

Hydraulic Rebar Cutter

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Abstract

In the work of liberalization (more freedom in action) the civil & mechanical sector has taken much importance in advancement & technology in various fields, and also much than the core industrial sector. In most developed cities need a lot of man power to split bar in to small parts. This man power requires various equipment viz. Hammer, chisel, hacksaw etc. Thus in order to avoid these project benefits in various ways. Use this lightweight tool to cut steel bars and other materials anywhere. Hydraulic power means minimum operator effort and a smooth guillotine-action reduces the risk of jamming Double-acting operation Cutting range 8 to14 mm in stroke. Hydraulic fluids also called hydraulic liquids are the medium by which power is transferred in hydraulic machinery. The hydraulic fluid also known as tractor fluid, hydraulic fluid is the life of the hydraulic circuit. It is usually petroleum oil with various additives. Some hydraulic machines require fire resistant fluids, depending on their applications. In some factories where food is prepared, either an edible oil or water is used as working fluid for health and safety reasons. In addition to transferring energy, hydraulic fluids needs to lubricate components, suspend contaminants and metal filling for transport to the filter and to function well to several hundred degree Fahrenheit or Celsius.

Keywords: Hydraulics, Valves, Hoses, Hydraulic power pack, Hydraulic bar cutter, Cutting Tool, etc.

1. Introduction

Hydraulic systems are used to transfer energy by converting mechanical energy to fluid energy, and then back to mechanical energy. The principle reason for converting to fluid energy is the convenience of transferring energy to a new location. Hydraulic drives have many advantages over other technologies. The ratio of weight, volume and inertia to available power is significantly lower than in electromechanical drives, especially for linear motion. Hydraulic systems are especially suitable for those operations characterized by abrupt loading, frequent stops and starts, reversing and speed variations that cause sharp peak, cyclic and fluctuating power demands.

Many device of mechanical are based on hydraulic power. Hydraulic device uses principles of fluid static and fluid kinematics are used for either storing the hydraulic energy or then transmitting when needed or maintaining the hydraulic energy several times and transmitting the same.

In all such machines, power is transmitted with the help of a fluid, which may be water or oil. Our mechanism is used in industrial fitting and maintaining department, in automobile garage or in industrial workshop.

Our project is used for reducing manufacturing cost and saving time and also to reduce maintaining cost or a manufacturing cost. Here we manufacture a lightweight & easy to handle machine so that you can carry anywhere into the shop. It used to cut rod.

Rebar (short for **reinforcing bar**), also known as **reinforcing steel, reinforcement steel** and colloquially in Australia as **reo**, is a steel bar or mesh of steel wires used as a tension device in reinforced concrete and reinforced masonry structures, to strengthen and hold the concrete in tension. The surface of the rebar may be patterned to form a better bond with the concrete.

2. Construction & Working

2.1 Construction

- It consist of piston & cylinder arrangement
- WPS material with hardening & tempering for cutting of bar
- Main equipment i.e. hydraulic power packs which itself consist of D. C. Valve, hose supply, oil tank, motor, pump, gauge etc.
- Rather than above construction also consist of metal pipes, base/frame, hoses, manifold, gauge etc.

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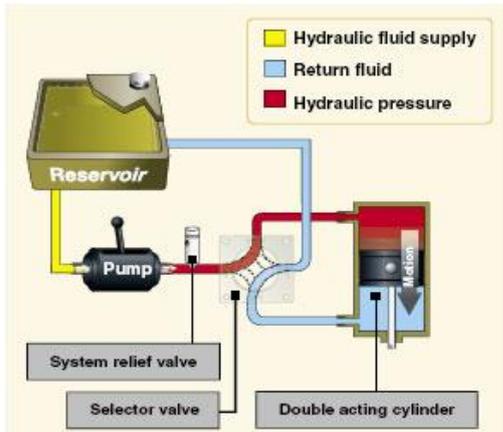


Figure1 Main Parts of System

- 1) Cylinder and Piston, 2) Hydraulic Power Pack, 3) D. C. Valve, 4) Manifold, 5) Cutting Tool, 6) Pressure Relief Valve, 7) Hoses Etc.

2.2 Description of Components used

1) Cylinder and Piston

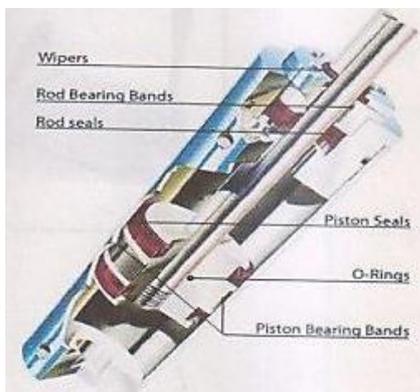


Figure 2 Cylinder and piston arrangement

It is piston and cylinder construction. The below figure describes the construction of cylinder. Its diameter is 100mm & stroke length is 40mm.

2) Hydraulic Power Pack

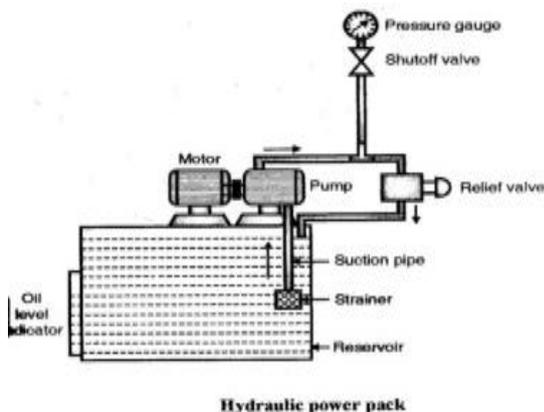


Figure 3 Hydraulic power pack

The hydraulic power pack consist of oil tank, pressure gauge, motor, hydraulic pump, hose construction etc. It is used for supplying pressure to the equipment to be worked based on hydraulic application. The capacity of oil tank is 40 liters

Cutting Tool (Blades)

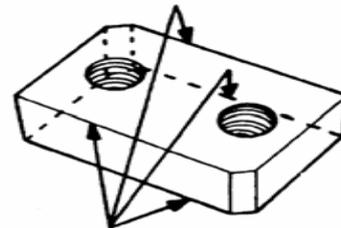


Figure 4 Cutting tool

Cutting blades are manufactured from heat-treated, high-strength machine steel, easily rotated for prolonged use and increased service life. The material of tool is WPS Material Which is Hardened & Tempered at 300 to 450 centigrade. The width of tool is 40mm, Thickness of tool is 10mm & length of tool is 55mm. The two tapped holes are provided because of reshaping.

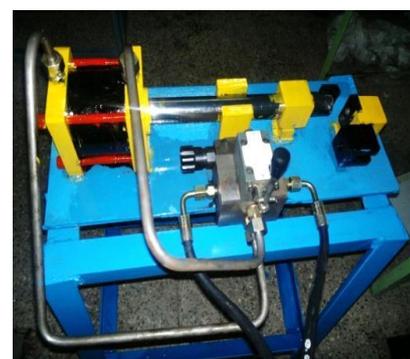
3) Direction control valve



Figure 5 Direction control valve

It is nothing but direction control valve. In this the direction of flow of fluid is controlled. The above figure shows the construction of DC valve. It also shows the symbolic representation of same 4/3 DC valve.

2.3 Hydraulic Circuit Design



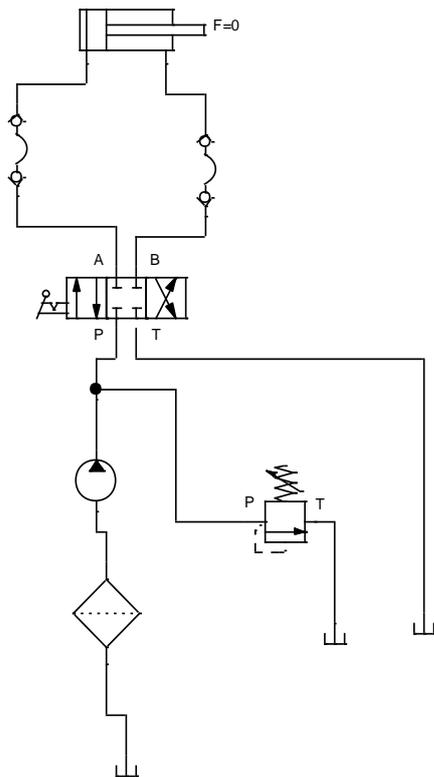


Figure 6 Hydraulic rebar cutter & It's Circuit Diagram

2.4 Working Principles

It works on the principle of hydraulic pressure. In this hydraulic energy is converted in to mechanical energy. This pressure is given from the source called hydraulic power pack. The tool (cutter) is welded to piston of cylinder. Thus when the piston from cylinder moves forward in linear motion the tool has movement and thus due to high pressure the bar is cut.

2.5 Working

The described working principle clarifies the working of equipment. The equipment consists of cylinder, ram and tool as main components and also hydraulic power pack plays very important role in this machine, because without power pack the project is useless. When power supply is given to hydraulic power pack the pump is actuated, when the direction control valve is operated with the help of hand lever, the flow of oil starts. The pressure flow flows in the cylinder. Due to high pressure, the piston has linear motion. Thus tool welded to piston moves forward direction; hence the bar is cut due to hydraulic pressure. The layout shown describes the working of on hydraulic unit.

Here, DC valve is an important part of unit. The initial literature describes the view of D.C. valve. The valve is 4/3 control valve. Hoses play important role. Hoses are beneficial in such equipment's. Also guides used to support the unit to be stable. Cylinder bore is 100mm and length of stroke is 40mm. Thus the stroke is sufficient for cutting of bar. The trial describes that

the pressure given to unit is sufficient to keep stable the unit.

Thus the forward direction of piston manages to cut the bar. Thus the simple working of equipment is beneficial in various ways.

▪ Cutting

- Insert rebar between stopper and front cutter block, making sure that it is properly seated in U-shaped support.
- Pull trigger-switch and keep depressed while piston advances and rebar is cut. (If switch is released at an intermediate point, piston will stop.)
- When cut is completed, release switch. Piston retracts automatically (Note that switch cannot be reactivated until piston has fully retracted.)

2.6 Design Considerations

a) Hydraulic Kit Specifications:-

i) Pump Selected For Hydraulic Kit

L.P.M. = 8 L.P.M

ii) Motor Selected For Kit

H.P. = 0.64 HP

iii) Force

Force range = 646.8 kg

iv) Tank Capacity

Tank Selected = 40 lts

b) Cylinder Specifications

i) Cylinder Bore (D) = 100 mm = 0.1 m

ii) Stroke (L) = 40mm = 0.04 m

iii) Piston rod Diameter = 40 mm = 0.04 m

iv) Pressure (P) = 40 $\frac{\text{kg}}{\text{cm}^2} = 3.924 \times \frac{\text{N}}{\text{m}^2}$

c) Tool Specifications

i) Length = L = 0.055 M

ii) Width = W = 0.032 M

iii) Thickness = T = 0.014 M

2.6.1 Design of Cylinder

$$\begin{aligned} \diamond \text{ Area of cylinder} &= A = \frac{\pi D^2}{4} \\ &= \frac{\pi}{4} \times 100^2 \\ &= 7.85 \times 10^{-3} \text{m}^2 \end{aligned}$$

$$\begin{aligned} \diamond \text{ Volume of cylinder} &= V = \frac{\pi}{4} \times D^2 \times L \\ &= \frac{\pi}{4} \times 100^2 \times 40 \\ &= 314.15 \times 10^{-6} \text{m}^3 \end{aligned}$$

$$\begin{aligned} \diamond \text{ Force} &= P \times A \\ &= 3.924 \times 10^6 \times 7.85 \times 10^{-3} \\ &= 30803.4 \text{ N} \end{aligned}$$

2.7 Advantages

- Easy in operation
- Not much skill is required.
- It is mobile unit.

- Up to 10mm bar easily cut.

2.8 Disadvantages

- Hydraulic power pack or hand pump is must.
- Initial investment is very high.
- Leakage of oil from the equipment is possible.

2.9 Applications

- Used in civil construction work.
- Also used in industries where bar is cut.
- It is also used to cut diameter of 4, 8, 10 & 12mm bar.

2.10 Further Development

- The equipment made by us is just for demonstration which is having less capacity.
- The project can be made portable by making certain changes.
- The development in cutter and using good property material its life can be increased. Whereas of cylinder. If used of high capacity, bar can be easily cut.
- The project can be designed in both vertical & horizontal way. Also by providing wheel to it, it can be mobile equipment. For further development investment of at least Rs.70000 is must.

Conclusions

The objective of this project in our final year of degree in mechanical engineering is to prepare ourselves to examine and view the project from all aspects, which are very helpful to us in our further industrial life it is also acquaints as with the actual manufacturing and the other problem involved in the process in the process.

During our course we have studied the subject like machine design theory of machine, strength of materials and science etc. by all the initial literature it can be concluded that the project is worth in various ways.

The project in various ways covered almost all subjects. It can be concluded that the project is beneficial in our day to day life.

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