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Design & Manufacturing of 20 Ton Horizontal Hydraulic Press Machine For Pipe Squeezing & Flaring Operation

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Abstract - *The hydraulic pressing machine used for converting shape of the material to the required form by compressive force of action. In this work hydraulic pressing machine of 20 Ton capacity is Designed and Manufacture. The design has to resist the generated force during operation and to calculate design parameters like stress induced and total deformation developed during operation. This pressing machine is made for manufacturing of automotive body buildings and sheet metal applications. The machine is designed for special purpose only like flaring and squeezing operation, to the load capacity of 20 Ton. The frame and cylinder is modeled using UG NX-11*

Key Words: Hydraulic Press, Squeezing and Flaring Operation. Special purpose machine, clamping, UG NX-11.

1. INTRODUCTION

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.

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.

The hydraulic presses have main advantage of positive response for the input pressure when compared to other type of machines. The force and pressure can be controlled accurately and ram travel utilizes entire magnitude force which is available during forward stroke. Press machine used for fitting operations are most valuable machines used in laboratories and workshops whenever high force is required

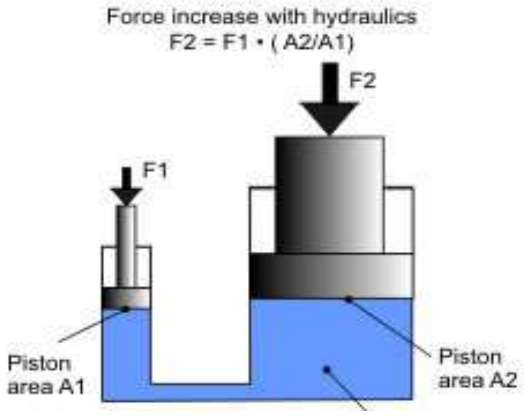

Fig-1: Hydraulic machine

2. LITERATURE REVIEW

[1] Ganesh M Mudennavar, Gireesha Chalageri, etc. all, The hydraulic pressing machine used for converting shape of the material to the required form by compressive force of action. In this work hydraulic pressing machine of twelve Ton capacity is Designed and Analysed. The design has to resist the generated force during operation and to calculate design parameters like stress induced and total deformation developed during operation. This pressing machine is made for manufacturing of automotive body buildings and sheet metal applications. The machine is designed for special purpose only, to the load capacity of 12 Ton. Structural analysis becomes a part to identify the product design.

[2] Akshay Vaishnav, Path Lathiya, etc. all Metal forming is a process which is done by deforming metal work pieces to the desired shape and size using pressing or hammering action. Hydraulic presses are being used for forming and pressing operations with wide range of capacities. Hydraulic press machine works under continuous impact load. Because of this continuous load, tensile and compressive stresses are experienced in various parts of machine. These stresses cause permanent deformation in some parts of machine. This work is based on optimization of a 250-ton four pillar type hydraulic press considering constraints like design, weight and cost. The work is focused on design and optimization of top plate of the press machine. Top plate holds the hydraulic cylinder and is one of the most critical parts of the machine. The design is based on sizing

optimization method and the results are validated by Finite Element method with proper boundary conditions. The CAD modelling has been carried out by PTC CREO and for FEA, ANSYS software is used.

[3] Deepak Annasaheb More, N. K. Chhapkhane, etc. all, A hydraulic press is a machine using a hydraulic cylinder to generate a compressive force. Frame, hydraulic cylinder and press table are the main components of the hydraulic press. In this project press frame, cylinder and press table are designed by the design procedure. They are analyzed to improve their performance and quality for press working operation. Using the optimum resources possible in designing the hydraulic press components can effect reduction in the cost by optimizing the weight of material utilized for building the structure. An attempt has been made in this direction to reduce the volume of material. So in this paper we consider an industrial application project consisting of mass minimization of H frame type hydraulic press. This press has to compensate the forces acting on the working plates and has to fulfill certain critical constraints. Here we use FEA implementation for analysis and optimization of hydraulic press.

[4] Tan Chin Joo , Mohammad Hossein, etc. all, the method of flaring process. In tube end flaring processes, a circular tube of certain length is axially pushed over a conical die to form a flared end. End flaring ratio is calculated from the percentage of increase in elongation of the circumferential bottom end before and after the process the circumferential length of the cracked bottom end is measured along the external edge and the percentage of increase is calculated. The effect of different cutting and end preparation methods on increasing the end flaring limit of seamless tube was studied. End flaring limits of seamless tube are strongly influenced by surface texture along its bottom end particularly the degree of smoothness along the external edge

[5] B. Parthiban, R.Sunil Muthu Kumar, etc. all, The hydraulic machine is used to convert the shape of any material into required form by pressing operation. A hydraulic is a machine using hydraulic cylinder to generate a compressive force. The top and bottom segment has to resist the force generate while pressing operation and it is significance to calculate the mechanical properties like total deformation and stress developed on the machine. The mechanism of this application of the machine is used for the manufacturing of car dashboard. The machine is designed and fabricated for this special purpose only the load capacity of 10 Ton. Structural analysis to become a part to identified the product design. The frame and cylinder are model by using CATIAV5. In this 10 Ton hydraulic pressing machine we observed that the deformation is high and the optimization of cylinder and tie rod are analyzing by using ANSYS software. The objective of this paper is to reduce weight and cost of the pressing machine in the quality of output in the component of machine. We modify the structure and reduce the material in it and the factor of safety is obtained from the modified structure is within the limit of the machine.

[6] Malachy Sumaila, Akii Okonigbon, act all, was designed, manufactured, and calibrated a 30-ton hydraulic press. The machine was tested to ensure conformability to design objectives and serviceability. The machine was found to be satisfactory at a test load of 10 kN. The major components of the press designed includes the cylinder and piston arrangement, the frame and the hydraulic circuit. The machine was tested for performance with a load of 10 kN provided by two compression springs of constant 9 N/mm each arranged in parallel between the upper and lower platens and was found to be satisfactory.

3. PROBLEM DEFINATIOM

For manufacturing of Exhaust manifold / Turbo flange adapter, there are some basic operations. But, the most important operation to perform on that part is Flaring operation. As the part is newly modified with different parameters, there are no suitable machines available for flaring operation. So, the design and development of a machine for Flaring operation is to be done.

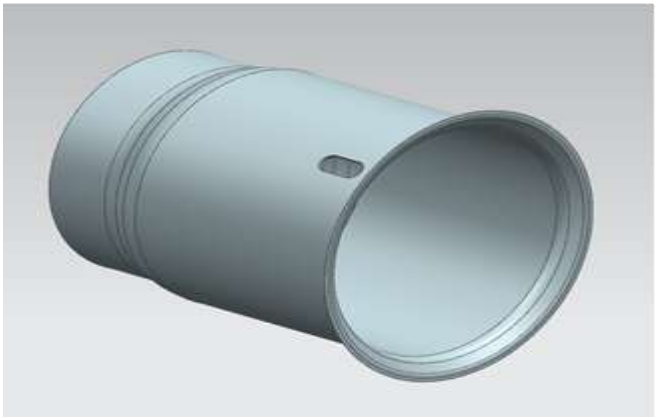

Fig-2: 3D Model of Turbo flange adapter

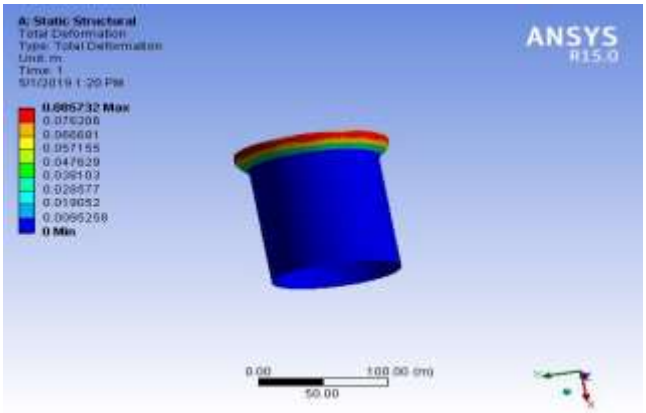

Fig-3: Force Estimation by using Ansys

4. Material Selection of Hydralic Press Parts

Table -1: Part Material and Properties

Part	Material	Density (Kg/m^3)	Young Modulus (Gpa)	Tensile Strength (Mpa)	Poisson Ratio
Cylinder and Pillar	ST-42-S	7850	210	412	0.3
Piston with rod, Nuts and Bolts	EN-8	7850	200	541	0.3
Platens and Bolters	EN-24	7840	207	800	0.3

5. DESIGN CALCULATIONS

Force calculations:

Force for punching (F1) = 200000 N

Force for clamping (F2) = 50000 N

Cylinder Dimension calculations:

D1 =√4×$F\pi$□p

D1 =√4×200000π□20□103

D1= 190.73 mm D1 = 200 mm

D2=√4×$F\pi$□p

D2 =√4×50000π□20□103

D2 = 95.365 mm D2 = 100 mm

System Pressure calculations:

p1 =F□ π□D2

p1=20□□04□ π□0.22

p1= 63.66 bar

p2 =F□ π□D2

p2=5□□04□ π□0.12

p1= 63.66 bar

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

Velocity calculations:

According to basic design consideration of the system Stroke length (s) = 200 mm

Time (t) = 9.5 sec

V1 =s/t

V1 =0.2/9.5

V1 =0.021 m/s

V2 =s/t

V2 =0.2/9.5

V2 =0.021 m/s

Flow rate calculations:

Q1 = A1□1

Q1 = 0.0314159260□.021

Q1 = 6.5973×10−4m3/s

Q1 = 39.58 l/min

Q2 = A2□2

Q2 = 7.8539×10−3×0.021

Q2 = 1.649×10−4m3/s

Q2 = 9.896 l/min

Qret 1 = (Ap-Ar)□Vret1

6.5973×10−4= (0.031416 −5.0265×10−3)×Vret1

Vret1 = 0.025 m/s

Qret 2 = (Ap-Ar)□Vret2

1.649×10−4= (7.8539×10−3−2.827×10−3)×Vret2

Vret2 = 0.03 m/s

Power calculations:

Power produced by Single pump = Qmax□max

Ppump = 39.58×10−3×63.66×105/60000

Ppump = 4.20 KW

Power supplied to the pump by motor = Pɳ

Pmotor = 4.200.75

Pmotor = 5.603 KW

Pmotor = 7.512 HP

6. 3D MODEL OF PART

I. Frame Structure

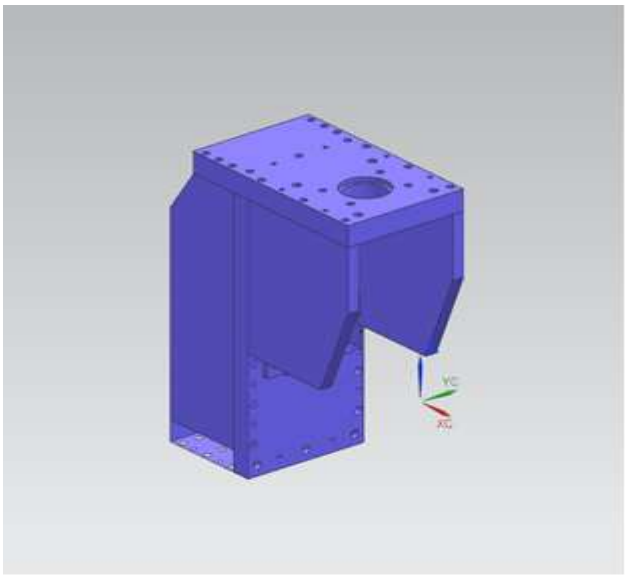

Fig-4: Frame Structure

II. Pillar

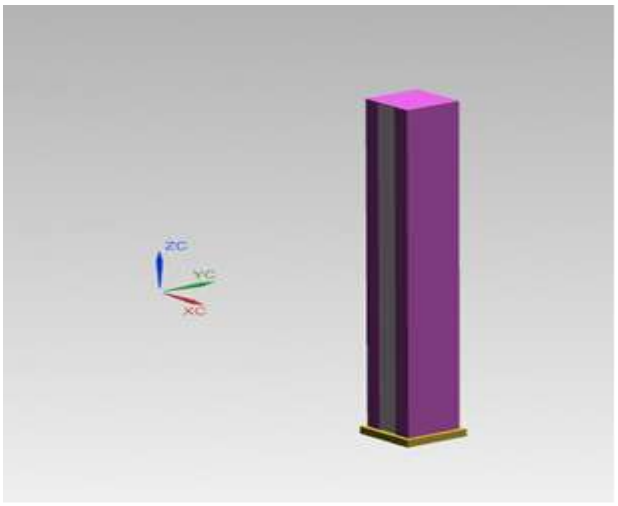

Fig-5: Pillar

III. Punch and Die

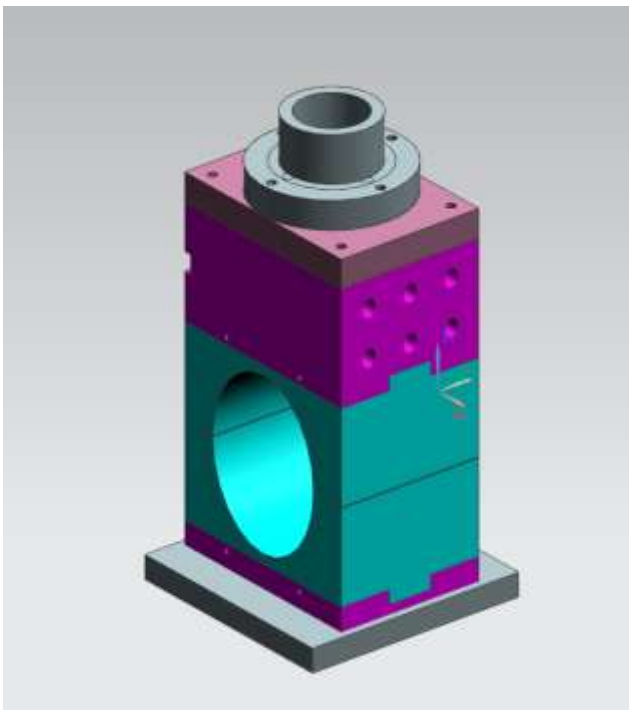

Fig-6: Punch and die

7. HYDRAULIC CIRCUIT DIAGRAM

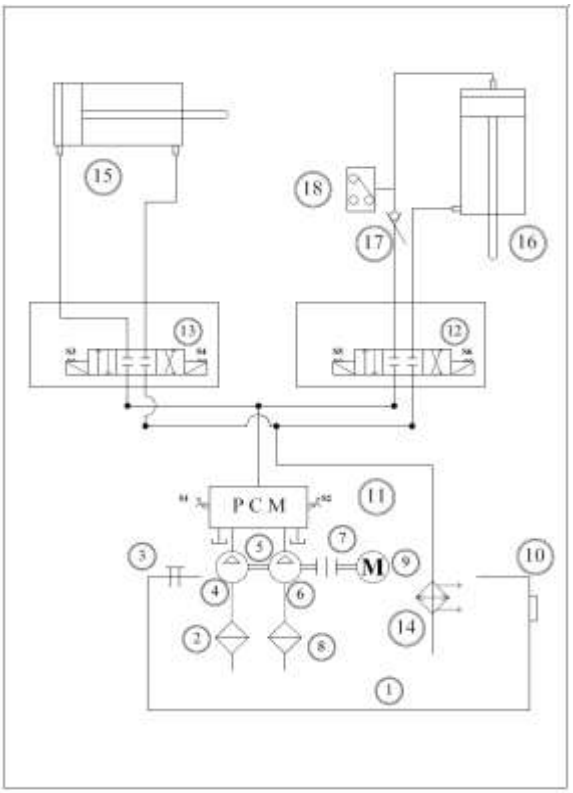

Fig-4: Hydraulic Circuit Diagram

8. 3D MODEL OF HYDRAULIC MACHINE

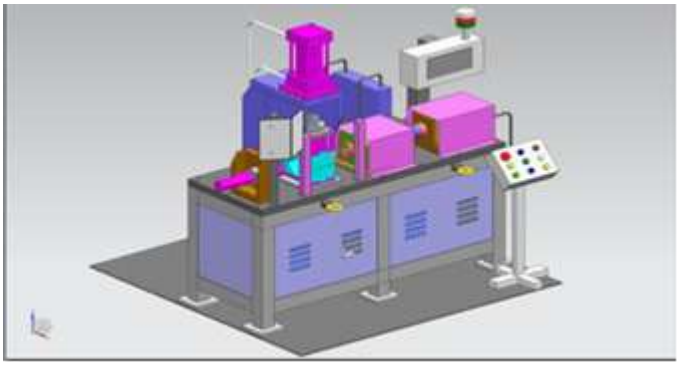

Fig-7: Isometric View of Hydraulic Press Machine

9. CONCLUSION

We are started up project that they want to do flaring operations more efficient. For this purpose, new hydraulic press is to be construct including modelling, technical drawings, all parameters' calculations, selection of the hydraulic components and strength analysis of the frame. The goal of this work is to construct a hydraulic press to for flaring. Which will be more efficient and more reliable. The project mainly emphasizes on the core of the mechanical field. Though this project not based on social issues or need, the project shows a great work of engineering. Basic purpose of project is to advancing toward the hydraulic field. This press can be efficiently used in making inlet sleeve for Mahindra Blazzo. It represents the study of various subjects of mechanical field such as design, hydraulics, mechanical engineering material and many more. Our aim is to design a press that would help Samarth industries. with our knowledge and efforts we are trying give our best in this project. Not only this, but it has also paved away for us enhancing more knowledge regarding the field of hydraulics. It has encouraged us. During each and every stage we are coming across many things, we are experiencing in design and analysis and has a whole it made us understanding importance of team work. Apart from the academics it helped us building our own way and lighting our sparks with our capabilities

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