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Design & Analysis of Bend Removal/Creation & Multipurpose Hydraulic Press Machine.

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Abstract - A hydraulic press machine is a machine that uses a hydraulic cylinder to generate a compressive force on the workpiece. In this the frame, table, pilers, hydraulic cylinder are the main components and all this are designed by design procedure and the earlier reference model. And by optimizing the material and the weight of the structure of the hydraulic press it will result in the cost reduction. We made a attempt towards reducing the volume of the material used in the frame structure of the hydraulic frame. We have designed this press for industrial applications and by using H-shaped structure we got to see that a large variety of operations can be performed in a single press machine by just changing the fixtures. Our main purpose behind making this hydraulic press is to remove the bends of the different manufactured parts created during manufacturing. To bend any part, we need to apply force above the elastic limit and enter the plastic region of the material.

Key Words: hydraulic press machine, compressive force, hydraulic cylinder, optimizing, H-shaped structure, elastic limit, plastic region, etc.

1. INTRODUCTION

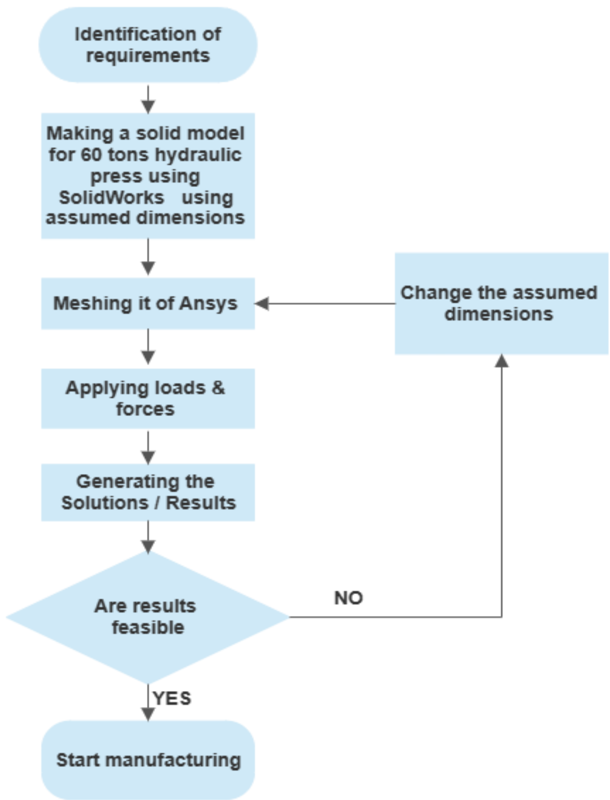
Hydraulic press machine is a tool to produce compressive force by means of pressurized hydraulic fluid. This hydraulic fluid is compressed by using either by hand operated piston or motor operated pump. It depends upon Pascal's principle that the pressure throughout an enclosed entity is constant. By means of hydraulic system larger forces can be produced in contrast with mechanical and electrical systems. Such forces can be used for the press work application. Hydraulic press commonly use in forging, stamping press-fitting.

1.1 PROBLEM STATEMENT

It is a manufacturing industry. During manufacturing maximum time the component bend So for removal of bends the company has to depend on other service providers And this costing are dependent on size of component. And service providers ask for per piece price.

So, After Designing and manufacturing this hydraulic press the dependency on service provider be reduced and cash outflow will decrease. It will help the manufacturer to save the time and provide the products to the consumer with no delays.

1.2 FLOW CHART



2. CALCULATIONS & DESIGN

These Calculations and design are done based on some earlier design and some assumptions. These hydraulic presses are made with some materials which are already tested for their ultimate strengths. So, we selected a mild steel as it is easily available and with low costs. Here we have selected H-Shaped frame structure for hydraulic press. H-Shaped hydraulic press has many advantages and can be used in many applications like punching, bending, press fitting, coining, bending, etc.

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Design of this hydraulic press consist of the following components:-

1. Top frame
2. Moving frame (working table)
3. Bottom frame
4. Columns
5. Supporting pins

2.1 Calculations for cylinder selection

-Sample calculations

Pressure (P) = **Force (F) / Area (A)**

Where:

Force (F) = 60 tons = 60,000 kg (since 1 ton = 1000 kg)

Area (A) = π * (diameter^2/4)

Putting in the values and converting the diameter from (mm) to (m) for consistency:

Diameter (d) = 80 mm = 80/1000 m = 0.08 m

Load (F) = 60,000 kg

Area (A) = π * (0.08/2)^2 = 0.005027 m^2

Now, we can substitute the values into the pressure formula:

Pressure (P) = 60,000 kg / 0.005027 m^2

Pressure (P) = 11,927,232.591 kg/m^2

Pressure required to generate 60 tons of load 11,927,232.591 kg/m^2

Converted from **kg/m^2 to bar**

11,927,232.591* 0.00001= **119.27 bar**

Table -1: For generating 60 tons of load maximum pressure needed with different diameters

Diameter of cylinder in mm	Pressure in bars
50	305.7
55	252.53
60	212.8
65	180.21
70	157.88
75	135.83
80	119.22
85	106
90	94.32
95	84.3
100	76.41

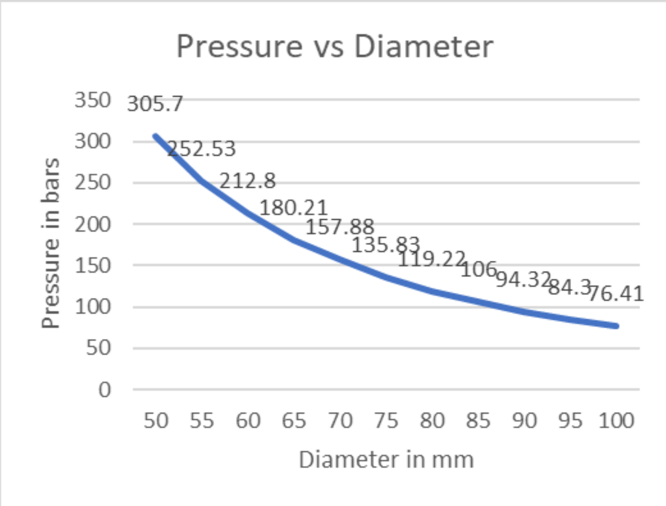


Chart -1: Diameter vs Pressure

As we can see from the graph that as the diameter increases the pressure required to create the 60 tons load decreases.

And as the diameter decreases the pressure required to create the 60 tons load increases.

2.2 Calculations of load required for bending a plate in V-shape.

V bending formula:- **P = C*B*t2*tmax / L**

Where; C= coefficient of bending

1.5(L=5*t)

1.33(L=8*t)

1.2(L=16*t)

B= bending length mm

t= sheet thickness

tmax= tensile strength from design data book.

Ex.1 T=10, tmax= 420 Mpa , B = 40 , L = 80

by using v bending formula

P = C*B*t2*tmax/L

P= 1.5*40*100*420/80

P= 27.9 tons

P = 28 tons

Ejector pad= buffer ejection

Ejector pad = 0.3*p

= 0.3*28= 8.4tonns

Total load = Ejector pad + P

= 8.4+28

Total load = 36.4 tons.

Table -2: Load required to bend the plate with varying length

Thickness	Length	Width	Load in kg
10	100	25	13965
10	120	25	11637.5
10	150	25	9310

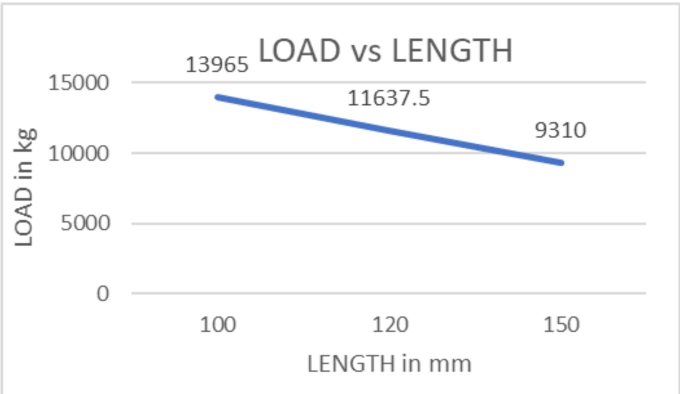


Chart -2: LOAD vs LENGTH

Table -3: Load required to bend the plate with varying thickness

Thickness	Length	Width	Load in kg
10	200	25	6982
15	200	25	15710
20	200	25	27930

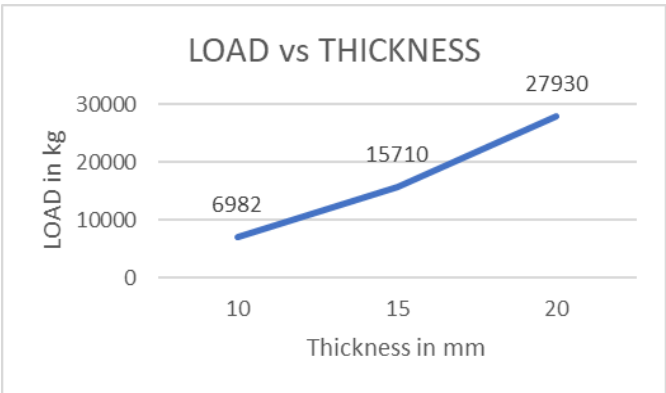


Chart -3: LOAD vs Thickness

Table -4: Load required to bend the plate with varying width

Thickness	Length	Width	Load in kg
10	200	25	6982
10	200	40	11172
10	200	50	13965

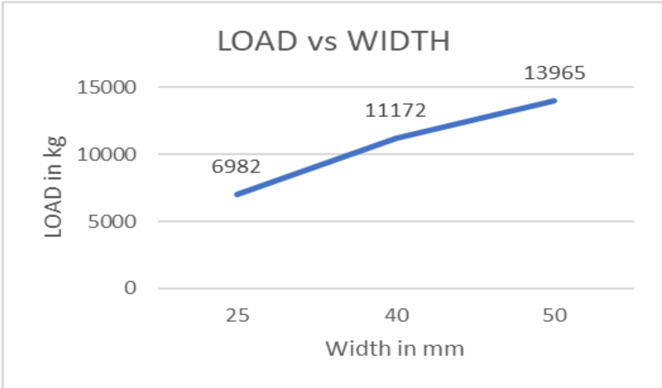
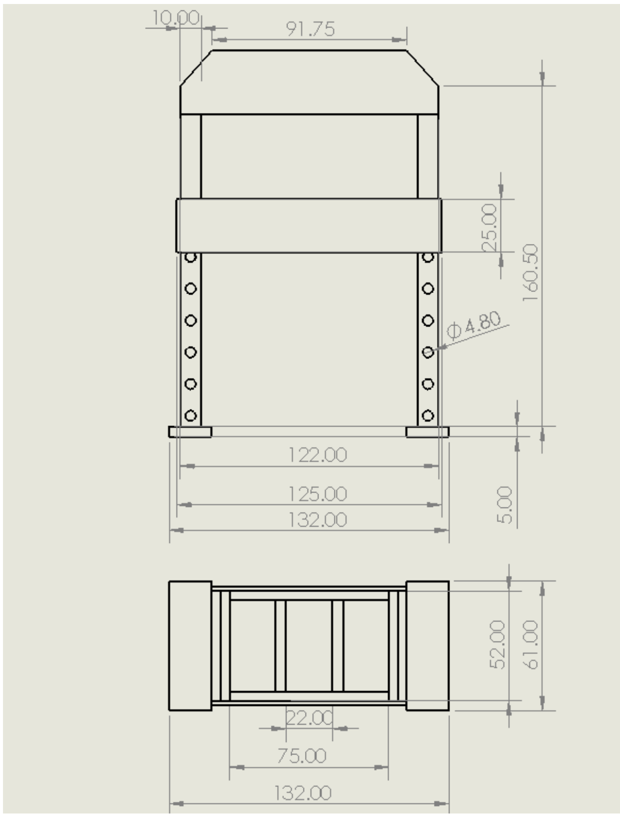


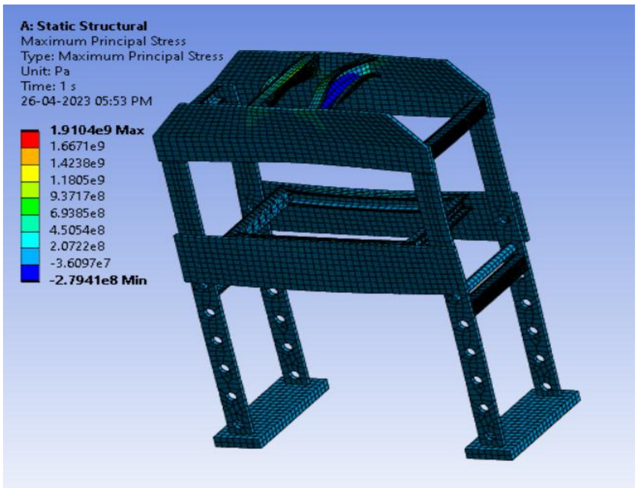
Chart -4: LOAD vs Thickness

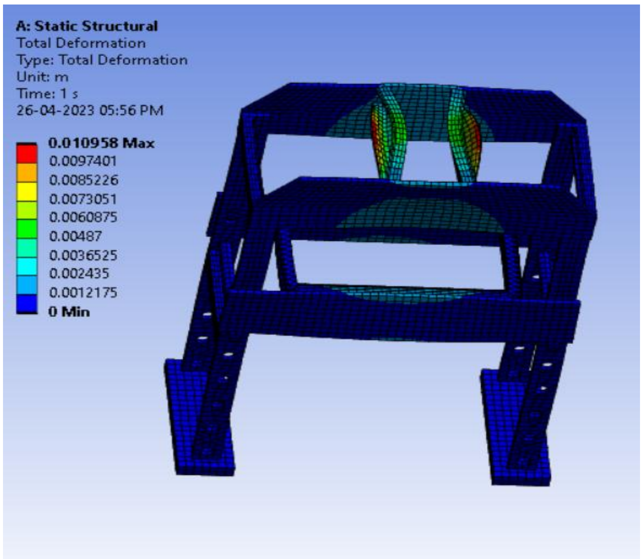
3. DRAWING



4. ANALYSIS

We have performed analysis on the frame of the hydraulic press machine by applying 60 tons load.





5. RESULTS

	Results		
Minimum	0. m	1797.1 Pa	-2.7941e+008 Pa
Maximum	1.0958e-002 m	3.1152e+009 Pa	1.9104e+009 Pa
Average	9.9225e-004 m	1.166e+008 Pa	7.1519e+007 Pa
Minimum Occurs On	piller and base|base|Boss-Extrude1		100x520x50 c section|Boss-Extrude
Maximum Occurs On	100x520x50 c section|Boss-Extrude1		100x520x50 c section|Boss-Extrude

6. CONCLUSIONS

As the maximum principle stress is less than the ultimate tensile stress and the total deformation is within the specified limits. Hence, the design is **safe**.

And we came to know that the force required to bend the plate is approx. equal to the force required for bend removal.

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