

# GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

## DESIGN ANALYSIS AND MANUFACTURING OF PORTABLE HYDRAULIC SISSOR LIFT

Ghangale Prashal<sup>\*1</sup>, Bhor Shubham<sup>\*2</sup>, Chavan Hrishikesh<sup>\*3</sup>, Hadawale Saurabh<sup>\*4</sup> and Mr. Ambare Rahul<sup>\*5</sup>

<sup>\*1,2,3,4</sup>Student, Department of Mechanical Engineering, Jaihind polytechnic, kuran, India

<sup>\*5</sup>Lecturer, Department of Mechanical Engineering, Jaihind polytechnic, kuran, India

---

### ABSTRACT

The following paper with describe with design as well as analysis hydraulic scissor lift. Conventionally this scissor lift or jacks are portable and easy to carry. It can be easily kept in boot space of an car. Conventionally it can be used at the time of changing the tyres at the time of puncture. To gain access to go the underside of the vehicle and to lift the vehicle body appreciable height and also for many other applications like used in service center and in the industries. Also such kind of lifts can be used for various purposes like at the time of maintenance of car and many material handling operations. In our case our lift was needed to be designed a portable and also work without consuming any electric power therefore we decided to actuate the cylinder by using hydraulic hand pump. Also such design can make the much suitable for medium scale work. It can be of mechanical, pneumatic or hydraulic type.

**Keywords:** Hydraulic scissor lift, Polyhydraulic hand pump.

---

### I. INTRODUCTION

With ceaseless development of science and technology, more and more new types of technologies are applied to lift. The aim of this project is that it is easy to operate, cost effective and portable so that it will be used conveniently at industries, service center and at the time of replacing tyres. It having more moving parts which may require only lubrication. A scissor lift mechanism is a device used to upward and downward motion of the platform by hydraulic means. The backward and forward displacement motion is achieved by the applying of force by hydraulic cylinder to one or more supports. The scissor lift are lift smoothly. In the scissor lift can be operate by application like that pneumatic, hydraulic and mechanical. This scissor lift design as compare to other heavy and costly scissor lift available in market. The frame is very hard and strong. The mild steel and the stainless steel are better at look at the equipment. A scissor lift mechanism is a device used to extend or retract a platform by hydraulic means. The extension or displacement motion is achieved by the application of force by hydraulic cylinder to one or more supports. Retraction through hydraulic cylinder is also achieved when lowering of platform is desired. The single acting cylinder is used to actuator. The poly hydraulic cylinders are used to operate the cylinder.

#### Types of lifts can be classified as follows:-

Classification based on the type of energy used

1. Hydraulic lift
2. Pneumatic lifts
3. Mechanical lifts

Classification based on their usage

1. Scissor lifts
2. Boom lifts
3. Vehicle lifts

### II. MATERIAL SELECTION

It is necessary to evaluate the particular type of forces imposed on components with a view to find the exact mechanical properties and required material for each equipment. A very brief analysis of each component follows thus:

1. Scissor arm:-
2. Hydraulic cylinder:-
3. Base frame:-
4. Top frame:-
5. Bearings:

**1.Scissor arm:-** The he buckling and bending load act on this arm it causes bend the component. Hence material base on stiffness. Strength, hardness, plasticity. The suitable material is the stainless steel.

**2.Base frame:-** The whole assembly is subjected on the base frame. Because it is responsible for the stability of the whole assembly, and ability to carry weight or load therefore strength, Hardness and stiffness are needed mechanical properties. Mild steel is used.

**3. Top frame:-** This component is placed at the top of the whole assembly, hence strength is required, therefore the frame made up of mild steel.

**4.Hydraulic cylinder:-** This component is considered as a strut with both ends are fixed. It is subjected to direct compressive force or load which act as a bending stress which may cause buckling of the component. It is also subjected to internal compressive pressure which creates circumferential and longitudinal stresses all around the body thickness. So the necessary material property must include strength, ductility, toughness and hardness. The required material is mild steel.

**5.Bearings:-** The selection of bearing consist of dimensional limitation, bearing load, rotational speed, bearing tolerance, rigidity, misalignment of inner and outer ring, noise and torque level, installation and disassembly.

### III. DESIGN THEORY AND CALCULATION

In this concept we have discussed and this concept consist of evolution criteria and process created, and finally some changes are done to modify the project designed.

Considerations made during the design of a single acting cylinder is as follows:

1. Functionality of the design
2. Manufacturability
3. Economic availability. i.e. General cost required for material and fabrication techniques employs
4. Hydraulic cylinder:

The hydraulic cylinder is placed at inclined position. The overall load acting on the cylinder consists of:

Mass to be put on lift: 500 kg

Factor of safety:- 1.25,  $500 \times 1.25 = 625\text{kg}$ , rounding weight is 650kg.

Top frame:- 3kg

Bottom frame:- 3kg

Cylinder:- 2.5kg

Mass of each link:-  $1 \times 8 = 8\text{kg}$

Total mass:- 666.5kg

Total load:- 6538.365N

Maximum force act on cylinder

$$\text{Area} = \frac{(3.14 \times 60)}{2} \\ = 2827.43\text{mm}^2$$

$$\text{Pressure} = \frac{\text{force}}{\text{area}} \\ = \frac{(6538.36)}{2827.43} \\ = 23.12\text{bar}$$

#### IV. ANALYSIS OF LIFT IN ANSYS SOFTWARE

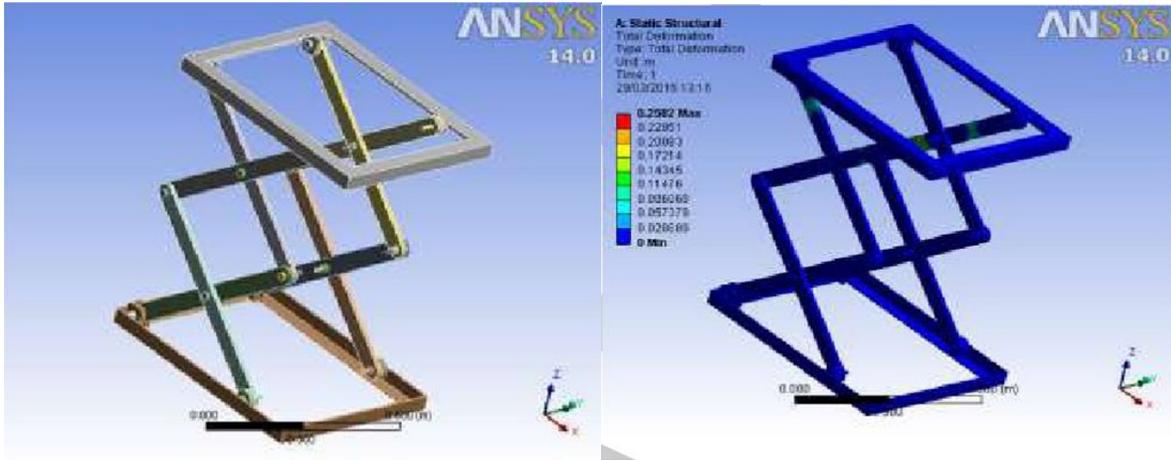


Fig No-1, ISO Assembly

Fig No-2, Deformation Analysis

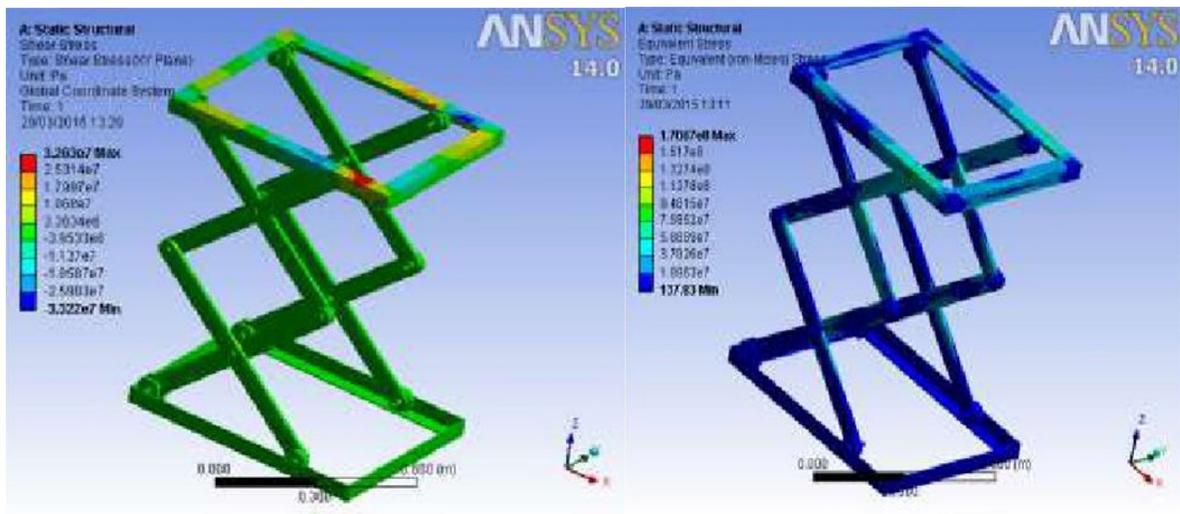


Fig. No.3 Von misses stress analysis

Fig. No.4 Shear stress analysis

#### V. FUTURE SCOPE

In future it can be operated by an electric pump. It can be also operated by pneumatic system. In future it can be used in workshop in various purposes. In future it can be operated by using sensor and remote. We are reduces the weight by using the aluminum.

#### VI. CONCLUSION

The design and fabrication of portable work platform raised by hydraulic cylinder was carried out meeting the required design standards. This portable platform it is operated by hydraulic cylinder and which is operated by poly hydraulic hand pump by an operated. It is necessary to give some comfort to the worker or operator. The high

capacity cylinder are used for lifting the scissor for high load. The hydraulic cylinder is easy to use and does necessary routine maintenance. The purpose of this device is that it is compact in size and less costly as compare to other scissor lift are available in market and low operating cost. The main advantage of this concept is that it can be easily carried out in the boot space of the car. Also used in small scale workshops.

### REFERENCES

1. *Industrial Hydraulics Manual, Vickers 935100-B. Esposito, Fluid Power with application, prentice hall.*
2. *Hydroteck Engineering Company Series Heavy Duty.*
3. *Indian Standard dimensions for hot rolled steel beam, column, channel and angle sections (Third Revision) IS 808:1989.*
4. *Mathematical analysis of Actuator forces in a scissor lift, Technical document 2643, May 1994 by H. Spackman. AD-A283 906*
5. *Mathematical analysis of Actuator forces in a scissor lift, Technical document 1550, May 1989 by H. Spackman AD-A225 220*
6. *Vector Mechanics for Engineers, Ferdinand Bear and E Russel Johnston, TATA McGraw Hill Publication*