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Desgin And Anaylsis Of Miniature Positive Displacment Of Pump

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ABSTRACT:

The design aimed at providing the down-stream sector of the petroleum industry and the small scale industry with an indigenous pump that could deliver about 4.09123x10-4m3/s (24.55litre/minute) of hydraulic oil. Pump is a device that enables mechanical energy to be imparted to a fluid and manifests in pressure energy increase. Pumps have wide applications in science and engineering including, public water supply, irrigation, up-steam/down-stream petroleum sector, auto-mobile, haulage equipment and chemical dosage. Gear pump is the main choice of fuel system designers due to long life, low maintenance cost and high performance. In this thesis, the static analysis is to determine the deformation ,stress and strain at different speeds (4000 and 2000 Rpm)of the gear pump for different materials (mild steel, stainless steel and C24 steel). In this the CFD analysis ie to determine the pressure Drop, velocity,and mass flow rates at different mass flow rates(24.55,40 and 60lit/min). 3D modeling by the CREO parametric software ,analysis done inANSYS

INTRODUCTION:

A pump may be a device accustomed move fluids, like liquids, gases or slurries. A pump displaces a volume by physical or mechanical action. Pumps make up 3 major groups: direct elevate, displacement, and gravity pumps. Their names describe the strategy for moving a fluid. positive displacement pump A positive displacement pump causes a fluid to maneuver by saddlery a hard and fast quantity of it then forcing (displacing) that at bay volume into the piping. or A positive displacement pump has associate degree increasing cavity on the suction aspect and a decreasing cavity on the discharge aspect. Liquid flows into the pump because the cavity on the suction aspect expands and therefore the liquid flows out of the discharge because the cavity collapses. the degree is constant given every cycle of operation. A positive displacement pump are often additional classified in step with the mechanism accustomed move the fluid: Rotary-type, internal gear, screw, shuttle block, versatile vane or slippery vane, circumferential piston, turbinate twisted roots (e.g. the Wendelkolben pump) or liquid ring vacuum pumps. Positive displacement rotary pumps air pumps that move fluid exploitation the principles of rotation. The vacuum created by the rotation of the pump captures and attracts with in the liquid. Rotary pumps are terribly economical as a result they naturally take away air from the lines, eliminating the requirement to bleed the air from the lines manually. Positive displacement rotary pumps even have their weaknesses. knowing to the character of the pump, the clearance between the rotating pump and therefore the periphery should be terribly shut, requiring that the pumps rotate at a slow, steady speed. If rotary pumps are operated at high speeds, the fluids can cause erosion. Rotary pumps that have such erosion eventually show signs of enlarged clearances, which permit of liquid to slide through and bring down from the potency of the pump.

1.1.MECHNISM OF SCROLL PUMP

Positive displacement rotary pumps are often classified into 3 main sorts. Gear pumps are the only variety of rotary pumps, consisting of 2 gears ordered out side-by-side with their teeth intermeshed. The gears recede from one another, making a current that traps fluid between the teeth on the gears and therefore the outer casing, eventually charcterstics the fluid on the discharge aspect of the pump because the teeth mesh and go around once more. Several little teeth maintain a relentless flow of fluid, whereas fewer, larger teeth produce a bent for the pump to discharge fluids in brief, pulsing gushes. Screw pumps are a additional difficult variety of rotary pumps, that includes 2 or 3 screws with opposing thread that's, one screw turns right handed, and therefore the different counterclockwise. A further strategy consists in employing a set of electrodes with completely different complicated forms. The screws are every mounted on shafts that run parallel to every other; the shafts even have gears on them that mesh with one another so as to show the shafts along and keep everything in situ. The turning of the screws and consequently the shafts to that they're mounted, attracts the fluid through the pump. like different styles of rotary pumps, the clearance between moving elements and therefore the pump's casing is lowest. Moving vane pumps are the third variety of rotary pumps, consisting of a cylindrical rotor incased during a equally formed housing. because the rotor turns, the vanes entice fluid

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between the rotor and therefore the casing, drawing the fluid through the pump. Reciprocating-type, for instance, piston or diaphragm pumps. Positive displacement pumps

have associate degree increasing cavity on the suction aspect and a decreasing cavity on the

discharge aspect

Liquid flows into the pumps because the cavity on the suction aspect expands and therefore

th liquid flows out of the discharge because the cavity collapses. The degree is constant every

given cycle of operation. The positive displacement pumps are often divided 2 main categories. • reciprocatory • rotary

The positive displacement principle applies whether or not the pump may be

• rotary lobe pump • Progressive cavity pump • rotary gear pump • piston pump • diaphragm pump • screw pump • gear pump • pump • vane pump • regenerative (peripheral) pump • peristaltic pump • Positive displacement pumps, in contrast to centrifugal or roto-dynamic pumps, can manufa-

cture a similar flow at a given speed (RPM) regardless of what the discharge pressure. • Positive displacement pumps are "constant flow machines"

A positive displacement pump should not be operated against a closed valve on the discharge

aspect of the pump as a result of it's no shut-off head like centrifugal pumps. A positive

displacement pump in operation against a closed discharge valve, can still manufacture flow

till the pressure within the discharge line are accumulated till the bursts or the pump is severely

broken - or each. A relief or escape on the discharge aspect of the positive displacement pump

is thus necessary. The escape cock are often internal or external. The pump manufacturer unremarkably has the choice to produce internal relief or safety valves.

2.LITERATURE REVIEW:

Design Analysis And Testing Of A Gear Pump

Nigeria depends heavily on importation of goods and machines. A shift from this trend requires the development of locally available technology. The design analysis of a gear pump that aimed at delivering 4.0913x10-4m3/s (24.55litres/min) of oil was carried out in this work. Available technology was utilized in the design and fabrication of the external gear pump. The design considered relevant theories and principles which affect the performance of a pump. The parts of the pump were produced locally from available materials. The performance of the pump was characterized and the test results showed a volumetric efficiency of 81.47 per cent at a maximum delivery of 20litres/minute. The discharge dropped with increase in pressure head at a rate of -0.344Litres/m.

Study Of Performance Analysis Of Reciprocating Pumps Using Cfd

Reciprocating pump is positive displacement pump. The energy is periodically added to generate flow. It is used in application where low discharge is required at high pressure. The analytical process for designing the pump and flow prediction is very difficult, time consuming and costly. Computational fluid Dynamic (CFD) analysis is a best tool for analysing the flow patterns inside the reciprocating pump and predicting the behaviour of the pump under different operating conditions. In this seminar, the CFD analysis of the effect of grooves cut along the length of piston of the axial piston pump is to be studied. The effect of number of grooves, their position and their orientation on the outlet delivery is analysed. Also collision characteristics of reciprocating pump is to be studied. CFD analysis of plunger pump is to be investigated. The case study for the CFD analysis of 2 D geometry of simplex pump has been performed. The result shows contours of static pressure, velocity magnitude and density.

Cavitation In Reciprocating Positive Displacement Pumps

Owing to their impressive properties reciprocating positive displacement pumps are used in many applications. Pumping fluids at high delivery pressures and metering are the areas of frequent use. The design of reciprocating pumps requires an exact knowledge of the appearing phenomena such as unacceptable pipeline pulsation and harmful cavitation. But cavitation in reciprocating positive displacement pumps is still an insufficiently understood problem. For a better understanding of the effects of incipient, partial and full cavitation in reciprocating positive displacement pumps high-speed camera measurements were done under real operating conditions using a horizontal single-acting plunger pump. Inspection windows were placed to capture all cavitation phenomena. Exemplarily the cavitation phenomena and their erosive potential are to be described on the basis of high-speed sequences for selected cavitation conditions. Also the mechanism of the incipient cavitation and the opening of the self acting valves could be clearly investigated with this experimental setup. Standards and guidelines were discussed concerning the economical operating of reciprocating positive displacement pumps.

A Cfd Study On The Mechanisms Which Cause Cavitation In Positive

Displacement Reciprocating Pumps A transient multiphase CFD (computational fluid dynamics) model was set up to investigate the main causes which lead to cavitation in PD (positive displacement) reciprocating pumps. Many authors agree on distinguishing two different types of cavitation affecting PD pumps: flow induced cavitation and cavitation due to expansion. The flow induced cavitation affects the zones of high fluid velocity and consequent low static pressure e.g. the valve-seat volume gap while the cavitation due to expansion can be detected in zones where the decompression effects are important e.g. in the vicinity of the plunger. This second factor is a distinctive feature of PD pumps since other devices such as centrifugal pumps are only affected by the flow induced type. Unlike what has been published in the technical literature to date, where analysis of positive displacement pumps are based exclusively on experimental or analytic methods, the work presented in this paper is based entirely on a CFD approach, it discusses the appearance and the dynamics of these two phenomena throughout an entire pumping cycle pointing out the potential of CFD techniques in studying the causes of cavitation and assessing the consequent loss of performance in positive displacement pumps.

Axial Piston Pump In Engineering: Novel Overview

Axial piston pumps release separate amounts of fluids into downstream piping. Each piston compartments creates a pressure rise and fall in the system piping, these pressure changes form a sine waves. This sine wave signifies the instantaneous flow rate of a single chambered and the mean flow rate of this pump is the average discharge per revolution. As increasing the number of pistons of an axial piston pump, that's means generating additional sinusoidal waves offset by time. As a result, the pressure

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fluctuations are reduced and decreasing amplitude of flow and pressure ripple. Hypothetically an unlimited number of pistons will completely remove release pulsation. Number of pistons varies by the type of pump construction. Commonly deal with piston pumps between one and eleven pistons, but in the industry where axial piston pump are designed a certain amount of confusion exists on the part of most designers regarding the trade-offs between designing a pump with an odd number of pistons and designing a pump with an even number of pistons. This proposal explores the flow and torque ripple which resulting from an axial piston pumps showing that the similarity between shafts torques and flow pulsations (ripple). explaining the relationship between the number of pistons and discharge flow-torque ripple by using graphical and numerical methods and finally establishing a numerical formulae relate between number of pistons and flow-torque pulsation factor and comparing the results of formulae of this present proposal with another previous work

CONCLUSION:

The design analysis of a gear pump that aimed at delivering 4.0913x10-4m3/s (24.55litres/min) of oil was carried out in this work. Available technology was utilized in the design and analysis of the external gear pump. By observing the CFD analysis of gear pump the pressure drop ,velocity and mass flow rate values are increases by the increasing the mass flow rate. By observing the static analysis results the stress values are increases by the increasing the gear pump speeds and when we compared the materials of gear pump the stress values are less for C24 steel at 2000Rpm So it can be concluded the C24 steel material is better material for gear pump

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