



Design And Failure Analysis Of Pneumatic Operated 2” Diaphragm Pump - A Review

Mr. Kapil Rangari¹, Prof. Ravindra Gandhe²

¹PG Student of Mechanical Engineering Department,

²Faculty of mechanical engineering Department

^{1,2}Abha Gaikwad Patil College of Engineering,

^{1,2}Rashtasant Tukdoji Maharaj Nagpur University, Nagpur

¹kapilrangari7@gmail.com

²rmdg201@rediffmail.com

Abstract

This paper presents a review on failure analysis of pneumatic operated 2” diaphragm pump. The diaphragm pump which is the core power output device of pipeline transport is one of the most important equipment for pipeline transport, so security issues of diaphragm pump is the key security issues of pipeline transport. Diaphragm pump forms pressure difference in the fluid to produce power, with the power to change the flow rate and flow of the fluid. Only keeping diaphragm pump operating effectively can ensure the normal operation of the pipeline transport.

Keywords: Diaphragm, Pump, Pneumatic, suction.

INTRODUCTION

The diaphragm pump is generally composed of valves and actuation. Diaphragm pump forms pressure difference in the fluid to produce power, with the power to change the flow rate and flow of the fluid. Only keeping diaphragm pump operating effectively can ensure the normal operation of the pipeline transport. The diaphragm pump which is the core power output device of pipeline transport is one of the most important equipment for pipeline transport, so security issues of diaphragm pump is the key security issues of pipeline transport. In recent years, the pipeline transport industry has developed rapidly, but there is an urgent problem that how to ensure the security and stability of the pipeline transport. Compared to the rubber coated diaphragms fabric reinforced diaphragms are reliable.



Fig.1: Diaphragm Pump.

LITERATURE SURVEY

1. Jia Yin, Jiande Wu, Xuyi Yuan, Xiaodong Wang and Yugang Fan ,*Research Journal of Applied Sciences, Engineering and Technology* 5(4): 1238-1244, 2013“*Study and Design of Diaphragm Pump Vibration Detection Fault Diagnosis System Based on FFT* “*ISSN: 2040-7459; e-ISSN: 2040-7467 Maxwell Scientific Organization, 2013.*

This paper deal with the system uses CMSS 2200 acceleration sensor to collect vibration signals, processing spectrum with FFT (Fast Fourier Transform) which is used effectively in current industry and finally achieve fault diagnosis and prediction for diaphragm pump. Through collection and analysis of the history signal.

2. Ms. Madhani Khushbu1 Prof. Ashwin Thakkar2 , All “*Analyzing the Effect of Fabric Reinforcement on Some of the Properties of Rubber Diaphragm* “*International Journal for Scientific Research & Development/ Vol. 3, Issue 03, 2015 | ISSN (online): 2321-0613*



This study involves the result of an effect of use of elastomeric fabric on rubber coated diaphragm. In such cases when rubber is composite with some fabric material it will have revised and improved property. In this paper it is been studied how (elastomeric fabric) improves quality of rubberized diaphragm. The experiment investigates comparison with other fabric reinforced diaphragm.

3. P. V. Sumanth Chowdary, Senthil Pandian. “A Comparative Study on RCC Structure with and without Shear Wall” International Journal for Scientific Research & Development/ Vol. 2, Issue 02, 2014 | ISSN (online): 2321-0613

Now-a-days tall buildings are provided with shear walls to improve the lateral load resistance. In the present paper we are study the solution for shear wall location and type of shear wall in seismic prone areas. The effectiveness of RCC shear wall building is studied with help of four different models. Model one is bare frame system and remaining three types are different shear wall buildings. An earthquake load is applied to 8 storey building located in different zones. The performance of building is evaluated in terms of lateral displacements of each storey. The analysis is done by using structural finite element analysis (SAP2000) software.

4. Parth D. Shah¹ Prof. Binita A. Vyas²” Automation of Diaphragm Wall Design for 3 Layers of Soil “International Journal for Scientific Research & Development/ Vol. 3, Issue 03, 2015 | ISSN (online): 2321-0613.

With scarcity of space in urban India, upcoming metro trains and development in ports, going deep in foundation will become more and more common. Diaphragm wall is very common type of earth retention scheme in deep excavation/foundation, weak/poor soil condition or congested site condition. Diaphragm walls are generally used in deep basement of building, congested urban spaces, underground structures of metro trains, riverfront structures and marine structures. In absence of standard procedure for analysis and design a tool which will take care of soil variation & give quick optimized results, is considered here

5. Ambarish G. Mohapatra Design and Implementation of Diaphragm, Type Pressure Sensor in a Direct Tire Pressure Monitoring System (TPMS) for Automotive Safety Applications “International Journal for Scientific Research & Development/ Vol. 3, 2015.

Correct tire pressure is a critical factor in the safe operation and performance of a motor vehicle. Over

Papers presented in ICIREST-2018Conference can be accessed from <https://edupediapublications.org/journals/index.php/IJR/issue/archive>

inflated tires often result in unnecessary tire wear, reduced gas mileage and less than optimal vehicle performance as well as vehicle safety. A tire pressure monitoring system (TPMS) monitors air pressure and temperature in the tires of a motor vehicle, and that generates a signal indicative of the tire pressure and temperature in each of the tires to increase the vehicle performance and safety. Present work is based on the design of tire pressure monitoring system which includes pressure sensor, an RF-communication unit, signal processing unit and display unit.

PROBLEM IDENTIFICATION

A double diaphragm is a positive displacement pump. It uses two diaphragms in and out to fill the pump chamber push it out when the diaphragm moves away from chamber. It lowers the pressure. If the chamber and fluid rushes in During this process the diaphragm in the diaphragm pump tends to get failed because of its motion several times. Hence the wok is to be carried out to know the working of diaphragm in the diaphragms pump and to analysis the material of diaphragm and make a diaphragm suitable material which won't fail during its operation.

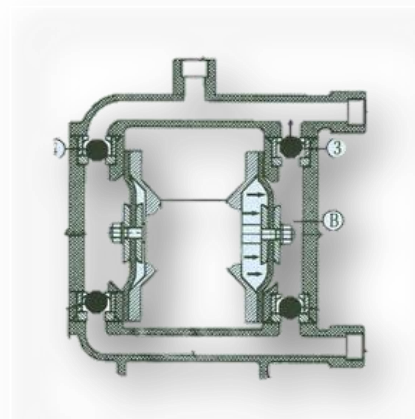


Fig.2: Valves Operated in Pneumatic Diaphragm Pump.

MOTIVATION

To help clarify the operation of the Double Diaphragm Pump we will divide the operation as follows. First we will describe the fluid flow. Then we will describe the air flow. Then we will describe the air valve triggering mechanisms used in Graco Double Diaphragm pumps. We will refer to the pump operation as the “right” or “left”. This is to aid in description only and bears no significance in real application.



DESCRIPTION OF THE PROPOSED WORK

A double diaphragm is a positive displacement pump. It uses two diaphragms in and out to fill the pump chamber & push it out when the diaphragm moves away from chamber. It lowers the pressure. If the chambers and fluid rushes in. During this process the diaphragm in the diaphragm pump tends to get failed because of its motion several times. Hence the work is to be carried out to know the working of diaphragm in the diaphragm pump and to analysis the material of diaphragm and make a diaphragm suitable material which won't fail during its operation

PRAPOSED DIAGRAM WITH COMPONENTS

1. Air Chambers:-

Compressed air flows into or out of the air chambers. The pump has a right and a left air chamber.

2. Fluid Housings:-

The fluid being pumped will flow through the fluid housings. Each pump has a right and a left fluid housing.

3. Diaphragms:-

Diaphragms separate the air chambers and fluid housings in the pump. The diaphragm is a materials that will flex with increasing or decreasing air pressure. A common shaft connects the two diaphragms.

4. Inlet Manifold:-

Fluid flows from the fluid container through the inlet manifold either to the right or left fluid housing.

5. Outlet Manifold:-

Fluid flow out of the right or left fluid housing past the check valves, then through the outlet manifold.

6. Air Valve:-

The air valve directs compressed air to either the right or left air chamber. The air valve consists of a triggering mechanism, a valve cup, and a valve plate. The air valve directs compressed air through a port to one of the air chambers while the opposite air chamber is directed to the exhaust port.

7. Check Valves:-

A double diaphragm pump has four fluid check valves, two inlet check valves, and two outlet check valves. The check valves control the fluid through the fluid housings and manifolds of the pump. Most double diaphragm pumps use ball type check valves. For a thorough explanation of check valve operation refer to the Fluid Controls module.

8. Muffler:-

The muffler minimizes the noise of the exhaust air. Different mufflers provide different levels of noise reduction.

9. Wetted Parts:-

The wetted parts include all parts that come into contact with the pumped fluid. They include the inlet manifold, ball checks and seats, diaphragms, fluid housings, and outlet manifold.

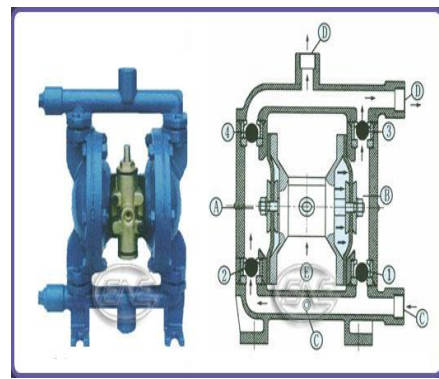


Fig.3 Propossed Diagram with Component Showing Parts Of Diaphragm

METHODOLOGY OF WORK:

For Design and Modification: CAD

For Analysis: Finite Element Analysis Method

ADVANTAGES:

1. Long life.
2. High maximum pressure
3. Simple cleaning/maintenance
4. Can run dry for short periods
5. Valves should be self-cleaning.
6. No non-return valve required.

DISADVANTAGES:

1. Requires frost protection measures.
2. Tend to leak if stripped for valve cleaning (plastic bodied ones)

CONCLUSION

Pneumatic operated 2" Diaphragm Pump suffers usual breakdown due to failure of Diaphragm. While other pumps transfer only water, this type of pump is usually



International Journal of Research
eISSN: 2348-6848 & pISSN: 2348-795X Vol-5 Special Issue-13
**International Conference on Innovation and Research in
Engineering, Science & Technology**
Held on 23rd & 24th February 2018, Organized by Tulsiramji Gaikwad
Patil College of Engineering & Technology, Nagpur,
441108, Maharashtra, India.



used for discharge of slurry from one place to another place. Diaphragm Pump has long life once the problem of Diaphragm failure is analyzed and resolved. Also, this pump has very low maintenance and main advantage of this pump is that it can run dry in dry condition while other pumps cannot. Hence, it can be concluded that the material of Diaphragm should be selected properly for its long run and performance availability.

REFERENCES:

1. Weisheng, Z., Y. Haiyan and L. Shaozhuo, 2009. The status of long-distance pipeline transportation technology and its application prospect in mine. *Met. Mater. Metall. Eng.*, 37(1): 57-60.
2. Parth D. Shah¹ Prof. Binita A. Vyas² "Automation of Diaphragm Wall Design for 3 Layers of Soil" *International Journal for Scientific Research & Development* | Vol. 3, Issue 03, 2015 | ISSN (online): 2321-0613.
3. Zhengjia, H., C. Jin, W. Taiyong and Z. Fulei, 2010. *Mechanical Fault Diagnosis Theory and Application*. Higher Education Press, Beijing.
4. Ms. Madhani Khushbu¹ Prof. Ashwin Thakkar², All "Analyzing the Effect of Fabric Reinforcement on Some of the Properties of Rubber Diaphragm" *International Journal for Scientific Research & Development* | Vol. 3, Issue 03, 2015 | ISSN (online): 2321-0613
5. Parth D. Shah¹ Prof. Binita A. Vyas² "Automation of Diaphragm Wall Design for 3 Layers of Soil" *International Journal for Scientific Research & Development* | Vol. 3, Issue 03, 2015 | ISSN (online): 2321-0613.
6. "Deep Support Systems Using Diaphragm Walls And Contiguous Piles" by Manish Kumar, Indian Geological Society Mumbai Chapter.
7. Air Operated Double Diaphragm Pump Full Flow High Pressure Series from "data Sheet, Service & Operating Manual