Project reference number :- 46S_BE_1696

Title of the project:- Design and Development of simple and affordable radial piston

College:- S G Balekundri Institute of technology Belagavi

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Introduction :-

A radial piston pump is a type of positive displacement pump that uses a set of pistons arranged radially around a central rotor to generate flow and pressure. The rotor is driven by a shaft, and as it rotates, the pistons move in and out of their respective cylinders, creating suction and discharge pressures.

A hydraulic pump is a mechanical device which transforms mechanical energy into hydraulic energy. It generates the flow of hydraulic fluid which is able to overcome the resistance pressure created by the load.

There are several types of hydraulic pumps: gear, piston, rotary vane and screw pumps. The piston pumps could be divided into axial and radial pumps. Radial piston pumps could have a cam at centre which hits the piston to create pressure. A radial piston pump is a type of hydraulic piston pump. The working pistons extend in a radial direction symmetrically around the shaft, marking the main difference between them and another piston pump, the axial piston pump, which has axially rotating pistons. Radial piston pumps arrange a series of pistons radially in a cylindrical block around a rotor hub. The block consists of a component, a cylinder barrel with pistons and rotating Cam. The component directs the fluid in and out of the cylinder with the help of check valve. The cam, mounted eccentrically in the pump housing, forces the pistons in and out of cylinders as it rotates, which cause hydraulic fluid to be sucked into the cylinder cavity and then be discharged from it. Inlets and outlets for the pump are located in a valve in a component. Each piston is connected to inlet port when it starts extending while it is connected to the outlet port when start retracting. An alternative design places inlets and outlets around the perimeter of the pump housing. Radial piston pumps can be purchased as fixed- or variable-displacement models. In the variable displacement version, the eccentricity of the rotor in the pump housing is altered to decrease or increase the stroke of the pistons.

Objectives :-

- To develop a pump which produces high pressure which can be implemented in VMC machines to deliver coolant at high pressure through very small holes of drill bits.
- To achieve the maximum pressure of 150 bar so that it can be implemented in the applications where high pressure is required.
- To achieve less floor space consumption so it is developed radially and can be mounted outside the sump.
- To achieve a continuous flow rate of 16 liters/minute at 1440rpm of motor
- To achieve at least 70% efficiency so that it is the most affordable pump in the market at this efficiency
- To make the design very simple so that anyone can assemble and disassemble the pump
- As the design gets simpler the proportionally cost of the pump will also be reduced

Methodology :-

- **Literature survey and Problem statement: -**

The literature review is carried to study the current as well as existing system different papers from different research scholars were studied to arrive at the problem definition**.**

- **Design Calculation**

Design calculations look at every aspect of construction. As the name suggests, they calculate the resources needed and the potential costs involved in doing the work. They also highlight any risks. The calculations include everything from foundations to walls to rafters.

- **Modeling**

Project Modelling is an entirely new approach to the sales, project estimation, and initiation phase of a project. Akin to a product configurator for manufacturing, a project modeler builds the components (i.e., the tasks and costs) of a project from a predefined set of models.

- **Different Materials used**

Different materials used in our pump are for plates, Shaft & components mild steel, For springs Music wire, For Cam, Piston & Follower Hardened stainless steel

- **Casting and Machining**

Casting and Machining are Complementary processes to each other in investment casting. Once the precision of investment casting cannot fulfil the finished component requirement. Machining operations will be chosen. Machining can help to achieve more precise dimensions.it also can make the surface finish better

- **Assembly**

Assembly is a collection of types and resources that are built to work together and form a logical unit of functionality. An Assembly can be a DLL or exe depending upon the project that we choose.

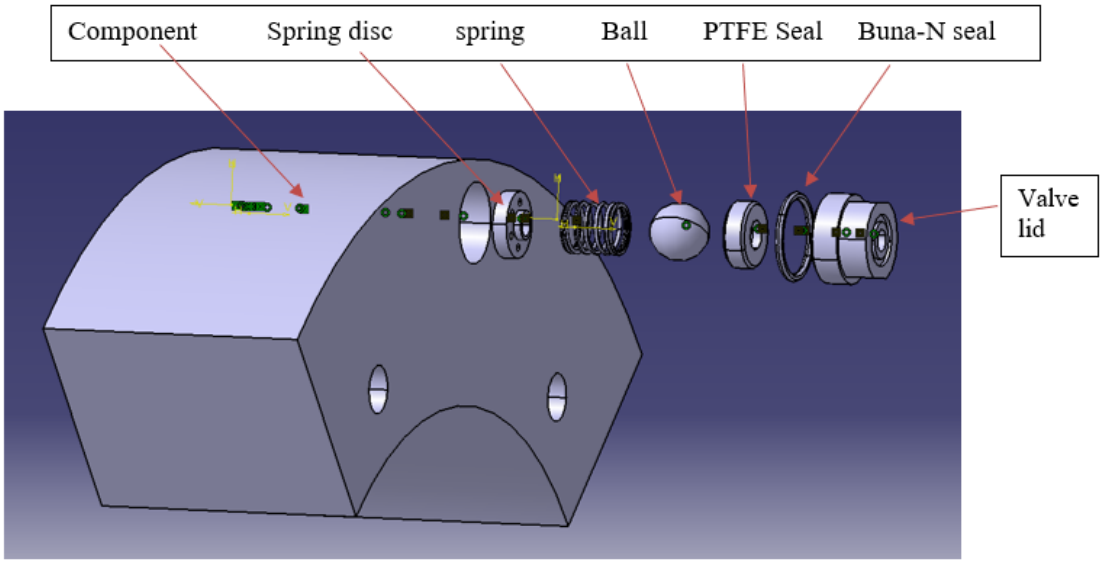

Figure 6.2.1 Component with Check valve Disassembly

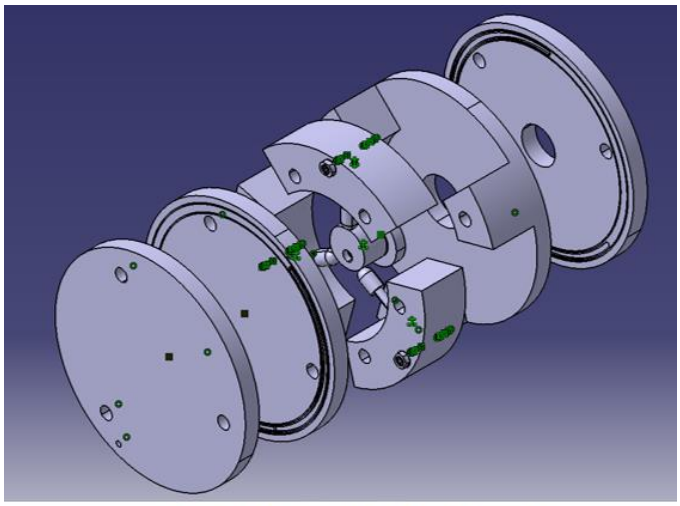

Figure 6.2.3 Disassembled View of Radial Piston Pump

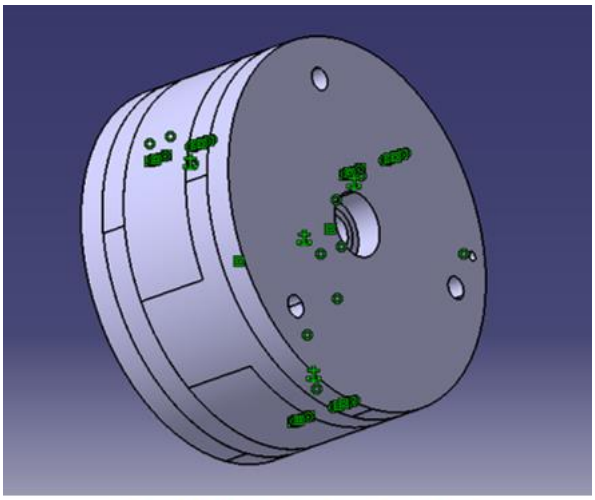

Figure 6.2.4 Assembly of Radial Piston Pump

- **Analysis :** We have done Static analysis on different springs used in this pump, Failure mode analysis on Piston & Follower & CFD analysis for the pipe for steady flow and Constant Pressure.

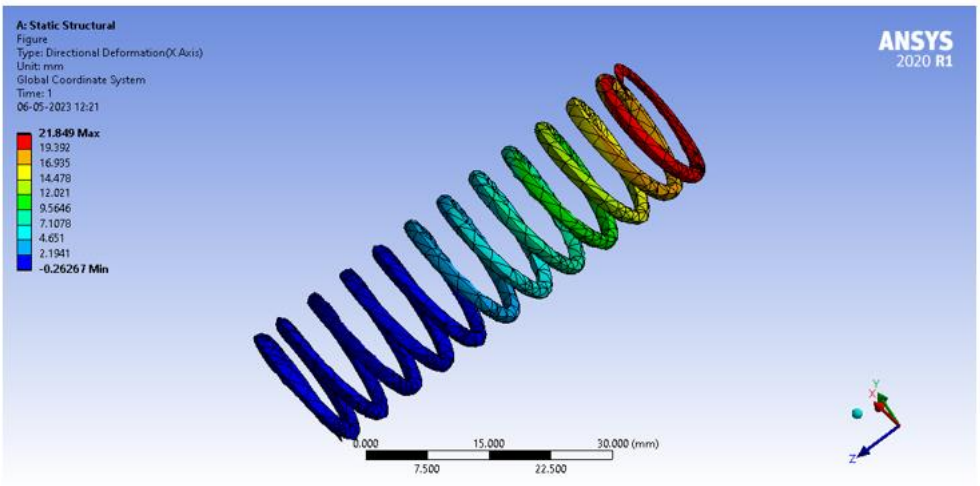

Figure 7.1 Analysis of Spring 1

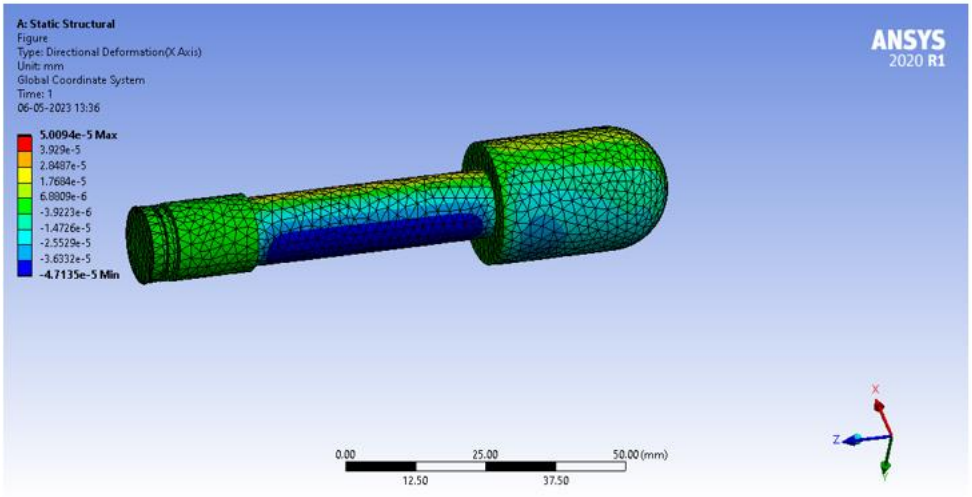

Figure 7.3 Compression analysis of Piston and Follower

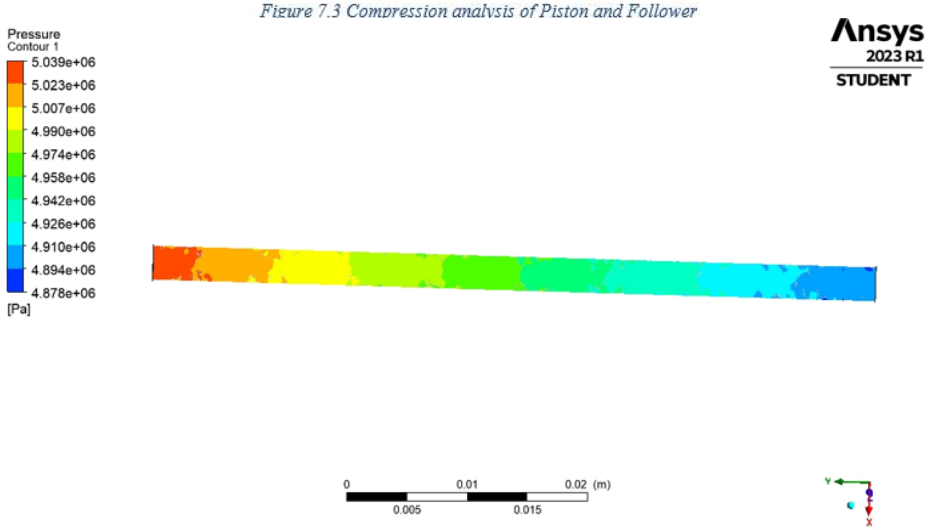

Figure 7.5 Pressure & Flow rate Analysis through the hole

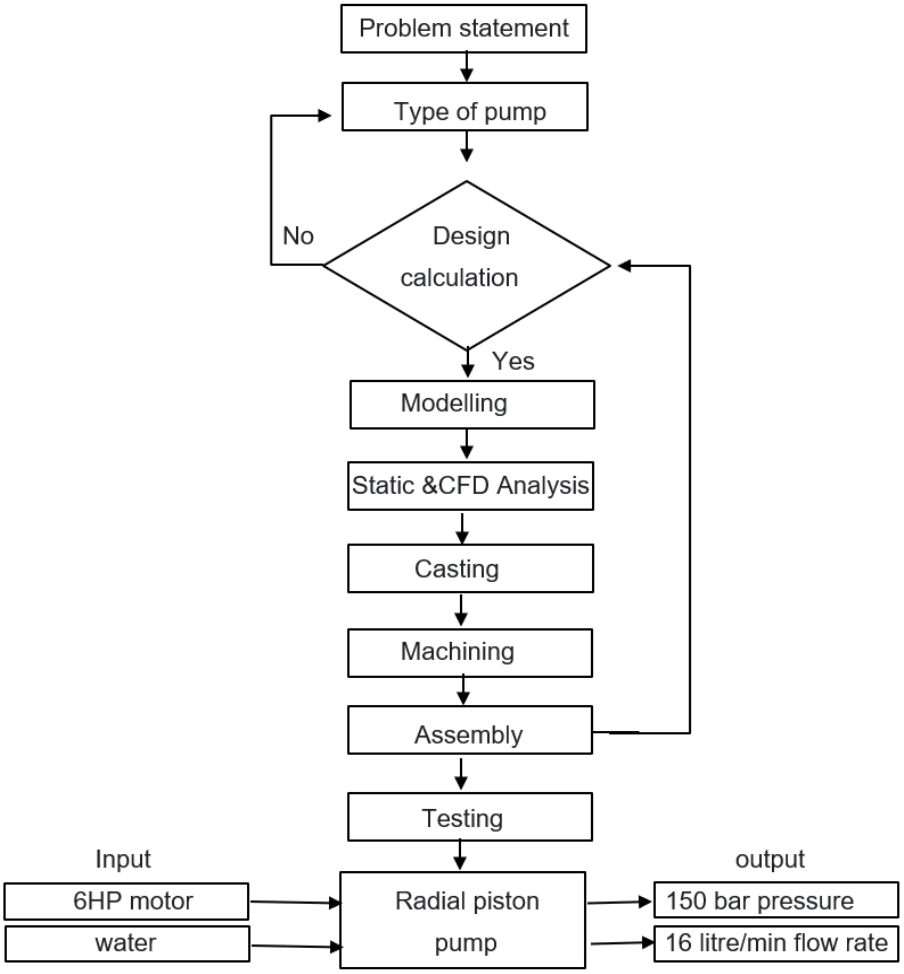

Figure - Methodology

Result & Conclusion :-

The proposed project deals with industries to produce high pressure in required applications. This project can produce up to 150bar constant pressure at the input of 6HP motor so that it can be implemented in coolants through inside the drill bit. This project is able to deliver 16 lit/minute water at high pressure of 150 bar. This can be mounted outside the liquid tank so that corrosion is avoided and we can expect long life. This Radial Piston is going to be the simplest radial piston pump exists in the market it can be assembled, disassembled by human being with basic knowledge.

Scope for Future work :-

- Weight & size of the Pump can further be reduced
- Complete analysis of pump in software will be added advantage
- Efficiency improvement can be done
- To reduce the Noise
- To reduce the cost of Maintenance and serviceability
- To improve Sealing and leakage prevention