International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 03 | Mar 2021 www.irjet.net p-ISSN: 2395-0072

DESIGN AND ANALYSIS OF HYDRAULIC CYLINDER USING DUCTILE CAST IRON

G. Senthil Kumar[1], Mariya Sunil Joshi.A[2], NARENDRAN.K [3,] Raveendar. V[4]

[1]Assistant Professor, Dept of Mechanical Engineering, Panimalar Institute of Technology
[2345] U.G Students, Dept Of Mechanical Engineering, Panimalar Institute of Technology

---

Abstract: Nowadays, Machineries development is very fast growing for fast work convenient environment. Proper mixing of raw materials is important task in any construction, for that use latest equipment which are mechanically and hydraulically combined operated mostly. Design of hydraulic cylinder and analysis is one of them which are operated by two prime movers one prime movers is use of hydraulic system operation for operating the hoper and other for operating drum for proper mixing of concrete. The work presented here in is mainly divided into the three chapters. The first chapter introduces the concrete benching mixing machine with problem formulation and provides motivation for the project. The second chapter presents the current state of mixing machine research as presented in the form of scientific literature review.

***Key Words*: :** Hydraulic Cylinder, Hydraulic Actuator, Hydraulic Barrel, Cast iron Barrel , Cast iron Actuator, Cast iron Cylinder.

1. INTRODUCTION:

A hydraulic cylinder is a complicated mechanical system that are used to provide linear force action and motion. Hydraulic cylinders are powered from externally pressurized hydraulic fluid. They are commonly used in equipment's and machinery. It consists mainly of cylinder barrel, piston and cylinder rod. The piston reciprocates producing linear force with compression and tension forces perfectly align in the rod's axial direction.

The aim of this study is to analysis one such implement mechanism to find out the maximum tensile load that comes on the piston-rod joint and required preload for no joint separation. The calculated tensile and pretension loads are applied on synthesized piston-rod concepts that are considered for analysis in order to find out the most suitable joint and suitable materials with good properties with low cost which would withstand the worst case hydraulic cylinder bottoming-up created by the implement mechanism.

1.1 Uses of Hydraulic Cylinder:

Hydraulic Cylinder 's are used in various applications. They are often seen at work in both industrial and (including hydraulic presses, cranes , forges, and packaging materials, and mobile applications (such as agricultural machines , construction vehicles and marine equipment). They're essential to the operation of excavators, loaders , ballers, telehandlers, man-lifts, drill -rigs, and dump trucks, not to mention operating booms, arms , lifts, platforms, and buckets. Hydraulic cylinders are the most effective and efficient method of pushing , pulling, lifting and lowering.

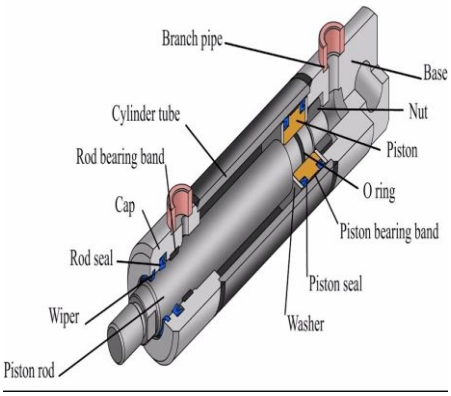
1.2 Objectives of Hydraulic Cylinder:

➢ To analyze various material and select suitable one for the hydraulic cylinder in JCB.
➢ To reduce the cost of the cylinder to affordable price.
➢ To make cylinder to withstand high stress and strain.
➢ To increase the overall strength and power.
➢ To withstand the maximum equivalent stress.
➢ To reduce the principle elastic strain acting upon the cylinder.

1.3 Hydraulic Cylinder using Ductile Cast Iron: -

Cast iron has many advantages that make it ideal for hydraulics and pneumatics. The self-lubricating properties of continuous cast iron help create cylinders that can stand up to years of reciprocation. Cast iron is an ideal material for use in fluid power applications that demand high volumes of cycles.

Beyond its favorable frictional characteristics, continuous cast iron is metallurgically superior. A cylinder machined from continuous cast iron will be more durable than sand cast or steel components due to the fact that continuous cast iron solidifies at a much more uniform rate.



2. Material Selection:

Based on the availability, cost and mechanical properties, I decided to make the Hydraulic Cylinder using Ductile Cast Iron as per the material I mention below.

Material Selected: Ductile Cast Iron

Performance Index

For the tube design, the best materials should be one with a good strength, light weight and modest cost. So the following properties of each materials will be analyzed against material properties which needed to be maximized and minimized.

- Tensile Strength
- Density
- Price

COMPOSITON

- Carbon = 3.2 – 3.60%
- Silicon = 2.2 – 2.8%
- Manganese = 0.1 – 0.2%
- Magnesium = 0.03 – 0.04%
- Phosphorus = 0.005 – 0.04%
- Sulfur = 0.005 – 0.02%
- Copper = <0.40%
- Iron = balance

Calculation

(a). To minimize the weight, for a strength design. performance index = Tensile Strength (Mpa)/density(g/cm^3).

For, Stainless steel 304 = 520/8 = 65

For, Ductile Cast iron 60-4018 = 414/7.05 = 58

(b). To minimize cost for a strength design.

- Performance Index = Tensile Strength (Mpa)/Cost per kg (Rs)
- For, stainless steel 304 = 520/195 = 2.66
- For, Ductile Cast Iron 60-4018 = 414/65 = 7
- Indian Mart = 2800/piece
- Quality Hydraulic = 2350/piece
- Exporters India = 2600/piece

Analysis

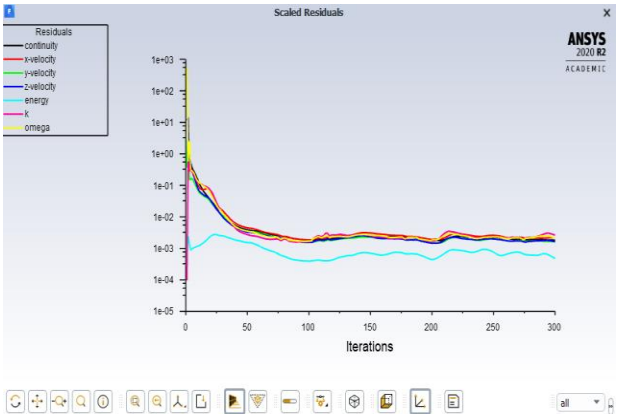


Fig.1: Fluent Analysis

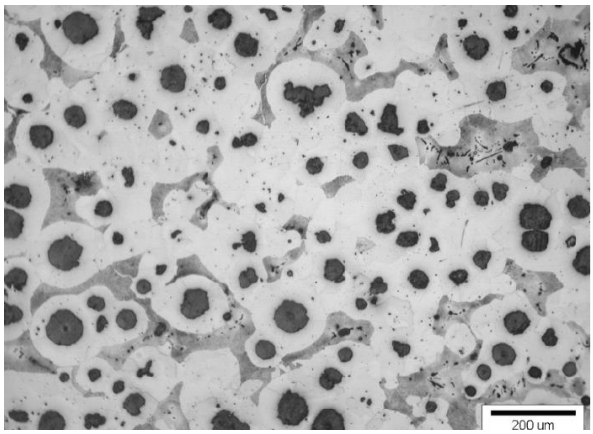


Fig.2. Microstructure of Ductile Cast Iron

PROPERTIES:

- Ductile cast iron has high wear resistance.
- It's better for machining like drilling, welding.
- Low in Cost.
- Low in maintenance cost.
- It's Hard and brittle.
- More fusible than stainless steel.

3. CONCLUSIONS

➢ From the design and analysis of double acting hydraulic cylinder. It is clearly visible that ductile cast iron 60-4018 is better material that stainless steel 304 for the usage in JCB .

➢Cost is the main deciding factor among other factors which differs the both materials effectively.

➢ By comparing both materials properties, advantages and cost, we recommend ductile cost iron 60-4018 instead of stainless steel 304 in JCB.

REFERENCES:

[1] Jack, Hitesh Prajapati, Vivek Patel, Amit Patel, Problems In Fluid Mechanics and Hydraulics | Vol. 5, Issue 05, 2017.

[2] Robert. J, Houghtalen. A, Osman. H, Yogita Chauhan, Madhvi Sharma, "Fundaments Of Hydraulic Engineering Systems, Volume 05, Issue 02, Feb 2018

[3] Grant Ingram, Mr. R.Shiva Kumar, Mr. S. Suhas Mr. N. Sai Charan, Mr. Alapati Bharga"A Textbook Of Fluid Mechanics And Hydraulic Machines, IJRI-International Journal Of Resarch And Innovation.

AUTHORS

Mr. Raveendar is pursing B.E Mechanical Engineering In Panimalar Institute Of Technology.

Mr. Mariya Sunil Joshi. A is pusring B.E Mechanical Engineering in Panimalar Institute Of Technology

Mr.Narendran.K is pursing B.E Mechanical Engineering in Panimalar Institute Of Technolgy.