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DESIGN & FABRICATION OF PROGRESSIVE DIE FOR MAKING WASHER

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***ABSTRACT*—The process of designing and fabrication of progressive die set for making washer, methods and techniques are required which improve the efficiency and productivity of manufacturing product, large scale and higher speed requires helper tool known as press tool. Manufacturing of Washer is accompanied by two types of press tool operation namely blanking, piercing .It is a metal stamping operation in which the sheet metal is punched to get the needed outer profile of the sheet metal component. During the blanking process, the blanking punch penetrates into the sheet metal & forces the material into the blanking die. The portion of the sheet metal which coming out through the blanking die opening is the component with the demanded profile. Piercing operation made up of simply hole punching. It differs from blanking such that the punching is the scrap and the strip is the work piece. Piercing is nearly always accompanied before the blanking operation, after or else at the same time.**

Keywords: Die, Blanking, Piercing, etc.

1. INTRODUCTION

progressive die is mostly use for stamping operation to produce various component of automotive like coining, bending, deep drawing. It allowing the fabricator or iron worker to shear, punch, bend, scroll, and press thousands of different parts. The hydraulic progressive press is the perfect machine shop tool for the metal fabricator, by considering industrial machinery. The hydraulic progressive press fits in any little to medium-sized industry, when machinery for big-scale production demanded there must be necessarily make way for machinery with distinctly lower production cost .The operating procedure of hydraulic progressive press machine is a simple mechanism when compared to other machinery like simple press. In simple press process which starts with loading of a sheet into the die and progressively pierce the hole in equal spacing. after changing die & plunger we again going to feed the same sheet into it which gives us the final product. This process is simple but time consuming.

In progressive die press machine the two operation are performed simultaneously blanking is a process in which the punch removes a portion of material from the bigger piece or a strip of sheet metal. The small removed piece is the useful part and the rest is scrap, the operation is called blanking. Blanking is a common sheet metal manufacturing process used in the production from the range of small components to high strength materials. The sheet range from the 0.2 to 20mm thickness can be used for the applications. In blanking, punch & die clearance is the important factor to give the better quality of the product and improve the tool life.

2. EASE OF USE

Progressive die system reduces labour work and improves the quality of washer . progressive die system will overcome the existing problems like time consumption. In future, by modifying with automation for the system also can be achieved less scarp & collected various batch wise washer where quality inspection become easy task & time will be release.

3. LITERATURE REVIEW

Anudeep S, April 2015,in this research paper we learn about blanking operation like how shearing operation done in which in which the sheet metal is squeezed between punch & die & also how to select hardening die which is highly capable to wear abrasion resistance property[1]. Vyshakh[a],aug 2016,from this research paper we came across to conclusion that the factor need to care about while designing is that all part which should be design have capability to withstand the heavy force .There must be a safety to operator & technician. Sufficient space should be given for loading & unloading the stock & die set should be made of proper material[2]. C. Sangeevi,April-2016, with the help of this research paper we gain knowledge about permission between punch & die like-wise how to optimize die design parameter with the help of multiple regression analysis used in mathematical modeling by this we can also improve the life of per stroke & reduce

the burr height or else to say proper clearance[3]. U. P Singh,1992, in this work we get beneficiary knowledge about finite element method's software ansys in which we studied how to keep down the cost of punch without decreasing the life of punch[4]. Claus guy[a],2017,from here we learn the technique about how to increase of lifetime of blanking & die tool the most important factor is the ratio of carbon/carbide of a material likewise hardness to toughness ratio also it looks that heat treatment play important role for lifetime of punch. The tool steel vanadis, 4 & vanadis 23 have the best overall performance for blanking steel sheet[5]. Gaurav c. Rathod, in this research paper we study about tool material selection criteria & concluded that tool generally made up of steel alloy based on carbon composition cause it only posses more strength than any other material[6]. Vishal Naranje, here we understand the losses of traditional die casting process in which main factor is time consumption & expertise requirement & also how to overcome from it such as use of artificial intelligent (AI), in this we manage the computer perform intelligent things for the processing of unstructured, scattered knowledge for the solution of complex die problem[7].

After reading and study all these research paper we discussed that d2 steel is the suitable and economical material for die & stainless steel for punch for piercing & blanking. conventional process can be overcome by wearing & abrasive loading which is the major motive behind our project

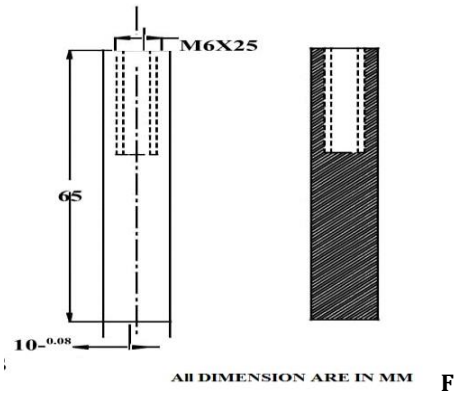
4. DESIGN OF MACHINE

4.1) Piercing Tool Calculation

Piercing is a basic and initial operation which is done in the progressive tool process. Here rear pillar and rear secondary guide pins are used to design the piercing stage tool which is designed to operate easily and for loading and unloading the part as show in below fig.1 our piercing tool dimension as length is 65 mm, diameter size 10mm,in which at top female matrix thread of size M6*25 is use which is connected to top plate of die set, which is operated by hydraulic cylinder.

Calculations :

1. Shear Force Calculation
   Shear Force = Shear Strength x Length of Cut x Thickness.
   Shear strength = 0.3447 KN/ MM^2
   Shear Force = 20.42 x 2 x 0.3447
   =14.07 KN
2. Total Shear Force = 2 x Shear Force
   =2 x 14.07
   =28.14 KN
3. Stripping Force = 20% of Total Shear Force
   = 0.2 x 28.14
   =5.628 KN
4. Press Force = Total Shear Force + Stripping force
   = 28.14 + 5.628
   = 33.768 KN
5. Press Tonnage Capacity = Press Force/ Press Efficiency
   = 33.768/ 0.70
   = 48.24 KN
   = 4.91 Tons



ig. 1 Piercing Tool Design

4.2) Blanking tool Calculation:

Blanking is a basic & initial operation which is done in the press tool process. Here rear pillared press tool is designed & the guide pin is diagonally located so operator easily feed the strip. Shear force is required to blank the sheet is calculated to get the press tonnage. Press tonnage means full capacity of the press machine to be selected for blanking considering all the criteria. Clearance is calculated and incorporated while designing of punch and die .in the blanking tool is design like a compound tool so in this cause 2 blank parts produces in a single shot.

Calculation : -

1. Shear Force Calculation
   Shear Force = Length of Cut x Thickness x Shear strength
   Shear Strength = 0.347 KN/MM^2
2. Shear Force = 2 x Shear Force
   = 2 x 47.64
   = 95.28 KN
3. Stripping Force = 20% of Total Shear Force
   = 0.2 x 95.28 KN
   = 19.05 KN
4. Press Force = Total Shear Force + Stripping Force
   = 95.28 + 19.05
   =114.33 KN
5. Press Tonnage/Capacity = Press Force/Press Efficiency
   = 114.33/0.70
   = 163.64 KN
   = 16.64 Tons
6. Cutting Clearance = 8% of Sheet Thickness
   = (8/100) x 2
   = 0.16 mm/Side.

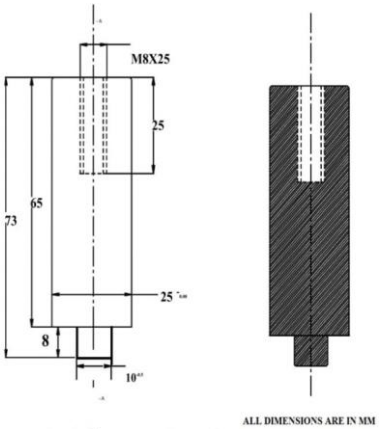


Fig.2 Blanking Design

In the Die Design we use the d2 steel material which is preferred because economically & long-lasting, as per their high strength property to withstand the high shear strength The d2 material is used as the material is already air hardening so the material withshand capacity increases. Air hardening also increases the life capacity of the material.The material used is sufficiently strong enough that it does not break easily.

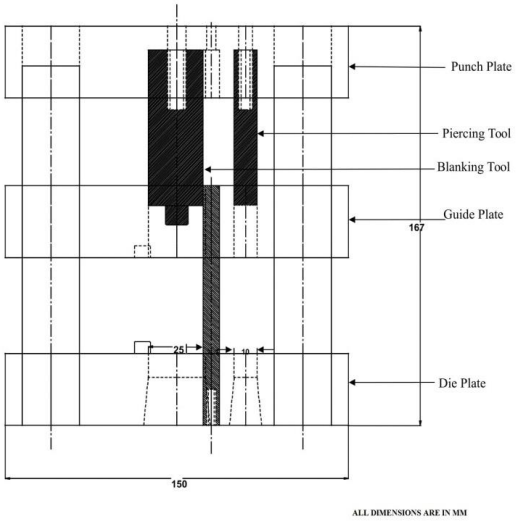


Fig.3 Die Set

In the above fig.3 all dimension are in mm. The above figure shows that the total height of our die model is 167 mm. The length of the die is 150 mm. The figure also shows the diameter of the piercing and blanking. The diameter of piercing id 10 mm and the diameter of blanking in our die is 25 mm. This is the Model according to which we are going to design our Die.

5. ASSEMBLY STRUCTURE

In this assembly we can clearly see that the structure of our machine consist of a Cylinder, Structural Frame, Die set guide pin, and Base Plate. The hydraulic Cylinder has input and output is connected to the hydraulic circuit. Which helps to actuate the Piston which is cylindrical shape moves backward and forward direction due to this motion it helps to obtain the required operation. The piston moves downward on the fixed die due to which the blanking and piercing operation is done.

The whole assembly is supported by structural frame. All the parts of the assembly are supported on the structure in their respective places. There is a guide plate which is used to guide the tool movement. The Whole assembly can be modified by using a collector which will collector in slots and can be automatically removed by using a suitable programming.

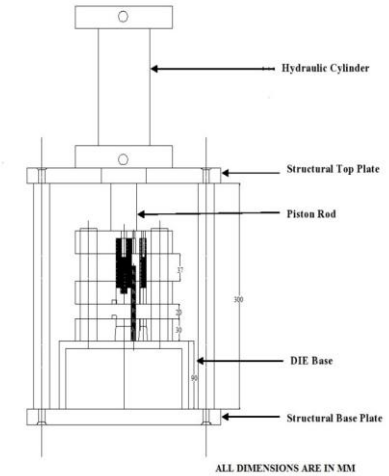


Fig. 4 Assembly setup

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