

# DESIGN AND DEVELOPMENT OF MANUAL HYDRAULIC PRESS

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**Abstract:** The paper deals with study of the Hydraulic press, which is a common machine used in all types of industries. Various operations are performed on it. The press machines are available in the market with various capacity and sizes. They are classified according to user requirements. Hydraulic presses are needed in Small and micro scale industries. In the present research paper, an effort is made to study the previous investigations that have been made in different structural analysis of hydraulic press. we are going to design and develop the C-frame type hydraulic press of 2 ton capacity in compact size for a small scale engineering industry. The hydraulic cylinder is used to generate 2 ton compressive force. The industry can purchase a readymade press available in the market. But its cost is higher which is not affordable to small scale industries. The ultimate objective of the paper is cost effectiveness of the machine without changing the quality of the applications.

**IndexTerms - Analysis, Cost Effectiveness, C-Type Hydraulic Press, Hydraulic Press**

## I. INTRODUCTION

A hydraulic press is a machine press using a hydraulic cylinder to generate compressive force. Hydraulic press used in industries are generally converted or built to crush or to press any “process” or the “product”. The hydraulic press depends on Pascal's principle which is the pressure throughout a closed system is constant. According to pascal principle, the external static pressure applied on a confined liquid is distributed or transmitted evenly throughout the liquid in all directions. Pascal also found that the pressure at a point for a static fluid would be same across all planes passing through that point in that fluid container. Hydraulic presses are commonly used for punching, moulding, blanking, forging, clinching, deep drawing, and metal forming operations. With the ongoing surge towards light-weight parts for aerospace, automotive appliances and many other industries, Servo Hydraulic and Hydraulic presses have become a key tool for the Thermoplastic Industries. Otherwise known as compression molding presses, control of speed, pressures, position, heating and cooling mould temperatures can be managed with the I-PRESS HYDRO controller for press and automation functions.

Advantages of hydraulic presses are:

1. Higher amount of force can be produced.
2. Uniform pressure distribution.
3. Slower and uniform ram punch speed.

What Makes Hydraulic Presses So Useful?

There are three good reasons that hydraulic presses are the most common in use as follows:

1. Their design makes them the most efficient.
2. They are dependable, the work horses of manufacturing.
3. The level of force of hydraulic cylinder they reach can't be duplicated with mechanical or pneumatic presses. By far the most common material for constructing a hydraulic press is stainless steel, which increases the life of machine. Hydraulic presses are versatile heavy equipment because they come in both single and multi-station configurations respectively. The single station has one set of tools inside the table, and multi-station units can handle several operations at the same time.

## II. LITERATURE:

Joshi Amey et al. represent paper on, Design of Special Purpose Hydraulic Press Machine. The present paper is associated with the design of special purpose hydraulic press used for assembly of muffler. The tool used for designing is Uni-graphics. A hydraulic press is a device using a hydraulic cylinder to generate a compressive force. A special purpose hydraulic press is suggested for press fitting two child parts of muffler used in silencers of automobile and marine industry. After observing the drawbacks in manual process of press fitting, hydraulic press needs to be designed. Thus the project is to design, analysis and fabrication of special purpose hydraulic press machine of required tonnage. [1]

Asim M. Kamate et al. represent paper on, Design, Development and Analysis of A 20Ton Hydraulic Press. Hydraulic Deep Drawing Presses are widely used for industrial sheet metal forming today. Small manufacturers of drawn parts and suppliers of the automotive industry especially appreciate these machines because of their high flexibility in process design. The present research work represents the new way of cost reduction in manufacturing of hydraulic press. The researcher has designed the press by using the simple sections of mild steel easily available in the market. The analysis is done for both, the existing and new one. The comparative study is given in the paper. The weight of newly designed Hydraulic Press is reduced up to 50% and hence cost is reduced up to 53.48%. The Pro-E tool is used for designing and the ANSYS tool is used for analysis and optimization. [2]

Manikanta Ma et al. represent paper on, Design and development of 5 ton c-type press structure and optimization through finite element analysis. In the present work, 5 tons of press structure is designed based on two conceptual designs. The research work is done on the basis of comparing two different designs. The comparison is done in deflection, total stress and natural frequency. The analysis is done in parts as well as in assembly. [3]

B. Parthiban et.al. Represent paper on, Design, Analysis and Optimization of 10 Ton Hydraulic Pressing Machine. The present research work is associated with the design analysis and optimization of the 10 ton hydraulic press. The design is done with

CATIA tool and the analysis is done with ANSYS tool. The main focus is given on cylinder and tie rod. They are designed and analysed by using ANSYS tool to reduce the weight of machine. [4]

Akshay Vaishnav et al. represents paper on, Design Optimization of Hydraulic Press Plate using Finite Element Analysis, In the present paper, study is done on the structural analysis of top plate of 250 ton hydraulic press. Top plate experiences both the tensile and compressive loads continuously. From sizing optimization method, the design is modified by incremental iteration approach. [5]

Santoshkumar S. Malipatil et al. Represent paper on, Analysis and Structural Optimization of 5 Ton H-Frame Hydraulic Press, Using the optimum resources possible in designing the hydraulic presses frame can effect reduction in the cost of the hydraulic presses. The methodology followed by comparing the stresses induced in machine for different part thickness used for construction of frame and column of the H-frame type hydraulic press. . By reducing the weight by 57.56 %, the cost is reduces by 57.55%. The ultimate result of paper is very important that without compromisation is done with the output result of press machine. [6]

Martin Zahalka et. al. represents, Modal Analysis of Hydraulic Press Frames for Open Die Forging, Dynamic behavior of the forging machines is necessary to explore due to the increasing of speeds on large forging hydraulic presses for open die forging. The paper describes the modal analysis of two selected presses, which represent the most common designs of hydraulic presses for forging. The first press is press with double-column frame CKV 50 with the force 50MN and the second press one is with four-column frame CKV 170 with the force 170 MN. Further are described the simulations of oscillation, which was excited by time-dependent work force. Results of analysis are compared with measurement in the real operation. [7]

Karel Raz et.al. represents, Dynamic Behaviour of the Hydraulic Press for Free Forging, Work on hydraulic presses is defined by a static forging force. The paper deals with higher frequency presses. The presses used for forging are basically with higher frequency of strokes. This paper helps to understand dynamic and shock loads. Different designed structures of same press are analysed with FEM tool so as to understand needs for lowering of first critical natural frequency. [8]

Wei wei Zhang et al represents, Structural optimization of cylinder-crown integrated hydraulic press with hemispherical hydraulic cylinder. In the paper, research focus is given on newly invented Cylinder-crown integrated hydraulic press. The hemispherical hydraulic cylinder is functions as a main portion of crown. Compared with the conventional hydraulic press in which cylinder mounted in the crown, the thickness of hemispherical hydraulic cylinder could be much thinner and the crown section modulus could be much higher under the same application condition.[9]

S. P. SINHA et al represents, Computer-Aided Design of Hydraulic Press Structures. In this paper, the structural analysis and mathematical model of simple hydraulic press is defined. To reduce computational time, the side plate (C-plate) was divided hypothetically into two parts. In this paper, the factors considered are fillet, edge cutting, provision of openings, change in position of stiffeners and eccentric loading. Due to modification, it is observed that the deflection due to load gets reduced. An author has used a simplified PS model for FEM analysis, as identified in the welded frame of the press and such a model has resulted in savings in computational time, core memory requirement and cost of analysis. [10]

Hui-lin Qu et.al. represents paper on, Optimization design of guiding device on hydraulic press column based on Axiomatic Design Theory, In this research paper, the basic focus is given on the guiding component of hydraulic press so it is make a safer design. . In this paper, they analyze the guiding device on a large tonnage hydraulic press, and we create the axiomatic design framework of guiding device on hydraulic press column by mapping and refining layer by layer. [11]

Mengdi Gao et.al. represents, Energy-saving Methods for Hydraulic Presses Based on Energy Dissipation Analysis, This paper deals with the worldwide energy consumption due to hydraulic presses and the ways to decrease it. The main focus of the paper is carbon emission through hydraulic presses. The paper will help us in such a way to select the type of hydraulic press as well as the method of actuation and energy transmission need to it. Ultimately the paper will teach us to manufacture an eco-friendly hydraulic press. [12]

Karel Raz et. al. represents, Using of a Hydraulic Press in Production and Manufacturing of Large Rings. This paper states the possibility of using hydraulic press for production of large rings made up of steel plates used in nuclear industry. Such rings are currently manufactured with different processes. By analysing the conceptual structure of the press machine with finite element method, the possibility of such a large press is discussed in this paper. [13]

Ganesh M Mudennavar et al. Represents paper on, Design and Analysis of 12 Ton Hydraulic Pressing Machine, In this paper, 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 Analyzed. 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. The frame and cylinder is modeled using CATIA V5 and analysis by ANSYS software. [14]

Saleha Shaikh et al. Represents paper on, A Review on Topology Analysis and Optimization of Hydraulic Press Brake, In the present review paper an effort is made to study the previous investigations that have been made in the different structural analysis and optimization techniques of hydraulic press machine brake. That analysis may be static or dynamic analysis. A number of analysis techniques like analytical and experimental are available for the structural analysis of hydraulic press machine brake. Determination of the different structural or topology analysis and optimization through the various methods like FEA, in a hydraulic press brake has been reported in research paper. [15]

Deepak Annasaheb More et al. represent paper on, Design, Development and Optimization of Hydraulic Press. In this paper, cylinder and press table are designed by the design procedure. They are analysed 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 of hydraulic press frame. From this paper, it can be concluded that simulation software is the powerful tool for prediction of safe design at given load. [16]

Mengdi Gao et. al. Represent paper on, Design and Optimization of the Slide Guide System of Hydraulic Press Based on Energy Loss Analysis. In this paper, a mathematical model of total energy loss in a hydraulic press has been developed that considers the leakage and friction in a slide guide system. Based on the principle of minimum overall energy loss, a method for calculation of optimum clearances was proposed, for which the maximum allowable lateral load may be calculated, which determines the maximum allowable side force that a hydraulic press may undergo while applying the load. A case study was considered for a hydraulic press. The methods proposed in this research paper were used to determine optimum clearances of approximately 0.4 mm. The energy loss was estimated to increase by approximately 83% when subjected to an eccentric loading condition. This paper is helpful in designing of guide system of hydraulic press. [17]

Ameet B. Hatapakki et al represent paper on, Design Optimization of C Frame of Hydraulic Press. This paper represents the design of C-frame hydraulic press with 100 Ton capacity. The focus is given on reduction in thickness of side plates so that the weight of machine gets reduced to reduce the cost of machine. By using the finite element analysis, the design analysis and optimization is done. The Von- Mises theory is used to find out criterion of failure. The Equivalent Stress of the Optimized Model is found to be well below the Design Stress, assuming a Factor of Safety of 3. The weight, by optimizing, is reduced by 12% and cost is reduced by Rs. 7800/- per machine. Hence, the paper is useful in design and analysis of hydraulic press. [18]

Mr. K. Shravan Kumar et al. represents paper on, DESIGN & FABRICATION OF HYDRAULIC PRESS. Frame and cylinder are the main components of the hydraulic press machine. In this research press frame and cylinder are designed by using design procedure. For the modeling of frame and cylinder uses software CATIA.. An attempt has been made in this direction to reduce the volume of frame material. So in this paper consideration for an industrial application consisting of mass minimization of H frame type hydraulic press. [19]

Satish B. Mariyappagoudar et al represents paper on, Design and Analysis of Hydraulic Press using ANSYS. The Separation of cotton seed from cotton is very important for the further use of the cotton for varies industries. The process of separating the cotton seed from cotton is called ginning and converting the cotton lint into bail is known as pressing. The frame structure has to withstand the forces generated while pressing operation and it is essential to calculate mechanical properties like total deformation and stress developed on the machinery. Hence, here the work has been being carried out on ten ton press machine. Design is done in CATIA V5 and analysis is carried out in ANSYS workbench 14.5. [20]

#### IV. OBJECTIVE

1. To find out the hydraulic press related problems in small and micro scale industries.
2. To focus the critical issue regarding press for the particular job in an industry.
3. Find out the cost efficiency of developed press.

#### V. BRIEF DESCRIPTION OF THE PROJECT UNDERTAKEN

We are going to design the hydraulic press. This hydraulic press should be capable of taking two ton load. So that we are going to design on paper with the machine design procedure, the general dimensions of structure. The model of the structure will then be designed with the help of PRO-E software. The part modeling and the assembly will be done with the same software. The model then will be taken into ANSYS software to analyse the dimensions. From the literature review, The hydraulic press which we are going to manufacture, has one hydraulic cylinder of 2 ton capacity for special purpose application. The cylinder type is common bottle jack which is easily available in the market. The structure of press will be made up of mild steel and will use the standard components for the fabrication of c frame of hydraulic press for reducing the weight of frame and also reduce the cost of fabrication.

#### VI. METHODOLOGY:

First to study the designs of 2 ton hydraulic press in geometric modelling software and then carry out analysis in FEA software to analyse the problems present in existing press. To design the critical components of the hydraulic press using geometric modelling software. After that, analyse and optimize the critical areas of hydraulic press. To finalize the design of low cost manual hydraulic press and analyse in ANSYS software, and fabricate the hydraulic press and take trials.

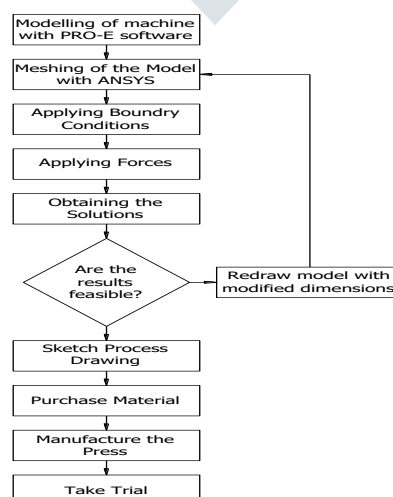


Figure: 2 Methodology Flow Chart

#### VI. CONCLUSION

In this paper an effort is made to review the previous investigations that have been made on the structural analysis of various frames. This literature survey gives the knowledge of shape optimization to reduce weight of the frame for topology optimization and permits the analysis of design solutions for optimizations of their performance and development of new solutions. In addition



to ensuring manufacturability of the structurally optimized components, using the standard components like c-channels, square tubes of material mild steel which increases the life of press as well as the design process delivers components with minimum cost and required performance.

#### REFERENCES

- [1]Joshi Ameya, Kamble Sanket, “Design of Special Purpose Hydraulic Press Machine,” International Journal of Advance Research and Innovative Ideas in Education, Vol-4 Issue-3, pp.2327-2331, 2018.
- [2]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 No.4, Issue No.1, pp.2560- 2563, December -January 2016.
- [3]Manikanta Ma, Dr.Mohamed Haneef, “Design and Development of 5 ton C-type press structure and Optimization through Finite Element Analysis,” International Journal for Ignited Minds, Volume: 03Issue: 09, pp.151-158, Sep-2016.
- [4] B. Parthiban, R. Sunil Muthu Kumar, “Design, Analysis and Optimization of 10 Ton Hydraulic Pressing Machine,” International Journal for Innovative Research in Science & Technology, Vol. 6, Issue 3, pp. 4589-4597, March 2017.
- [5]Akshay Vaishnav, Path Lathiya, “Design Optimization of Hydraulic Press Plate using Finite Element Analysis,” International Journal of Engineering Research and Applications, Vol. 6, pp.58-66, May 2016.
- [6]Santosh kumar S. Malipatil, Prof. Yogita N. Potdar, “Analysis And Structural Optimization Of 5 Ton H- Frame Hydraulic Press,” International Journal of Innovative Science, Engineering & Technology, Vol. 1, pp. 356-360, July 2014.
- [7] Martin Zahalka, “Modal Analysis of Hydraulic Press Frames for Open Die Forging”, Elsevier Science Direct, pp. 1070–1075, 2014.
- [8]Karel Raz, Vaclav Kubec, “Dynamic Behavior of the Hydraulic Press for Free Forging”, Elsevier Science Direct, pp. 885 – 890, 2015.
- [9]Weiwei Zhang, Xiaosong Wang, “Structural optimization of cylinder-crown integrated hydraulic press with hemispherical hydraulic cylinder”, Elsevier Science Direct, pp. 1663 – 1668, 2014.
- [10]S. P. Sinha, P. D. Murarka, “Computer-Aided Design Of Hydraulic Press Structures,” Math1 Comput. Modelling, Vol. 10, No. 9, pp. 637-645, 1988.
- [11] Hui-lin Qu, Yi-xiong Feng, “Optimization design of guiding device on hydraulic press column based on Axiomatic Design Theory”, Elsevier Science Direct, pp.247 – 251, 2016.
- [12]Mengdi Gao, Haihong Huang, “Energy-saving Methods for Hydraulic Presses Based on Energy Dissipation Analysis”, Elsevier Science Direct, pp. 331 – 335, 2016.
- [13]Karel Raz, Kubec Vaclav, “Using of a Hydraulic Press in Production and Manufacturing of Large Rings”, Elsevier Science Direct, pp. 1064–1069, 2014.
- [14]Ganesh M Mudennavar, Gireesha Chalageri, “Design and Analysis of 12 Ton Hydraulic Pressing Machine,” Volume 3, Issue 8, pp. 109-117, August 2018.
- [15]Saleha Shaikh, Hardik Bhatt, “A Review on Topology Analysis and Optimization of Hydraulic Press Brake,” International Journal for Innovative Research in Science & Technology, Volume 1, Issue 6, pp. 2349-6010, November 2014.
- [16] Deepak Annasaheb More, N. K. Chhapkhane, “Development and Optimization of Hydraulic Press,” International Journal for Research in Applied Science & Engineering Technology, Volume 3, pp. 2321-9653, June 2015.
- [17]Mengdi Gao, Haihong Huang, Design and Optimization of the Slide Guide System of Hydraulic Press Based on Energy Loss Analysis, Energies Volume 9, 2016.
- [18]Ameet B. Hatapakki, U D.Gulhane, “Design Optimization of C Frame of Hydraulic Press Machine,” Asian Journal of Convergence in Technology Volume II, pp. 79-89, 2015.
- [19]Mr. K.Shravan Kumar, B.Prashanth, “DESIGN & FABRICATION OF HYDRAULIC PRESS,” International Journal of Scientific Development and Research , Volume 2, pp.227-230, July 2017.
- [20]Satish B. Mariyappagoudar Vishal S.Patil, Design and Analysis of Hydraulic Press using ANSYS, International Journal for Innovative Research in Science & Technology, Volume 3, pp.57-60, December 2016.