfully. This project helped the company to increase their production in enormous form. Variety of Bi-metals can now be produced and the flexibility of the machine has also improved. Streamlining of activities were also enhanced. SMED concept was understood in a better way so that we can actually implement it on any other machine.

VIII. ACKNOWLEDGEMENTS

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