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# HYDRAULIC BENDING MACHINE


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| **Sidharth Chauhan** | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, UP, India |
| **Pankaj Kumar Gond** | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, UP, India |
| **Deepak Singh** | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, UP, India |
| **Mohd Arshad** | Department of Mechanical Engineering, IIMT College of Engineering, Greater Noida, UP, India |


**ABSTRACT** Nowadays the world is focusing into automation. Each and every work of human is reduced by a machine, but few areas like construction the usage of machines for bending rods for stirrups which are used to withstand loads in beams and columns are not done by machine because the cost of machine is high and need skilled labors to operate it. So this project is aimed to do bending operation for stirrups using hydraulics and named as hydraulic rod bending machine. The main objective of our project is to implement the hydraulic rod bending machine in the construction sites with less cost compared to the existing bending machines, and increasing the productivity of the stirrups. Hydraulic rod bending machine consist of Double acting cylinder, P-40 Direction control valve, Hoses, Motor, Pump, Rack and Pinion, Free wheel, Fixture. The rod is bent by the hydraulic cylinder piston with holding the rod in the fixture. The main advantage of our project is the square shape of the Stirrups is bent continuously without repositioning the rod in the machine.

**KEYWORDS :** Hydraulic Rod Bending Machine, Jack, Hydraulic Operation, Frame.

## 1.INTRODUCTION

This project is to bend the strip at the specified dimensions which is used in the building construction which called as Strip. Strip is an important reinforced element which acts as a shear reinforcement. Presently, strips are made manually, which suffers from many drawbacks like lack of accuracy, low productivity and resulting into severe fatigue in the operator. In manual strip making process, operators not only subjecting their hands to hours of repetitive motion, but in many occasions it results into several musculoskeletal disorders (MSDs). The project is designed based on the principle of Hydraulic system. The hydraulic load has more power compare to the other type of loads like pneumatic and electric. By using heavy loads we can increase the productivity of the product. The manual strip making process suffers from the many drawbacks. The construction worker not only subject their hands to hours of repetitive motion but also sometimes suffers internal injury to his body organ i.e. disorder carpal tunnel syndrome CTS, slipped disc problem etc.

## 2.WORKING PRINCIPLE

The system that we propose is that bending of rectangular strips. The strip is bent with the help of hydraulic force, because the power of hydraulics is very large the main aim of our project is to increase the productivity so with the help of hydraulic force we can able to bend 3-6 strip depending upon the diameter.

## 3. DESIGN CALCULATION

A. Hydraulic assembly and working the hydraulic circuit used for bending operation has been designed and the components that are used in the construction of the kit are listed in the Table 1.1.

| S.No. | Description |
|---|---|
| 1 | Top cap |
| 2 | Oil tight tank |
| 3 | Release valve |
| 4 | Base |
| 5 | Circle seal |
| 6 | Pump plunger |
| 7 | Hydraulic oil |
| 8 | Ram |
| 9 | Cylinder |

**Table 1.1**

## INDIVIDUAL COMPONENT DESIGN CALCULATION

- Hydraulic power
- Cylinder specification
- Bore diameter = 76 mm
- Wall thickness = 2.84 mm
- Length = 186 mm
- Piston thickness = 27 mm
- Stroke length = 150 mm
- Pump specification: Max. Pressure = 175x105 N/m2
- Force calculation: Area, A $=4.53x10^{-3} m^2$
- Force or load $=175x10^5 x4.53x10^3$ $=79.275$ kN

## HOW TO CALCULATE FORCE TO BEND METAL FORMULA

BF =(Safety factor x k factor x ultimate strength x bend length x thickness$^2$) / die opening

Where

| | |
|---|---|
| Die opening | = thickness x die ratio |
| k factor | = 1.46 -(0.016 * die ratio) |
| BF | = bending force |

Example – The thickness of a sheet is 3cm die ratio 6,tensile 4, factor of safety 4, then calculate v bending force of sheet .

| Given | |
|---|---|
| Sheet thickness | = 3 |
| Die ratio | = 6 |
| Bend length | = 3 |
| Tensile | =4 |
| Factor of safety | =4 |
| Rectangular bending force | = ? |

**Solution – Step 1.**

First let us calculate rectangular bending force. Substitute the given value in formula

BF =(Safety factor x k factor x ultimate strength x bend length x thickness$^2$) / die opening

BF = (4.1364 *4*3*3$^{2)}$ /18 = 32.736

**Step 2.**

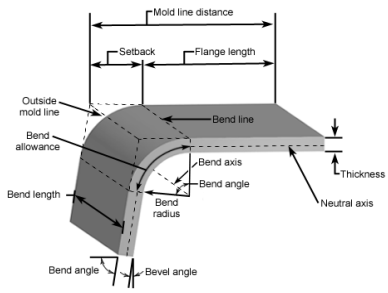
Now, let us calculate the rectangular bending force in rectangular bending force = BF/2000
=32.736/2000
= 0.02

**Result**

Rectangular bending force (BF) = 32.736
Rectangular bending force = 0.02

**Bending allowance calculation**

Assume that:-
Sheet thickness (in) = 1.25
Bend radius (in) = 2.5





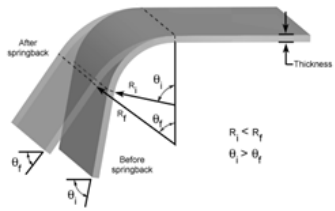

Bend angle ($^0$) = 65
k- factor = 0.33

**Result :-**

Set back (in) = 2.386
Bend allowance (in) = 3.304
Bend deduction(in) = 0.836

**Bending spring back calculation**

Sheet thickness (in) = 1.25






k- factor =0.33
Yield strength (psi) = 65
Modular of elasticity(ksi) = 45
Initial bend radius (in) = 5

**Result :-**

Final bend radius (in) = 5.092
Final bend angle($^0$)= 63.91
Springback factor $k_s$ = 0.98

## 4. CONCLUSION

- It is manually operated bending machine.
- It works on the hydraulic power.
- It simple and compact design.
- In latest attempt a successful solution for the manual stirrup making is obtained.
- By changing the die in the frame we can obtain various sizes of the product.
- Instead of complicated designs the simple kinematic system is used.
- The system can be handled by any operator very easily.
- Due to low cost and simple design this can be marketed to any of the nation.
- The productivity of power operated hydraulic bending machine is higher.
- Time required to complete bending operation is less and requirement of extra worker reduced.
- Power operated hydraulic bending machine is less time consuming process with high productivity.

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