

CASE:

Varnish Potential Reduction in Large Compressor Lube Oil Systems by Dynamic Filtration

Proof of Concept testing of Ocean Team's IDOC unit

The formation of Varnish in a lubrication system is a widespread problem impacting many industries. This article reviews Ocean Team's extensive test on 3 Major GE Frame 9 Turbine Compressor skids, each with a lube oil capacity of 35,000 liters. All three systems indicated an increased Varnish Potential Rating (VPR). This provided the ultimate scenario for testing Ocean Team's IDOC unit and, thereby, establish Proof of Concept for removal of all deposits and contamination - with out shutting down the systems.

Ocean Team, successfully, assisted their customer in reducing the VPR to the minimum requirement in all 3 compressors.



IDOC Unit ▲

The ATEX approved IDOC (In Depth Oil Conditioner) Skid was exclusively designed and developed in-house at our Ocean Team facility targeting the removal of varnish generating catalysts, namely water, dissolved gases and oxidation by-products from lubrication oil systems.

Compared to similar, more conventional systems in the market the IDOC, with its ability to achieve a higher flow rate of 200 lpm, generates a flow that disturbs and loosens sludge and varnish contamination deposited at the bottom of all oil reservoirs.

Conventional Filtration vs. Dynamic Filtration

A conventional filtration and varnish removal is designed as a static decontamination/filtration process which solely cleans the oil - Not the system!

Ocean Team's IDOC solution on the other hand is a dynamic decontamination/filtration process that not only cleans the oil, but the entire system including the reservoir and all oil path.

The dynamic filtration process of the first unit was initiated on October 16, 2014 and the overall conditioning of the 3 units were completed by January 14, 2015

Intensive Monitoring

Samples were taken on a daily basis in order to keep a close track of the varnish reduction process. A Membrane Patch Colorimetry (MPC) Test was done on the samples in OTQ's lab in accordance with the standard ASTM D7843-12.

The dynamic filtration process created peaks in VPR every time any section of the reservoir was agitated. (Reference Graph 01, 02 & 03) A couple of weeks into the filtration process it became clear that the original time estimation for the purification could not be met. The actual duration to reach $\Delta E \leq 15$ took between 3-4 weeks for each system depending on the type of oil, the operation, temperature, load of contamination, and ingress rate.

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Satisfying Results

By utilizing the IDOC unit, the three 35,000 liter systems were conditioned to a VPR level of $\Delta E \leq 15$. The overall result of the Varnish Potential Reduction and contamination purification process of the three Turbine/Compressor Lube Oil Systems was satisfactory. The results of this test project has proven that it is possible to decrease the VPR value to the desired VPR $\Delta E \leq 15$, according to the ASTM standard D7843-12, by utilizing the IDOC unit.

Alongside the project, Ocean Team observed differences in the test results received from other participating laboratories for the same set of samples and therefore began to investigate the root cause of these inconsistencies.

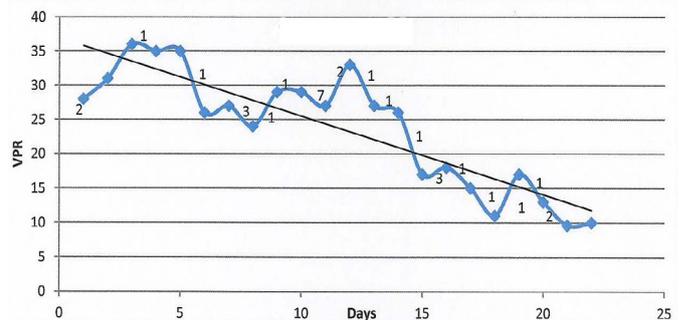
The investigations revealed that the inconsistencies appeared due to the miscellaneous interpretations of the ASTM D7843-12 standard for VPR testing by the different laboratories. To maximize data density and minimize data disturbance it was recommended that OTQ assist the customer when interpreting the ASTM D7843-12 standard and thereby generate an exact procedure applicable for all future VPR tests. A procedure that provides a consistent picture of the system monitoring with regards to the VPR figures.

Ocean Teams Experience Improves the IDOC

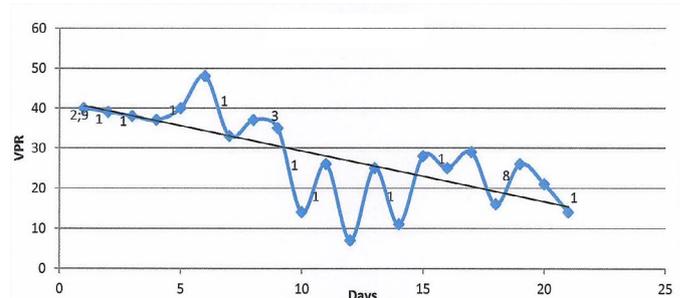
This project has provided valuable information and learning about the the IDOC unit's performance. The information has been evaluated internally and the outcome will be a modification of the IDOC unit's design enabling the unit to drastically shorten the duration taken to remove the varnish potential contamination.

An additional Balanced Charge Agglomeration (BCA) Filtration Technology (by ISOPur) will be integrated into the existing Skid. This redesign project of the IDOC unit has been initiated.

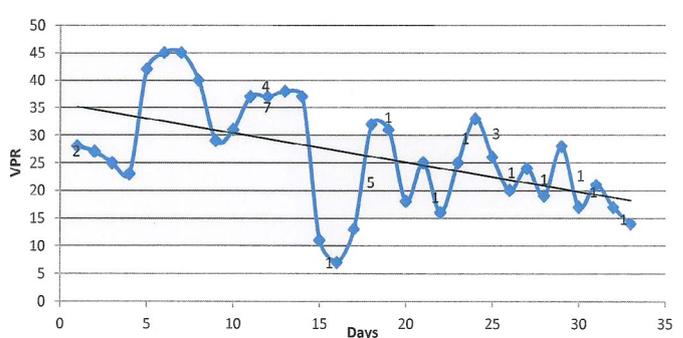
No. '1' indicates the peak in the VPR as a result of the agitations caused by the dynamic filtration process.



▲ Compressor no. 01 - Graph 01



▲ Compressor no. 02 - Graph 02



▲ Compressor no. 03 - Graph 03