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Datum : 03-05-2019
Betreft : Testen en olie analyses Rederij Bais Beheer BV
Aan : DEX Oil BV
Tav. : Hr. Carl de Vries
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: 3016 BM Rotterdam
Uw kenmerk : Ervaring Bais Beheer BV
ORM kenmerk : OR19-0036

Dear Mr. De Vries,

This is in response to your request to create a report of the practical testing done with DEX lubricant at the ship owner's location (Bais Beheer BV in Den Helder). Here is the requested information.

General:

Bais Beheer BV in Den Helder operates its own three fishery ships: the HD-3 Nieuwediep, HD-4 Hendrika Petronella, and HD-30 Fortuna.

With a fleet of three ships, the use and management of lubricants and diesel fuel are important factors and, as such, have a significant impact on business results.

ORM Advies provides guidance and advice to the ship owner in the use of lubricant and diesel fuel, including via independent, extensive analyses of the above-mentioned lubricants and diesel fuel.

In response to our discussions at the ship owner's location regarding various technical lubrication problems, ORM Advies brought the noteworthy properties of DEX lubricant to the attention of Bais. The ship owner then made arrangements with DEX for the testing and delivery of DEX lubricant

- The first test was conducted in a Caterpillar 3306 diesel generator motor aboard the HD-30.
- The second test was conducted on the HD-4 in the reverse gear.

First test: Caterpillar 3306 DI-T generator motor HD-30, lubricant volume: 36 litre carter

Prior to starting the test:

When using “common” engine lubricant, the high amount of consistently recurring impurities in the engine oil and the expiring chemical values result in the recommendation that the engine oil and engine oil filters be refreshed at intervals of roughly 250 operating hours (once every two weeks of fishing).

The test:

When the switch to DEX lubricant was made, the engine had at that point registered 38,665 operating hours.

At the recommendation of DEX, the lubricant filters on the engine were changed one extra time after a single week of fishing.

The first two analyses, after 130 hours and 400 hours respectively, revealed that the oil was highly stable as a lubricant. The crew also reported that the engine ran more quietly.

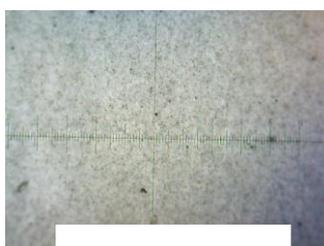
The high detergent properties of DEX lubricating oil (which loosen dirt and impurities) broke up soot and deposits in the engine. The membrane analyses for the lubricant revealed that the standard filtration system in the engine failed to remove these (often very small) impurities, which obstructed efforts to extend the lubricant usage time.

After the engine had run roughly 600 hours with DEX lubricant, it was decided to provide additional filtration by using a CC Jensen HDU 15/25 offline filter (see attachments).

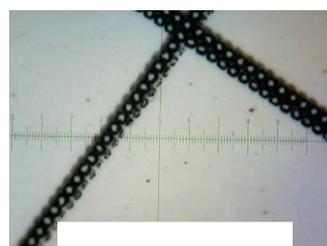
After installing the CC Jensen, the “old” impurities were filtered out of the oil, the oil remained at the expected purity level, and it was possible to continue extending the oil usage time in the test.



Membrane analysis
130 operating hours



Membrane analysis
1900 operating hours



Membrane analysis
2800 operating hours

During the test, it was noted that the amount of dissolved (ionized) copper increased. Further investigation revealed this to be a common phenomenon in these types of engines. Due to the modified chemical properties of the lubricant, copper components, such as the lubricant cooler, released oxidized particles which dissolved into the lubricant. In order to exclude the possibility that these particles resulted from regular wear, further analyses were conducted in the laboratory, during which the above-mentioned explanation was confirmed. The level of dissolved copper in the oil eventually stopped increasing, but did not decrease either.

After 2800 operating hours (11x the previous usage time) with a filled carter running on DEX, the oil was changed at the recommendation of ORM Advies. This resulted in a sharp decline in the dissolved copper content, which no longer increased afterwards.

Meanwhile, since the last lubricant change the tested diesel engine has been running for 5000 hours (20x the standard usage time) with a filled carter and oil analyses provide no indication that other inspections or revisions are needed.

During the test, the lubrication usage of the engine also dropped significantly: the original consumption was 2.2 litres of lubricant per week of fishing and this dropped to 1 litre per week of fishing.

The ultimate goal of the ship owner is to make one carter refill suffice for the entire usage period of the engine between installation and a standard overhaul.

2nd test: HD-4 reverse gear, 400-litre lubricant volume:

The reverse gear in the HD-4 was the second piece of equipment on which the DEX lubricant was tested.

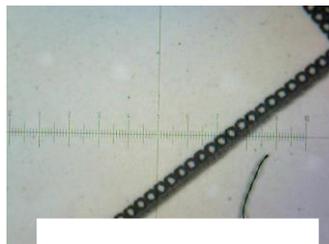
The oil in the reverse gear proved heavily polluted with particles and there was significant accumulation of resin due to oxidation (varnish). Resin in the lubricant of gearboxes and hydraulic systems cause many problems, such as interruptions in the lubrication film, filter blockages, and clogged fans.

The test focused on existing resin deposits, which because of the strong detergent property of DEX lubricant would dissolve, thus preventing damage and allowing the resin to be drained out when the oil was changed. However, because of the high cost of an oil change, a different solution was found for draining the resin.

In order to drain the resin that was loosened by the new DEX lubricant, a CC Jensen offline filter was installed, using a filter medium that traps and holds the resin, thus allowing the resin to be removed from the oil with the replacement of the filter insert.



Membrane analysis directly prior to testing



Membrane analysis during the test at 200 operating hours

Immediately after changing the oil in the reverse gear to DEX, the operation of the gearbox became noticeably quieter.

After the ship with the new DEX lubricant in the reverse gear started sailing, Bais received a message from the captain at sea, stating that the temperature of the reverse gear was lower than “normal”. The reason turned out to be the decreased resistance in the gearbox, which demonstrated the exceptional lubricating properties of this oil.

The temperature of the reverse gear had dropped by 9° C corresponding to a roughly 29 kW decrease in lost capacity throughout the gearbox, which translates into decreased fuel use.

Summary:

The tests revealed that:

- exceptional results can be achieved with DEX lubricant in engines and gearboxes.
- when using DEX lubricant, the resistance between the moving parts in the above-mentioned equipment decreases in comparison with the typical lubricant used before.
- during the transition from a different lubricant to DEX in an existing system, additional filtration is recommended.

As a result of the satisfactory test results, the ship owner decided to extend the use of DEX lubricants to the other ships’ engines and reverse gears.

Appendices:

- Analysis report of the Caterpillar auxiliary motor HD-30
- Analysis reports of the HD-4 reverse gear
- Specification sheets for CC Jensen HDU 15/25

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Peter de Caluwé

