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### **Design, Analysis and Optimization of Hydraulic Press Machine using FEA**

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**ABSTRACT-** In hydraulic press machine, the force generation, power transmission and amplification are achieved using fluid under pressure. The liquid system exhibits the characteristics of a solid and provides a very positive and rigid medium of power transmission and amplification. In a simple application, a smaller piston transfers fluid under the high pressure to a cylinder having a larger piston area, thus amplifying the force. There is easy transmissibility of large amount of energy with practically unlimited force amplification. It has also a very low inertia effect. Main objective of project is to modify major component of one cylinder four post hydraulic press machine so that rigidity and strength of the components are increase by using optimum material. The function of the major component like frame, bottom plate, bed, top box are to absorb forces, to provide precise slide guidance and to support the drive system and other auxiliary units. The structural design of the component depends on the pressing force this determines the required rigidity. The current machine does not have high rigidity and it needs to be redesigned.

**KEYWORDS:** Hydraulic Press, Fluid, Power transmission, Cylinder.

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## INTRODUCTION

**Hydraulic press:** In hydraulic press machine, the force generation, power transmission and amplification are achieved by using fluid under pressure. The liquid system exhibits the characteristics of a solid and provides a very positive and rigid medium of power transmission and amplification. In a simple application, a smaller piston transfers fluid under the high pressure to a cylinder having a larger piston area, thus amplifying the force. There is easy transmissibility of large amount of energy with practically unlimited force amplification. It has also a very low inertia effect. In these types of presses, press-body is of C Shaped. When free space required from three sides of press table to work for loading and unloading of pressed component then this type of hydraulic presses are designed. As main cylinder placed eccentric to central axis of press-body, it applies eccentric load on press-body hence heavier press body is required as compared to same capacity of other type of press. These types of presses are also called as single press.



Figure1: Existing Press machine

## IDENTIFIED GAPS IN THE LITERATURE

Main objective of this project is to modify major component of one cylinder four post hydraulic press so that the rigidity and strength of the components are increased.

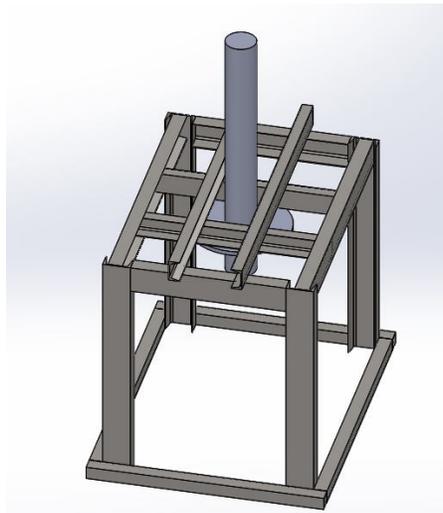
## PROBLEM FORMULATION

In hydraulic press, the force generation, power transmission and amplification are achieved using fluid under pressure. The liquid system exhibits the characteristics of a solid and provides a very positive and rigid medium of power transmission and amplification. In a simple application, a smaller piston transfers

fluid under high pressure to a cylinder having a larger piston area, thus amplifying the force. There is easy transmissibility of large amount of energy with practically unlimited force amplification. It has also a very low inertia effect. Main objective of this project is to modify major component of one cylinder four post hydraulic press so that rigidity and strength of the components are increase by using optimum material. The function of the major component like frame, bottom plate, bed, top box are to absorb the forces, to provide precise slide guidance and to support the drive system and other auxiliary units. The structural design of the component depends on the pressing force this determines the required rigidity. The current machine does not have high rigidity and needs to be redesigned.

***Methodology:***

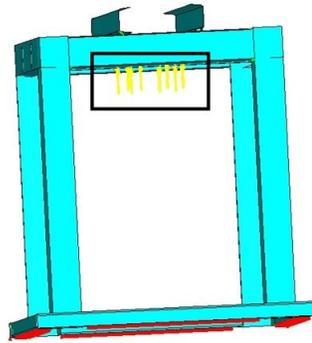
- Modelling of 3-d press machine using solid works
- Static analysis of the model in order to solve the problem formulation
- Optimization of the model



**Figure 2: CAD Model of Existing Machine**

## ANALYSIS

### Loading:



- Total force acting =  $80000\text{kg} \times 9.81$   
= 784800N
- We consider 20 nodes on which force would be acting thus force on a single node =  $784800/20$   
= 39,240

Figure 3: Loading on Existing Machine

### Solution (results):

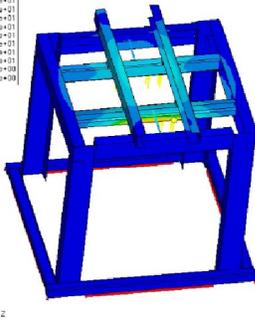
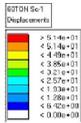


Figure 4

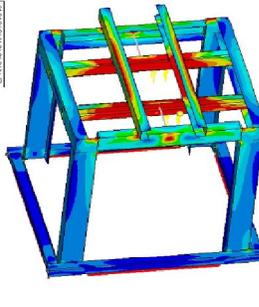
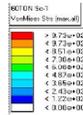


Figure 5

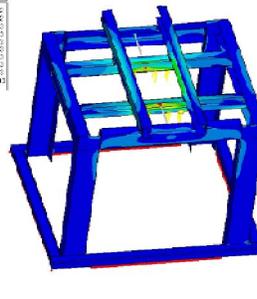
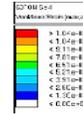


Figure 6

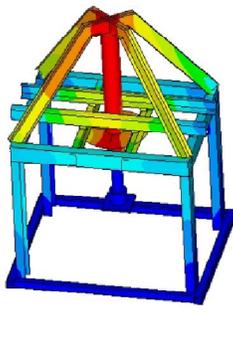
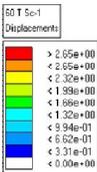


Figure 7

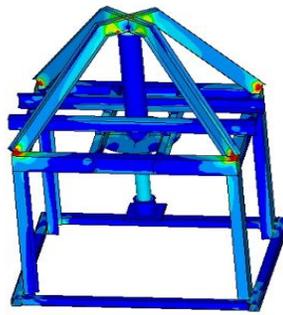
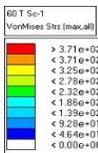


Figure 8

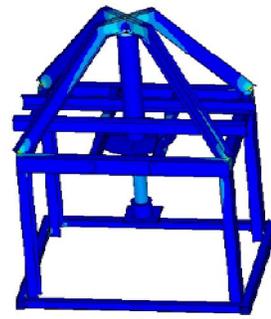
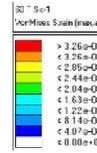


Figure 9

Figure 4-9: FEA Solutions Results

## **CONCLUSIONS**

By undertaking this project, major component of one cylinder four post hydraulic press machine will be redesigned and optimized so that it has sufficient strength and stiffness. As it is evitable that the stress of the previous design was high and the stresses of the modified design are less.

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