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Design & Analysis of 20 Ton Hydraulic Press Machine for Flaring Operation

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A B S T R A C T

The aim of this project is to design and analysis of hydraulic press to facilitate the ease of operation to manufacture the smaller parts in bulk. In current scenario time constraint is crucial part for completion of any production process. Thus, with the aid of automation the production time can be reduced as well as high degree of accuracy can be achieved easily. One more advantage is that human effort will be all aviated thus attempt has been made to provide the smooth and rapid functioning of press work with the help of hydraulic system. Hydraulic press is a device which uses hydraulic cylinder to generate the compressive force. The aim of this project is to make the special purpose machine for flaring operation on inlet sleeve which is used in Mahindra blazzo exhaust system. Previously there was no such machine available which is capable of clamping as well as flaring automatically. In previous case holding was accomplished mechanically, as large force is required for flaring operation, mechanical clamping was unable to sustain large amount of force which lead to damage of parts due to slipping. In order to overcome the above circumstances there is need to design hydraulic press.

Keywords: Hydraulic press, flaring, automation, special purpose machine, clamping.

1. INTRODUCTION

In this project the special purpose machine for flaring operation on inlet sleevz is designed used in Mahindra blazzo exhaust system. Previously there was no such machine available which is capable of clamping as well as flaring automatically. In previous case holding was accomplished mechanically, as large force is required for flaring operation, mechanical clamping was unable to sustain large amount of force which lead to damage of parts due to slipping. In order to overcome the above circumstances there is need to design hydraulic press.

In tube end flaring process, a circular tube of certain length is axially pushed over a conical die to form a flared end. In this project same method is applied for the component named Inlet Sleeve on which flaring is done at one end. In flaring operation first, the tube end is curled outward with a conical die having a large inner angle, followed by the flaring of tube end. The second process closed up the curled end and formed a hem. The flaring limit increases size of the pre-curl due to improvement in ductility around the tube end.

In this project design of hydraulic press is done to facilitate the ease of operation to manufacture the smaller parts in bulk. In current scenario time constraint is crucial part for completion of any production process. Thus, with the aid of automation the production time can be reduced as well as high degree of accuracy can be achieved easily. One more advantage is that human effort will be alleviated thus attempt has been made to provide the smooth and rapid functioning of press work with the help of hydraulic system Hydraulic press is a device which uses hydraulic cylinder to generate the compressive force .

1.1 Introduction to Hydraulic Press

A hydraulic press is a machine press using a hydraulic cylinder to generate a compressive force. It uses the hydraulic equivalent of a mechanical lever, and was also known as a Bramah press after the inventor, Joseph Bramah, of England. He invented and was issued a patent on this press in 1795.

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The hydraulic press depends on Pascal's principle-the pressure throughout a closed system is constant. One part of the system is a piston acting as a pump, with a modest mechanical force acting on a small cross-sectional area; the other part is a piston with a larger area which generates a correspondingly large mechanical force. Only small-diameter tubing (which more easily resists pressure) is needed if the pump is separated from the press cylinder.

Pascal's law: Pressure on a confined fluid is transmitted undiminished and acts with equal force on equal areas and at 90 degrees to the container wall. A small effort force acts on a small piston. This creates a pressure which is transferred through the hydraulic fluid to a large piston.

Hydraulic presses are commonly used for forging, clinching, moulding, blanking, punching, deep drawing, and metal forming operations. With the growth and importance of light-weighting in the aerospace and automotive industry, more applications are present in Thermoplastics, Composites, SMC Sheet Moulded Composites, RTM Resin Transfer Moulding, GMT Glass Mat Transfer and Carbon Fibre Moulding. All of these applications require precise control and repeat-ability. Since the hydraulic press works on the basis of Pascal's Law, its working is similar to the one of the hydraulic system. A hydraulic press consists of basic components used in a hydraulic system that includes the cylinder, pistons, the hydraulic pipes, etc.

The working of this press is very simple. The system comprises of two cylinders, the fluid (usually oil) is poured in the cylinder having a small diameter. This cylinder is known as the slave cylinder.

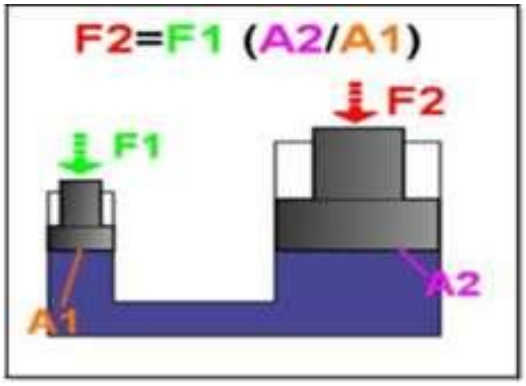

Figure 1.1: Working Principle

1.2 Problem Statement

The design of a machine for Flaring operation is to be done.

1.3 Scope of Work

Mahindra is launching a new series of **BLAZO HCV 7.2 L** (Heavy Commercial Vehicles). For which they have done some modifications in the design of exhaust system. The Design & development of machine for manufacturing of Exhaust system component which is **'Turbo Flange Adapter'** is entrusted to '**Samarth Engineers & Designers'**.

1.4 Objectives of Work

- The main objective of this project is to design, analyze, develop and manufacture the hydraulic press for flaring operation.
- To increase the productivity.
- To reduce the labor work.
- To make machine structure simple to enable easy mounting.
- To minimize the rejections.
- To Ensure Safety during operation.

1.5 Part Drawing

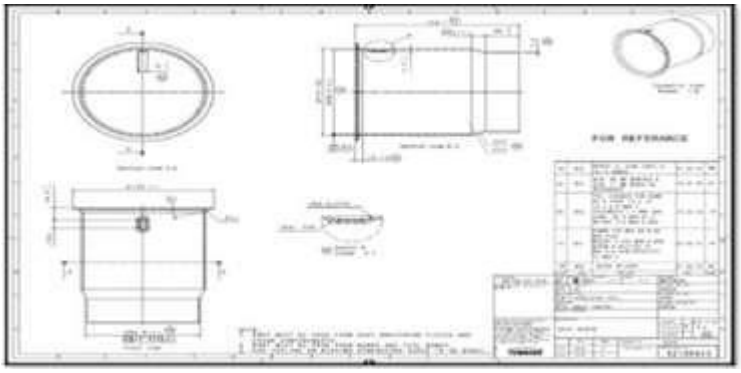

Figure 1.2 2D Diagram of Turbo flange adapter.

2. Design and Force Calculation

2.1 Force Estimation

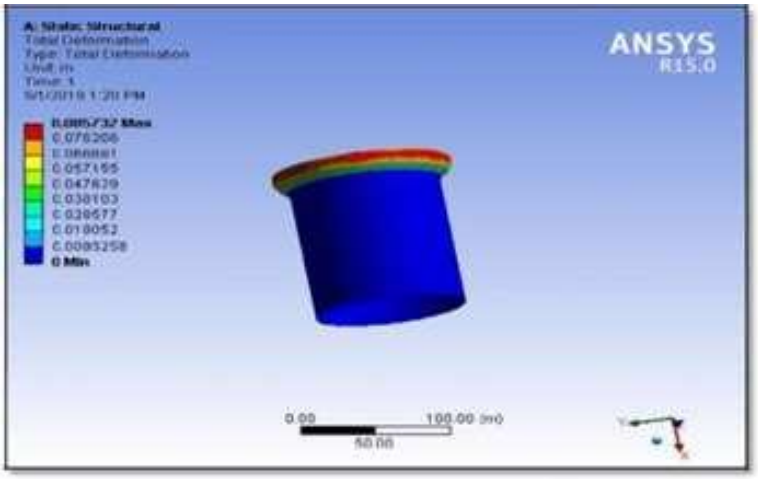

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Figure 3.2 Force Estimation by using Ansys.

From the part drawing provided, it is clear that the total deformation require in final product is around 7.8 mm. So, on application of the force around 20 tones produce total deformation of 8.5732mm is proved from the analysis.

2.2 Design Calculations

Force calculations:

Force for punching (F_1) = 200000 N
Force for clamping (F_2) = 50000 N

Cylinder Dimension calculations:

$$D_1 = \sqrt{\frac{4 \times F}{\pi \times P}}$$

$$= \frac{\sqrt{4 \times 200000}}{\pi \times 70 \times 10^3}$$

$D_1 = 190.73$ mm $D_1 = 200$ mm

$$D_2 = \frac{\sqrt{4 \times F}}{\pi \times P}$$

$$D_2 = \frac{\sqrt{4 \times 50000}}{\pi \times 70 \times 10^3}$$

$D_2 = 93.365$ mm $D_2 = 100$mm

System Pressure calculations:

$$P_1 = \frac{F \times 4}{\pi \times D^2}$$

$$P_1 = \frac{20 \times 10^4 \times 4}{\pi \times 0.2^2}$$

$P_1 = 63.66$ bar

$$P_2 = \frac{F \times 4}{\pi \times D^2}$$

$$P_2 = \frac{5 \times 10^4 \times 4}{\pi \times 0.1^2}$$

$P_2 = 63.66$ bar

Assumed pressure i.e. 70 bar doesn't exceed maximum pressure in system. Thus design is safe.

3. Installation of Press

3.1 Manufacturing of base frame

Manufacturing of base frame comprises of following operations-

1) Selection of material for base frame.
2) Structure designing on software.
3) Ordering raw material.
4) Cutting raw material into required size by cut off machine.
5) Performing arc welding for joining parts according to design.
6) Drilling holes on base plate according to markings by DRO machine.
7) Placing base plate on frame.
8) Bolting of base plate by dowel pins.
9) Welding base plate by arc welding to insure strength of base frame.

3.2 Manufacturing of C - frame

Manufacturing of C - frame comprises of following operations-

1) Selection of material for C frame.
2) Structure designing on software.

3) Ordering raw material.
4) Cutting raw material into required size by cut off machine.
5) Finishing with milling machine.
6) Drilling holes on plates according to markings by hand drill.
7) Assemble plates together by bolts.
8) Welding C - frame plate by arc welding to insure extra strength.

3.3 Mounting & Assembly

1) Placing components on base plate.
2) Securing components by bolts.
3) Connecting hydraulic components with pipes and hoses with help of connectors.
4) Setting required working pressure for different components.
5) Filling hydraulic oil into the reservoir.
6) Setting up sensors and PLC components.

4. Conclusion

In this project, design and analysis of hydraulic press has been conducted to facilitate the ease of operation to manufacture the smaller parts in bulk. Design calculation and installation of press has been discussed.

REFERENCES

[1] Tan chin Joe, Mohammad Hossein Dord keshan, "Experimental study on tube end flaring process for different bottom end surface textures", International journal of mechanical and production engineering, volume-5, issue-7, 2017.
[2] Malachy Sumaila and Akii Okonigbon Akaehomen Ibhadode, "Design and manufacture of a 30-ton hydraulic press", Research Gate, 2011.
[3] Mr. K. Shravan Kumar, B. Prashanth, "Design fabrication of hydraulic press", International of Scientific Development and Research (IJSDR), 2017.
[4] Asim M. Kamate, Prof. (Dr.) J.S. Bagi design, "Development and Analysis of a 20 ton hydraulic press", international journal of innovative technology and research volume, 2016.
[5] Bethrand N. Nwankwojike, Chukwunonso N. Nwoguand Godswill Kalu , "Development of a Manually Operated Hydraulic Press and Pull Machine", FUOYE Journal of Engineering and Technology, Volume2, Issue2, 20 17.

Books:
1. Oil Hydraulic System, S. R. Mujumdar.
2. Hydraulics and Pneumatics, Andrew Parr.