Test report Ovet B.V. - Crane 8

In April 2019, DEX Premium Lubricants, received the invitation from Ovet B.V. Terneuzen, to test DEX DP2 ISO VG100 gear oil taking into account the following:

- To eliminate further wear on the gears, tooth.
- To postpone the upcoming revision
- To reduce energy consumption
- To reduce the operational cost and shutdown time

The field-test took place on Ovet Crane 8, a floating lemniscate crane intended for the distribution of large bulk loads in North Sea Ports. Ovet B.V. has 4 floating lemniscate cranes in operation.

For the test, the oil was exchanged into two identical gearboxes. The two gearboxes have practically the same load in operation.

The oils used are:

A. DEX DP2 ISO **VG100** – Lifting gearbox (gearbox) (200 liter)
B. ISO **VG320** (Major X) – Closing gearbox (gearbox) (200 liter)

Both gearboxes are of the type:

Make: Thyssen/ Type: NK SDN 450/SO/S
Pe (KW): 300/ Volume: 200 liters

Tester:

1. Oil change 12-04-2019
2. 1st oil sample 16-05-2019 after +/- 50 hours
3. 2nd oil sample 21-06-2019 after +/- 300 hours
4. 3th oil sample 29-08-2019 after +/- 500 hours
5. Reporting

The results:

1. Before the oil change, both gearboxes where fully drained and except for a small residual layer at the bottom ready to be filled with DEX DP2 ISO VG 100 respectively (Major X) ISO VG 320 oil.
   During the pre-inspection the gearbox is jogged so that all the teeth could be viewed properly. The overall impression was good. Although with clearly visible pitting, craters and here and there mirroring on the pitch.

2. The 1st analysis on 16-05-2019, after approx. 50 hours with DEX DP2 ISO VG100 of the lifting gearbox (Lifting gearbox) is taken an oil sample. This has been sent and analyzed for assessment to: ORM advice in the laboratories of AR Analyses and Bureau Veritas Oil & petrochemistry.
   - *The standard examination: membrane, photo, ICP, particle count (iso 4406), TAN, Water, viscosity and* PQ *index*

   The rash gave a very low iron value (Fe-3), from which it can be concluded that the pitting is stopped on the lifting gearbox. The next oil sample has been decided to extend the laboratory test with the MCP Varnish/ lacquer *test to see which sources are the potential cause of the pitting.*

3. The 2nd analysis at 21-06-2019, an oil sample was taken from both gearboxes to compare the Fe value between the two oils. When taking the oil sample at operating temperature, it was noticed that the (Major X) ISO VG320 heavily foamed and the DEX ISO VG100 not. *(See images in the appendix)*
   - *The standard examination: membrane, photo, ICP, particle count (iso 4406), TAN, Water, viscosity and PQ index added with MCP, Varnish*

   This laboratory result indicated that the DEX DP2 ISO VG100 gearbox (Lifting gearbox) now had a value of 4 (Fe) and the (Major X) ISO VG320 gearbox has a value of 10 (Fe). Additionally, the gearbox was suffering from resin formation and that the DEX DP2 ISO VG100 the resin had absorbed in the oil. (resin = Varnish).

4. The 3rd analysis on 29-08-2019, an oil sample has been taken again from both gearboxes. Again, at operating temperature, strong foam formation was noticed in the Major X gearbox and not in the DEX gearbox. *(See images in the appendix).*
   - *The standard examination: membrane, photo, ICP, particle count (iso 4406), TAN, Water, viscosity, PQ index added with MCP, Varnish.*

   This laboratory result indicated that the DEX DP2 ISO VG100 lifting gearbox now had a value of 5 (Fe) and the (Major X) ISO VG320 gearbox has a value of 16 (Fe). The resin formation in the (Major X) ISO VG320 gearbox appears to have increased and it is advised to apply a resin cleaning or replace the oil.

How does DEX DP2 ISO VG100 prevent wear in the gearbox?

- **Pitting** occurs when there is no hydrodynamic separation between the rotating parts. Pitting shows a high iron content in the analysis. If a high iron content is found in the analysis, one knows that a wear process is underway which shortens the life span of the gears, the bearings and the gearbox.

  DEX prevents pitting *because it adheres to the metal parts and thus remains a lubricating surface. The oil achieves the maximum result in* the *FZG friction test (FLS > 14). The test shows that the* DEX *lubricating film remains uninterrupted even under heavy loads. The extreme-pressure properties of the DEX DP2 ISO VG100 exceed that of the (Major X) ISO VG320 as has now also been demonstrated in practice in this test. The low friction that characterizes the DEX DP2 ISO VG100 which in this case results in a substantial temperature drop of 4 degrees centigrade, meaning less wear.*

- **Varnish** arises because in oil an oxidation process takes place - the polymerization of the hydrocarbon molecules. The varnish enters into a polar bond with metals which is recognizable by the brown discoloration. The varnish creates an uneven lubricating surface which causes the lubricating film to break and the oil to not be able to do its job.

  DEX DP2 ISO VG100 has a strong deterging effect, *which solves the existing* varnish *deposits in the gearbox. Although this* varnish *does not cause PITTING anymore, the MPC value will have to be monitored. In older gearboxes, a lot of pollution is often caused by the strong deterging effect. In case the MPC value has reached 35, it is advisable to filter the oil momentarily.*

- **Foaming oil** is caused by air intake of spinning gears. That air separates itself slowly from the oil. The compressed gases cause enormous temperature increases. Resulting in high oxidation of the oil which can cause varnish. Often, in non-stable base oils, a strong tendency to develop varnish is shown. Foam also has a strong negative influence because cavitation occurs.

  DEX DP2 ISO VG100 has an extremely good gas discharge and is very oxidation-and viscosity stable. The DEX DP2 ISO VG100 is therefore not foaming. *(See images in the appendix)*

Conclusion:

After an intensive test, the DEX DP2 ISO VG100 demonstrated that there is no more pitting in the lifting gearbox and that this oil with a viscosity 100 offers better protection than an oil with a viscosity 320. Bearing this in mind the following benefits for Ovet B.V. will immediately be visible or will become visible in the longer term:

a. Lower operating costs (shutdown time)
b. Extending the life span of the complete gear box
c. Strong fuel and energy savings
d. Higher reliability

We thank Ovet B.V. for the possibility that it has offered DEX Premium Lubricants to test an ISO VG100 against an ISO VG320 thereby confirming the results of the performed FZG test in practice.

Attachments:

- Images foaming
- Analyses available on request.

Na. The (Major X) Oil selected by Ovet B.V., which has been tested against the DEX oil, is an excellent oil, which will not or hardly differentiate in performance from similar oils of the other majors. However, all these parties are aware of the problem that they can't influence the monomolecular layer thickness of the oil molecules, which is what DEX technology does which leads to extreme and long-lasting differences in performance.

Appendix 1: Foaming Images

Foam – (Major X) ISO VG 320 – Gearbox (Closing gearbox)	**No foam – DEX DP2 ISO VG 100 – Gearbox (Lifting gearbox)**
Gear Oil: (Major X) ISO VG 320 In real-time Ovet Crane No 8. Visual inspection: 29-08-2019 Make: Thyssen Type: NK SDN 450 SO/S Sn: 8 8252 5 1132/53016 KW: 300 N1/N2 rpm 1000/40 Content: 205L Hours: 526 Average Temp: 52.5 °C	Gear Oil: DEX DP2 ISO VG 100 In real-time Ovet Crane No. 8. Visual inspection: 29-08-2019 Make: Thyssen Type: NK SDN 450 SO/S Sn: 8 8252 5 1132/5301 KW: 300 N1/N2 rpm 1000/40 Content: 205L Hours: 500 Average Temp: 48.2 °C