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Analysis and Maintain Compressor Performance by Using Innovative Bypass Filter

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Abstract

A way to increase the efficiency of a non-positive air compressor is to spray the lubrication oil to use it not only as a lubricant and roofing agent but also as a performance enhancer. The importance of economic exploitation of resources has brought about the need for integrated and efficient systems. In this paper to use Optimum oil used for compressor, thin wear and tear between contacts, improve compressor efficiency by increasing oil quality (according to NAS Theory) by using different filters.

Keywords*: - Screw compressor, NAS Theory, Filters.*

INTRODUCTION

Compressors are compacting devices. It is widely used in industry and has a wide range of applications. In modern production facilities, the use of compressed air is often the most important part of the process.

How they differ from a pump:

1. The main difference is that compressors carry gases and pumps carry liquids.

2. As the gases pressurize, the compressor also lowers the gas volume.

3. Liquids are not the same, while others may be suppressed.

Whether the compressed air is in direct contact with the product or is used to perform a specific process, provide incentive, package products, or produce other gases in the area, clean, dry, and reliable

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ventilation is essential. Maintain efficient and inexpensive production. There are many different types of air compressor available today, and because of their functionality and reliability, the rotary screw compressor has developed itself a technology for much industrial selection and use. Choosing a screw compressor can be a daunting task because of the number of manufacturers and the wide variety they offer. One of the biggest decisions you have to make when choosing a compressor is to choose an oil or oil-light model. Marketing messages are often aimed at industries such as food, beverage, pharmaceuticals and electronics and play on the fear that oil is at high risk for the pollution they face in the pressurized air.

This project has been developed to give the reader an understanding of where oil and other pollutants come from in the depressed air system and how to achieve clean, dry and oil-free air for critical applications. Also, the main goal is to improve the life of the compressor & oil through the Bypass filter system.

SCREW COMPRESSOR

The various demands of the pressurized industry have led to the development of compressor equipment and advanced requirements. Those requirements include reliability, good size parameters, easy adjustment and efficiency. Screw compressors have one good combination of these components, resulting in excellent performance; this explains their popularity as part of mobile and plumbing systems, gas stations, freezing systems and more. This specification is constructed by reducing the rotor profiles itself (one of the rotor profiles can be reduced) in relation to textual profiles, rectifying production errors, heat and loading that occur during operation. They determine the performance of the compressor and the efficiency and smoothness of the engagement, which can cause additional vibration, depending on. Therefore, the goal of access to the actual rotor profile can only be achieved by looking at all the factors discussed above. The rotary screw compressor contains two inter-meshing helical rotors containing the housing. The junction between the rotor pair and between the housing and the rotors is .003 in .005 in.

The main rotor (male rotor) is driven by an enlarged shaft of an engine or electric motor. The other rotor (female rotor) is driven by the main rotor with an oil film from an oil injection; no metal connection. The length and width of the rotors determine the volume and pressure of the outlet. The longer the rotors, the greater

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the pressure; the larger the rotor, the greater is the size. The helical rotor grooves are filled with gas as they pass through the shear harbor. When the rotors turn, the rivers are closed off the housing wall, forming a pressure chamber. See below **figure 1**.

Lubricant is applied to the compression chamber after Cleto grooves provide seal, cooling and lubrication. As the rotors turn to press the lubricant/gas mixture, the pressure chamber volume decreases, pressing the gas/lubricant towards the leaving port. The gas/lubricant mixture exits the compressor as the compression chamber passes through the discharge port. Each rotor is supported by anti-fiction bearings mounted on the plates on the edge of the rotor hole. Occasional carrier, which is usually exhausting, adjusting the rotation mechanism by axial coupling, carrying radial loads, and providing the minimum effective axial specification required. After compression, the gas/lubricant mixture enters the separator using lubricant. From the separation, the gas flows back to cooling. The lubricant is also cooled, returning to the compressor with a smooth-controlled valve. Oil is the lifeblood of a rotary screw compressor. The limited specificity within the rotation scale means that without proper lubrication, the scale can get higher than normal wear. Rotary screw compressor operators use hydrocarbon-based oil of ISO 100, 150 or 220 viscosities.

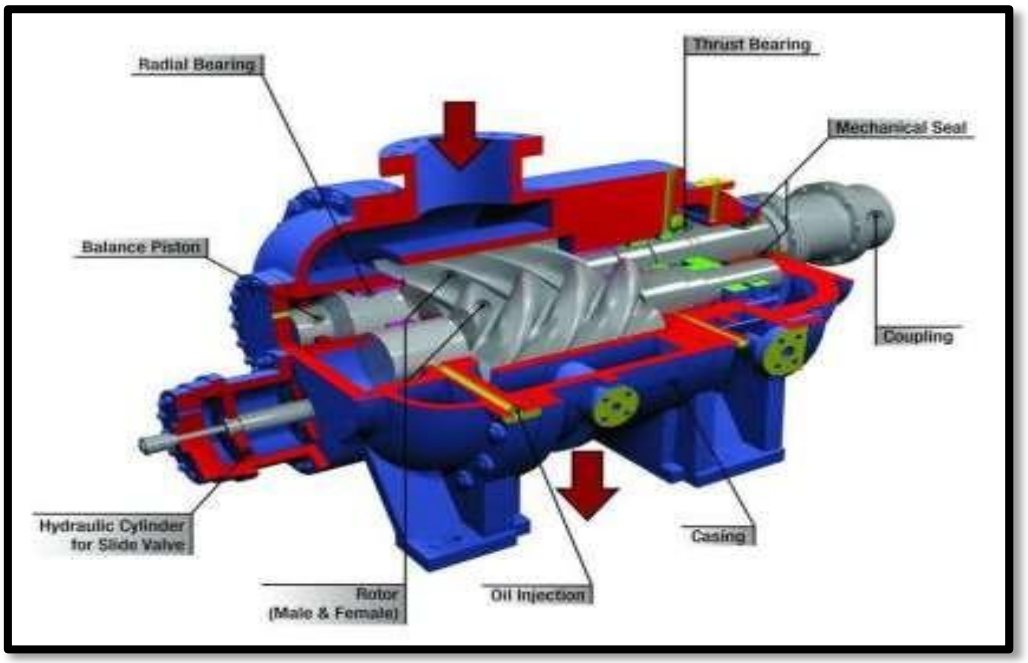

Fig. 1: Screw Compressor

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Lubrication in compressor

The application of compressors must accomplish one or more of the following:

1. Reduce friction between moving parts
2. Carry heat away from contacting surface
3. Prevent both rust during operation and when the compressor is suspended
4. Reduce gas leakage between seal surface and end closure.

In rotary screw compressors, oil is used to remove gas pressure, cut rotors, and lubricate bearings. On the basis of coagulation, crankcole oil softens the bearings, carries heat, reduces inflammation, and prevents corrosion. To keep the size and weight down, packages are often built around high speed compressors. This makes the lubrication of cylinders and piston and the installation of the rod very important. The lubrication system is determined by the size of the cylinder and rod. A separate power supply lubricator pumped from the crankshaft delivers oil to compressor cylinders and piston rod packing. Standard compressor lubrication system. Divider valve blocks consisting of metering pistons are fitted with a blocking mechanism with flow channels and built-in test valves to ensure proper oil flow in the cylinders. The cycle indicator is used in one of the blockchain blocks to provide a good indicator of system performance. The piston extension is an extension of the piston with rotations back and forth as the piston moves. Pints of oil per day and maximum duration of the cycle are determined by the compressor package. In the replacement of compressor cylinders, the oil has emerged with a function designed to reduce wear and tear and prevent corrosion. The diagram shows a typical flow diagram of an oil-filled compressor screw pipeline.

Fig. 2: Flow diagram of oil in compressor

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LUBE OIL SELECTION

All of the above conditions need to be considered before selecting compressor oil. With the right look in the selection, the life of the parts worn can be extended for several years. With inactive lubrication, life can be just minutes. Oil Oviscence Any selected oil must have sufficient viscosity at operating temperatures to keep moving parts from contacting and to reduce corrosion when large particles pass through the system. There are two different temperatures to consider when selecting oil: a) " cold flow; Cold temperatures should not be associated with the "- point point' 'in oil fields. Cold flow is the temperature at which the oil pumps dissolve or the concentrators fail to fill the side with constant tightness. Regardless of the selected oil, cold flow range from 6,000 to 10,000 SUS viscosity range.

Contamination

When the dirt particles in the lubricating oils are considered, the oil cleans cleanly. Even dust particles much smaller than the average film thickness can cause wear if tight. If they are large enough to penetrate the oil film thickness, they will exert local stresses on the surface and thereby significantly shorten the life of the system. This means it always pays to keep the concentration of dirt and water in the lubricant as low as possible. The primary sources of contamination in the compressed air supply include ambient air and compressor. Atmospheric air that feeds the compressor inlet at any time may contain contaminants such as solid particles (dust, sand, soot, metal oxides, and salt crystals), water vapor, oil vapor, and microorganisms. Care should be taken about taking the compressor to avoid these contaminants as much as possible. The first precaution is to filter the filter regularly and replace it according to the manufacturer's guidelines. NAS is a breakdown of particle contaminants so when trapped between cell surfaces it splits into smaller particles such as 1 → 2,

2 → 4 and until the oil is completely carbonized. This process of studying oil contamination is called NAS theory. It is also used as a standard to define the quality of oil used in the system. This is the logic for all cell measurement methods

- ISO 4406 / NAS 1638. The well-known hydraulic theory proves that a one-degree reduction in NAS increases the life of parts by 6 times, meaning that NAS 8 → NAS 4

→→ 24 times the life of parts means no useless time.

Sources of Pollution

The sources of pollution are as follows:

- Air taken from the atmosphere

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- In plant cells due to plant defects
- Mating cells caused by friction between two mating parts

FILTER

A filter is a physical, biological or chemical operation that separates solid and liquid from a mixture with a filter medium through which a complex structure can pass through which only liquid can pass. Solid particles that cannot pass through a filter medium are described as large and the liquid that passes through is called a filtrate. Larger particles form a filter cake on top of the filter and can also block the filter lattice, preventing the liquid phase from crossing the filter, called blinding. The size of the largest particle that can successfully pass through a filter is called the effective pore size of that filter. The separation of solid and liquid is incomplete; Solids are contaminated with some liquid and the filtrate contains fine particles (depending on pore size, filter thickness and biological activity). Filtration occurs in nature and in engineering systems; there are biological, geographical and industrial forms. There are many different methods of filtering; the goal is to achieve separation of materials. Separation is achieved by filtration and filtration between the materials or objects to be removed. The material passing through the filter must be liquid, i.e. liquid or gaseous. The filtration methods vary depending on the location of the target material, i.e. whether it is dissolved in the liquid phase or solidified.

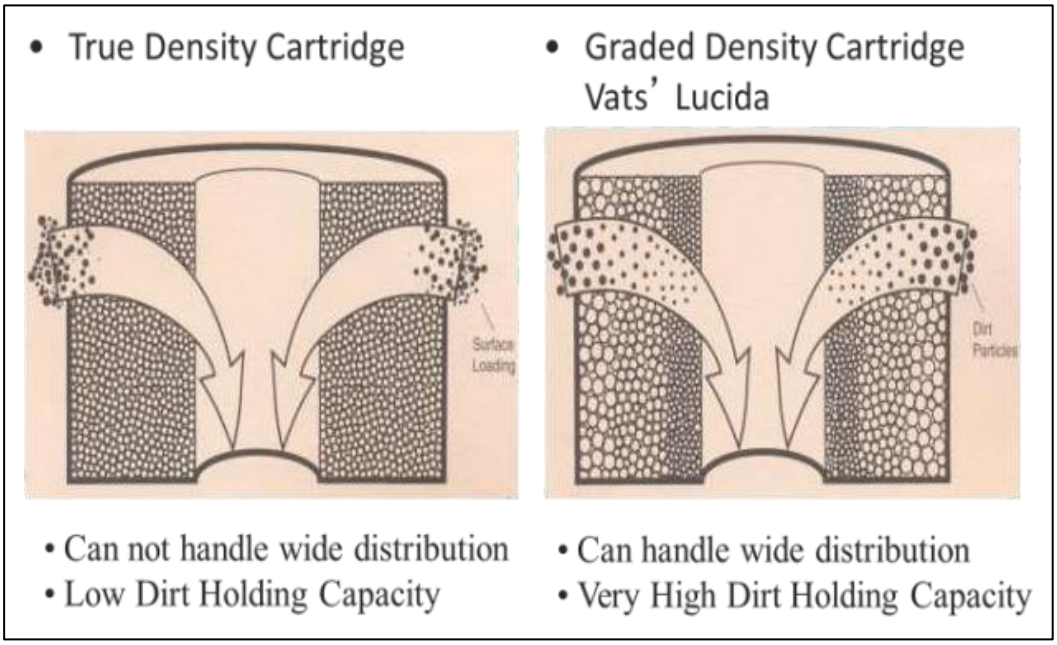

Fig. 3: True density filter V/S Graded density filter

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Technical Selection Parameters of Bypass Fine Filter

- Micron rating (degree of filtration)
- Consistency- initially and end of choking
- High dirt holding capacity
- Cost of bypass fine filter

Experimental Work

The test rig for the oil filter is designed and built as described above. The system is a hydraulic system as the system needs to be designed for the lubricant. Some parameters such as system pressure & system flow rate (discharge) must be considered for the design of the hydraulic system. Different filters need to be tested for a certain number of hours for this project. See below **figure 4**.

Graded Depth Density Bypass Filter Depth filters are different types of filters that use a porous filter medium to retain particles throughout the medium, rather than on the surface of the medium. These filters are usually used when the fluid to be filtered contains a large number of particles, because, compared to other types of filters, they contain larger particles before clogging. See **figure 5**.

Depth filters characterized by multiple porous layers with depth are used to extract solid contaminants from the liquid phase. Due to the tortus and channel-like nature of the filter medium, the particles are kept intact throughout the medium in its structure, rather than on the surface.

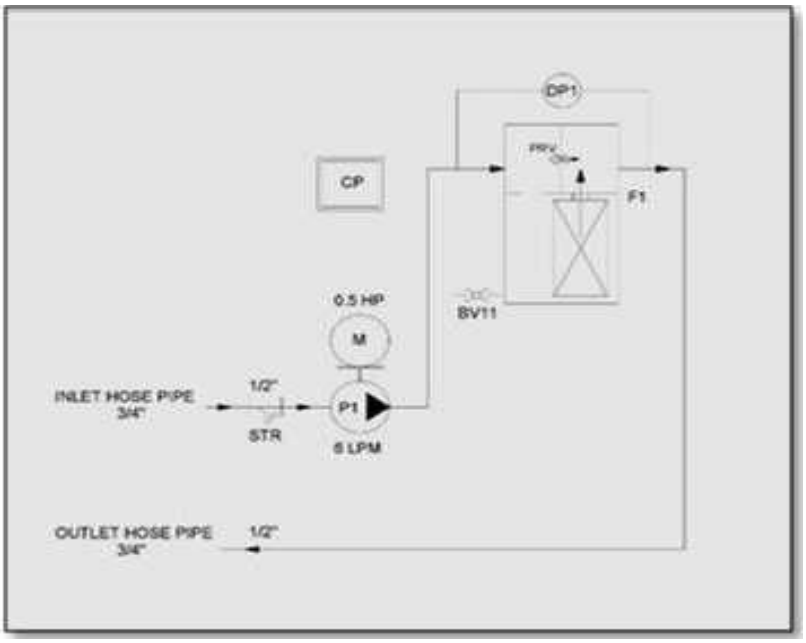

Fig. 4: Layout of Test Rig

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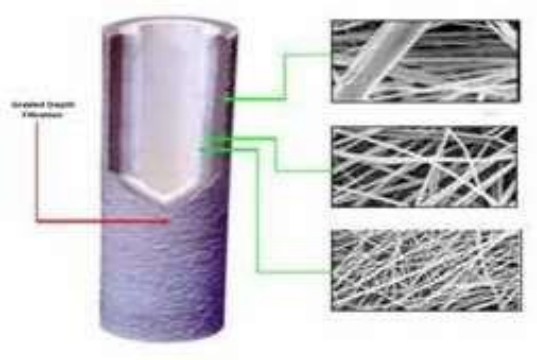

Fig. 5: Graded Depth Density Filter

With the advancement in process technologies depth filtering models are constantly adapting and improving to meet the needs of the industry.

TEST METHODOLOGY AND OBSERVATIONS

Patch Test

It is used to find the grade of oil as well as the quality of oil. From this patch test we can find out the life of compressor parts and the life of oil. It is helps to decide the oil changing frequency. Test includes Vacuum pump, Flask, Paper Filter, Measuring Tube, Lube oil, solvents, etc. In this the solvents are of different according to the lubricating oil. They are Petrol, Benzile and Hexile.

Procedure

First take 10 ml of lube oil from the system to be tested, then add 20 ml of solvent (petrol) and stir it properly. Then take an 8 micron patch off filter. When we take gear oil take 5ml oil and 25mg petrol instead of lube oil and filter paper will be 5 microns. It takes about 10 minutes to finish the oil from the patch. Using a standard patch chart, determine the oil grade.

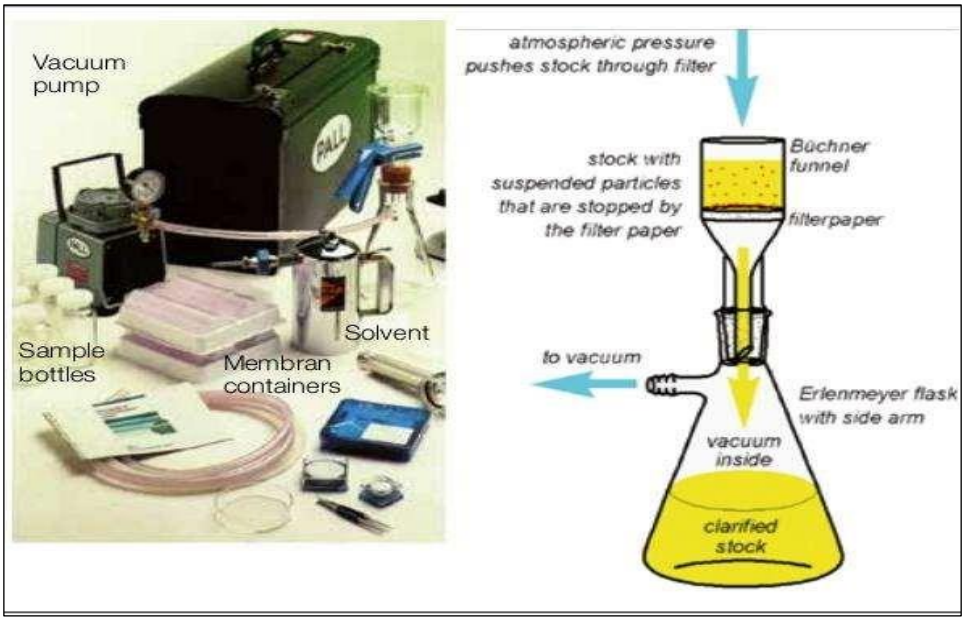

Fig. 6: Patch Test

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Particle Measurement Test

From the total power input, about 80% is used by the compressor, most of which is lost in the form of heat released during the compression process.

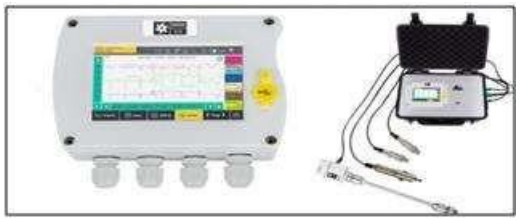

Fig. 7: Particle test instrument

In addition, about 5 to 10% of the energy used for air treatment is left, leaving only 10 to 15% of the total inlet energy, which we can use in the form of quality compressed air. We cannot greatly affect the efficiency of the compressor but on the other hand have a big impact on the efficiency of the air treatment.

Particle measurement

1) Knowing the actual content of solid particles

2) Ensuring a consistent process and finishing product quality

3) In accordance with ISO 8573

Solid particles are introduced into the lubrication system by a compressor or produced inside the system as a product of wear and corrosion. Cells make battles of various shapes and sizes from 50 to 0.001 microns (human hair is usually 70 microns thick for comparison). In a typical industrial environment, we have 91000 000 (ninety-one million) particles at 0,1 to 0,5 microns per cubic meter of air. Since the presence of solid particles can have a negative impact on he wear of the gaseous equipment and the final product / process quality, it is essential that the particle size and concentration be within the required limits.

How it works?

Let's see, how particle detection works. When a particle is illuminated by a light beam the beam is either absorbed or redirected which means that there is some sort of light interaction with the particle. Each time laser source is interrupted by a particle some light will be reflected and photo detector transforms this into an output signal.

RESULT

Table: 1 Paper filter

Sr. No.	Time (In Days)	NAS Value	Test Sample
1	**00**	**09**	
2	**10**	**10**	
3	**20**	**12**	
4	**30**	**14**	

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Table: 2 G2D filter

Sr. No.	Time (In Days)	NAS Value	Test Sample
1	00	09	
2	10	10	
3	20	12	
4	30	12	

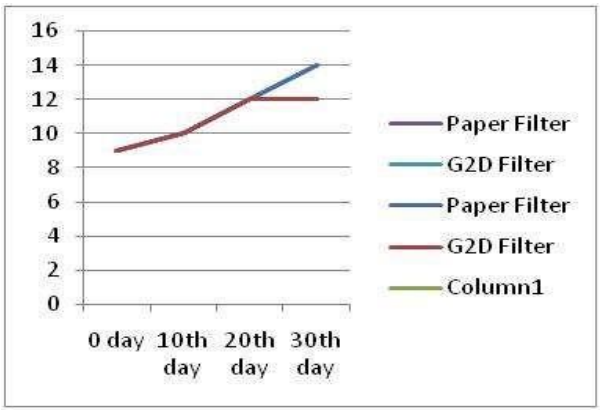

Fig. 8: Comparison between Paper & G2D Filter

CONCLUSION

A way to increase the efficiency of a non-positive displacement compressor is spraying lubrication oil to exploit it as a lubricating and sealing agent and as a performance-improving factor. The significance of economic exploitation of resources has brought a need for compact and efficient electromechanical systems. There are various factors that affect the performance and life of compressors. One of the main factors is contamination. When the foreign particles enter the compressor, it damages the compressor parts and deteriorates the purification quality; also, the compressor life gets reduced, resulting in the replacement of the compressor, which is expensive for the manufacturer. To overcome this problem, the compressor should have a filtration system to improve the compressor performance and life. Thus, in the following project, different kinds of filters are to be used before the compressors, and comparative analysis should be done to understand the best performing filter. In this paper, optimum use of oil used in compressor minimum wear & tear between contacting surfaces, improve compressor efficiency by increasing oil quality (according to NAS theory) by using different filters. In this project, we have studied the parameters of compressor and oil for the required hydraulic system. A general layout of the filtration system is prepared. They determine compressor performance and efficiency as well as engagement smoothness, which can cause additional vibration, depends on it.

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