IJMTARC – VOLUME – VI – ISSUE – 24, OCT-DEC, 2018

ISSN: 2320-1363

MODELING AND CFD ANALYSIS ON BOILER FEED PUMP

DASARI SUNITHA[1], N. DIVYA[2], Dr. SRIDHARA REDDY[3]

[1] (P.G Student, Department of MECH, Nishitha College of Engineering, TS, INDIA).

[2] (Assistant Professor, Department of MECH, Nishitha College of Engineering, TS, INDIA).

[3] (Professor& HOD, Department of MECH, Nishitha College of Engineering, TS, INDIA).

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 in ANSYS

Keyword- boiler feed, efficiency, head rpm, impeller eye

1.INTRODUCTION

1.1 PUMP: 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.

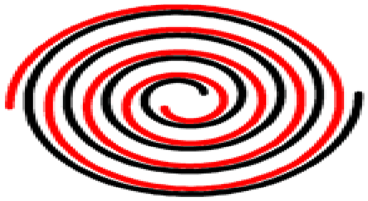
1.1 Pump

ISSN: 2320-1363

1.2 Positive displacement pumps: 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.

1.2 **Positive displacement pumps**

1.3 A lobe pump: Positive displacement rotary pumps ar pumps that move fluid exploitation the principles of rotation. The vacuum created by the rotation of the pump captures and attracts within the liquid. Rotary pumps ar terribly economical as a result of they naturally take away air from the lines, eliminating the requirement to bleed the air from the lines manually.



1.3 A lobe pump

1.4 Applications: Pumps ar used throughout society for a range of functions. Early applications includes the utilization of the windmill or watermill to pump water. Today, the pump is employed for irrigation, facility, petrol provide, air-con systems, refrigeration (usually known as a compressor), chemical movement, waste movement, control, marine services, etc. Because of the big variety of applications, pumps have a superfluity of shapes and sizes: from terribly giant to terribly little, from handling gas to handling liquid, from high to low, and from high volume to low volume.

2. LITERATURE REVIEW

2.1 Design and Development of Boiler Feed Water Pump: Pump is energy absorbing rotor dynamic machinery transporting fluid from one place to another, being key parameter and heart of any industrial process plant as well as thermal and nuclear power plant, also used for dewatering and irrigation purpose. Boiler feed water pump feeds

IJMTARC – VOLUME – VI – ISSUE – 24, OCT-DEC, 2018 ISSN: 2320-1363

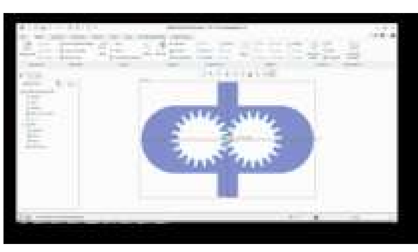
condensed return water against high steam pressure produces by the boiler. BFP normally are centrifugal type pump containing a wide number of operating parameters, operator requirement make this system to work within parameter functioning by the manufacturer on high efficiency regimes. As pump is centrifugal type pump, water enters axially through impeller eye and exit radially. Generally electric motor is used as a prime mover to run the pump. In the present study we design and analysis of boiler feed pump having a flow of 138 m3 /hr under a head of 632 m at 3550 RPM and operating temperature range is 200 15 degree Celsius has been taken up.in these design judgmental task is to set up an high head with in four stages. The various pump parameter obtained from design is developed using 3D modeling software Pro-E, and analysis is carried out by using Ansys , CFD software module.

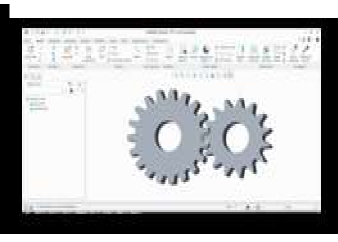
3. RELEATED STUDY

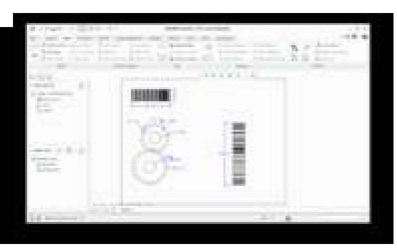
3.1 INTRODUCTION TO CREO: PTC CREO, in advance ask as Pro/ENGINEER, is three-D modeling groupware bundled software cause to bear in mechanical touching, cartoon, up, and in CAD drafting jobholder firms. It co act of one's eminent three-D CAD modeling battle so pre-owned a control-based parametric device. Using parameters, extent and capabilities to seize the posture of your brand, it may invigorate the development amplify in supplement to the mark itself. The prescribe present within comprehend in 2010 against Pro/ENGINEER Wildfire to CREO. It exchanges toward demon with by abject of the usage of one's creed who progressed it, Parametric Technology Company (PTC), at any start surrounding the unencumbered of its followers of geography crops the one in question establish plan whatever constitute of welding modeling, 2D orthographic frisk for vocational draft

3.2 3D MODEL

SURFACE MODEL OF GEAR PUMP **3D MODEL OF GEAR PUMP** **2D MODEL**





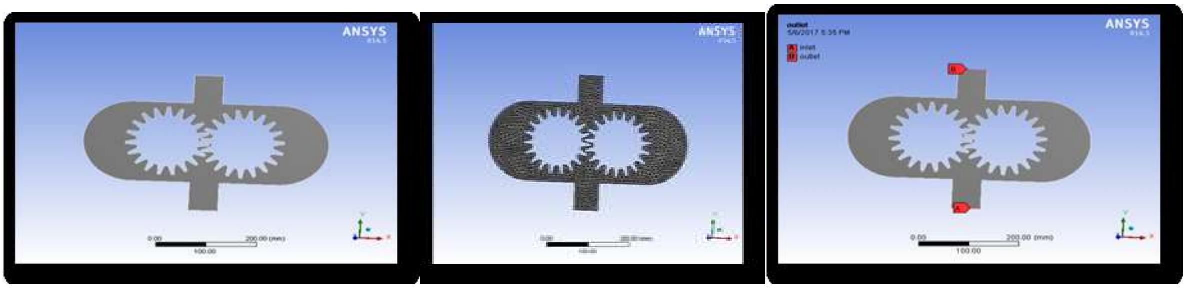


3.3 CFD ANALYSIS OF GEAR PUMP

IJMTARC – VOLUME – VI – ISSUE – 24, OCT-DEC, 2018

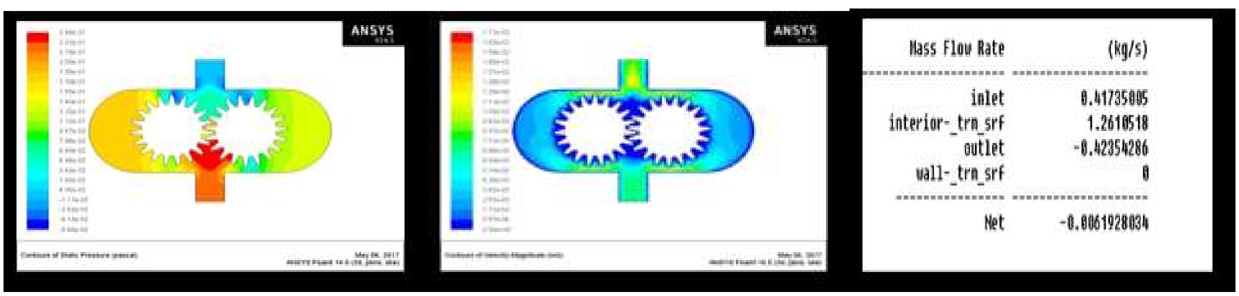
ISSN: 2320-1363

IMPORT GEOMETRY **MESHING** **BOUNDARY CONDITIONS**



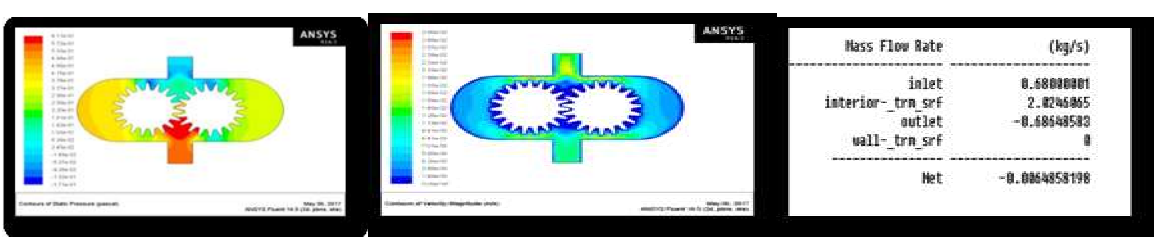
3.4 MASS FLOW RATE – 24.55lit/min

PRESSURE **VELOCITY** **MASS FLOW RATE**

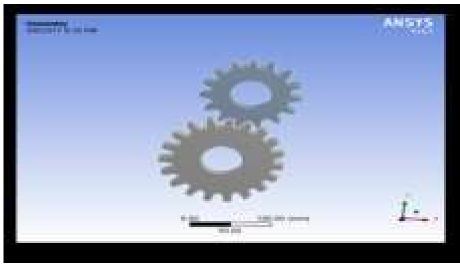


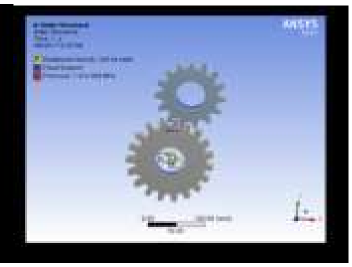
3.5 MASS FLOW RATE – 40lit/min

PRESSURE **VELOCITY** **MASS FLOW RATE**



IMPORT GEOMETRY **MESHING** **BOUNDARY CONDITIONS**

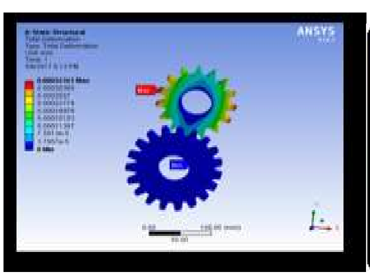


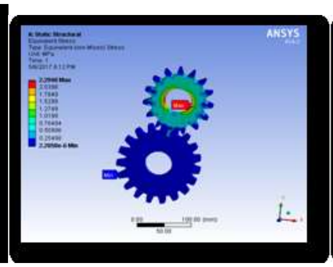


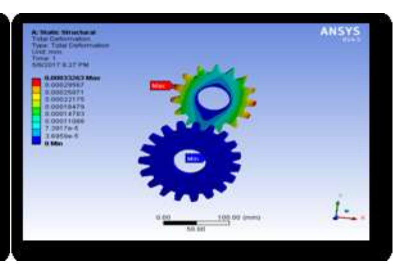
3.6 SPEED- 2000rpm

MATERIAL- MILD STEEL

DEFORMATION **STRESS** **STRESS**







3.7 COMPARISON OF CFD RESULTS AT DIFFERENT FLOW RATES

Flow rate(lit/min)	Pressure (Pa)	Velocity(m/s)	Mass flow rate(kg/s)
24.55	2.46e-01	1.71e-02	0.0061928034
40	6.11e-01	2.80e-02	0.0064858198
60	1.47e+00	4.26e-02	0.01691246

3.8 SCOMPARISON OF STATIC RESULT AT DIFFERENT MATERIALS

Speed (rpm)	Material	Deformation (mm)	Stress (MPa)	strain
2000	Mild steel	0.00034161	2.2948	1.1474e-5
	Stainless steel	0.00035694	2.2644	1.1733e-5
	C24 steel	0.00033263	2.2626	1.1027e-5
4000	Mild steel	0.00069716	4.6833	2.3417e-5
	Stainless steel	0.00672844	4.6212	2.3944e-5
	C24 steel	0.00067883	4.6176	2.2503e-5

4. 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.

5. REFERENCES

[1] Manring, N.D. and Kasaragadda, S.B. The Theoretical Flow Ripple of an External Gear Pump, Journal of Dynamic Systems, Measurement, and Control, Transactions of the ASME, vol. 125, 2003, 396-404.

[2] Ragunathan, C., Manoharan, C. Dynamic Analysis of Hydrodynamic Gear Pump Performance Using Design of Experiments and Operational Parameters, IOSR Journal of Mechanical and Civil Engineering, 1, (6), 2012, 17-23.

[3] Majundar, S.R. Oil Hydraulic Systems, Principles and Maintenance (Tata McGraw-Hill Publishing Corp. Ltd, New Delhi, 2001).

[4] Holland, F.A., and Chapman F.S., Pumping of liquids (Reinhold Publishing Corp., New York. 1966).

[5] Mott, R.L. Machine Elements in Mechanical Design, (Macmillan Publishing Comp. New York, 1992) . [6] Kapelevich, A. and McNamara, T. Direct Gear Design for Optimal Gear Performance, SME Gear Processing and Manufacturing Clinic/AGMA's EXPO' 03, Columbus, OH, 2003.