Golden Research thoughts
Volume 2, Issue. 1, July 2012
ISSN:-2231-5063

Available online at www.aygrt.net

ORIGINAL ARTICLE

Investigation On Effect Of Synthetic Oil Of Refrigerating Compressor Over Traditional Oil

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Abstract:
The oil within the A/C system that lubricates the compressor. R12 systems use a special type of mineral oil. R134a systems use either a PAG or ester-based oil. A certain amount of compressor oil must be in the system at all times to prevent compressor damage. Loss of compressor oil (or failure to replace oil that was lost during the service or replacement of system components) will in compressor failure. Too much oil in the system can cause loss of cooling efficiency or compressor failure. The correct viscosity grade compressor oil is recommended for use in rotary screw, rotary vane, reciprocating and other compressor applications. Compatible with PAO, ester- and petroleum-based compressor oils. Not compatible with glycol- or silicone-based compressor oils.

KEYWORDS:*Synthetic Compressor Oil, Condition monitoring of synthetic oil*

INTRODUCTION :

A compressor is a power driven mechanism that takes in a gas compresses it and delivers it at a higher pressure. Compressors find use in various industrial applications. Refrigeration and Air Conditioning systems, Pressurize gases during manufacture of plastics, polymers and other chemicals. Compressors operate between two pressures i.e. suction and discharge .The ratio of the absolute discharge pressure to the absolute suction pressure for any given installation is always a constant .
Pressure Ratio =P2/P1 =Absolute Discharge Pressure/Absolute Suction Pressure = Constant .

CLASSIFICATION OF COMPRESSORS

a.Reciprocating >single acting >double acting (cross head type)
b.Rotary >sliding vane >screw (positive displacement)
c. Centrifugal (radial flow)
d. Axial Flow (turbo type)

FUNCTIONS OF LUBRICANTS:

Compressors are designed and built to the highest standards .Their safe and reliable operation demand that

Please cite this Article as : Om Prakash Shukla[1] , Amit Bahekar[2] and Deepak Gupta[3] , Investigation On Effect Of Synthetic Oil Of Refrigerating Compressor Over Traditional Oil : Golden Research Thoughts (July; 2012)

they are correctly lubricated considering that the compressors generate considerable forces and high temperatures. The selection of oil depends on the design of the compressor, gas to be compressed, the compression ratio and the final compression temperature. The main function of a lubricant is to reduce friction, wear ,cool and improve sealing.
Carbon- di- oxide compression require pharmaceutical white oils ,synthetic lubricants like di-esters, polyalkylene-glycols , polyalphaolifines, offer superior oxidation stability ,improved low and high temperature performance, oil changes and filter separators changes can be up to eight times ,have better lubricity ,reduce power consumption compared to mineral oils. Mineral oils i.e. solvent refined and hydrotreated.

PROPERTIES OF LUBRICANTS:

*Correct viscosity
*Viscosity Index
*Flash Point
*Pour Point
*Resistance to Oxidation
*Corrosion Protection
*Cleanliness

THE CASE :

One of the oil and gas industry for the first time installed a screw compressor for flare gas recovery that is normally let out into the atmosphere there by avoid air pollution and conserve gas.
Floated a tender for requirement of ISO VG 100 PAO based oil (approximately 10 kl.)
As per the operation manual fresh lube oil should be filled in after following the procedure laid down for initial start up as well as any start up after an extended shut down period like in this case, wherein the compressor has not been operated for more than 6 months. Such procedure includes flushing of the system with an ISO VG 68 grade of oil before filling the regular lube oil of ISO VG 100.Fresh oil should be charged through 100 mesh strainer to the oil charging drum before filling of oil tank separator.

PROBLEM ENCOUNTERED:

On starting up of the pump it was seen that although delivery pressure was achieved to the required levels, there was an excessive pressure drop across the 9-10 micron filters which has triggered tripping of the system.
The oil was heated to 60 Deg. C using the heaters provided in the system in order to improve the flow. The above has resulted in marginal improvement of flow and the flow could sustain for 5 minutes before tripping again because of the pressure drop across the filters.

OBSERVATIONS :

The old oil (imported along with the compressor) has remained unused for more than 6-8 months in the system due to non-operation of the compressor which had resulted in agglomeration of external contamination which was present in the used oil. Subsequent to draining of the old oil and charging of fresh oil, it has been seen that fresh oil got contaminated with external impurities getting injected back into the system, causing a flow disruption across the filters.

OILANALYSIS:

Samples of old oil, newly charged synthetic oil 100 from the system and from the barrels for contamination/cleanliness through Millipore membrane test. The same has indicated a very clean spot of synthetic oil 100 drawn from the barrel, dirty spot of synthetic oil 100 from the system and relatively more severe dirty spot of old oil. This corroborates our observations indicated above.
The oil samples of old oil and synthetic oil100 drawn from the system were analyzed in the lab and the test results are as under:

Properties	Synthetic oil 100	Old Oil
Appearance	Clear & Transparent	Dark
Kin. Viscosity @ 40 Deg.C	93.65	78.56
Kin. Viscosity @ 100 Deg.C	13.87	12.37
Viscosity Index	151	155
Flash Point Deg. C	242	80
Kin. Vis. At 40 Deg.C (after heating Oil for 100 Deg.C for one hour)	No change	89

The above clearly shows that the old oil was containing the dissolved higher ends of the flare gas which brought down the viscosity.

RECOMMENDATIONS:

Around 50 Lts Of oil to be removed from the bottom of sump (oil tank separator) at that time containing 6 kl. of Synthetic oil 100. This will remove the external contaminants present in the sump as well as which came out from the system. Once the sump oil is removed of the bottom dirt, it has to be passed through 100 mesh strainer for further making it clean. If the pressure differential is satisfactory with this cleaned oil compressor may be restarted to check its running without any tripping.

If compressor is running smoothly, samples of 500 ml each will be taken for condition monitoring analysis at intervals of 5 hrs. 100 hrs., 500 hrs. 1000 hrs etc. If compressor is not able to work satisfactorily, the cleanliness is to be improved further by going in for separate filtration system i.e. making the oil cleaner through sequential filtration system i.e. 6 micron followed by 3 micron portable filters which can be done at the site. For this filtration procedure approximately 72 Hrs . Prior to running the compressors, the 10 micron filter of the compressor should be taken out for cleaning and flushing. The entire pipeline should be checked for air pockets and should be bled using the valves provided or by de-venting.
The recommended drain /change of oil is 10000 hrs synthetic oil 100 has give life up to 21000 hrs.On the cost savings more than 50 lakhs was reported .

CONCLUSION :-

The learning's that can be taken from this case study can be summarized as under:
Follow the instructions of the OEM for commencing and maintaining the system.
*Imported oil can always be substituted with indigenously available oil and cost effective.
*Condition monitoring of oil samples at regular intervals and take corrective action like pre- Filtration /cleaning to avoid contamination.
*Result in considerable savings to the industry in terms of oil cost, compressor down time and maintenance expenses.

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