Higher Demands from the Wind Energy Segment Require Advanced Gear Oil Technologies

WIND AFTERMARKET (SPAIN)

Wind Turbine Gearboxes

Castrol Optigear® Synthetic X 320

Excellent Gear Protection and Oil Condition After Four Years

THE SITUATION

The Wind energy segment has increased demands for longer life of the turbines and lower maintenance costs. One area that can drive up maintenance time and costs is the main gearbox.

Castrol conducted a four-year study on 330 kW turbines in Spain to determine the ability to reduce these maintenance costs through the use of our latest technology gear oil.

THE CHALLENGE

- Goals were to show the following:
  - Low wear rate on the gears
  - Long oil life
  - No sludge creation
  - No foam
  - Excellent gear oil properties after 4 years in operation

THE RESULTS

- Results of 4-year study were:
  - Little or no wear on gears
  - Oil life of 4+ years projected
  - No sludge or residues
  - No foam
  - Gear oil performance properties are like new after 4 years

THE SOLUTION

- Castrol's Technology and Engineering groups worked collaboratively to develop a new technology gear oil to meet the greater demands of the Wind energy segment.
- The result is Optigear Synthetic X which utilizes long-life synthetic base oil and the most advanced additives to provide long life of the gears, bearings, and oil.
- The additive system contains a combination of materials including Molybdenum compounds which were shown to develop very low coefficient of friction, high resistance to micro-pitting, and overall maximum gear protection in lab tests.
- This 4-year field study was done to support the lab test results and ultimately confirmed our findings in a real-life scenario.

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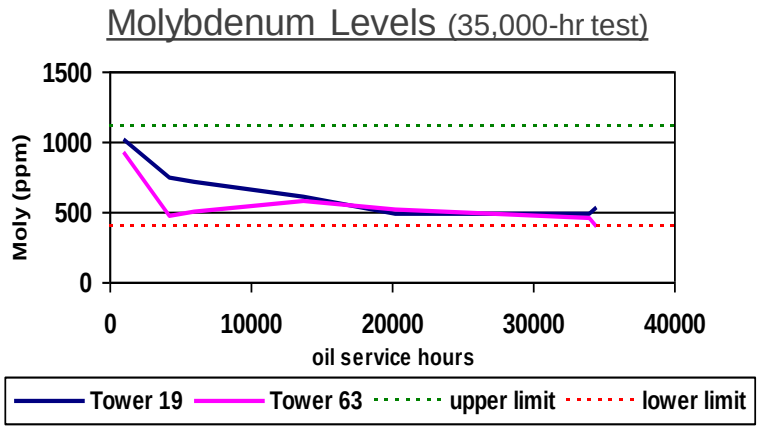
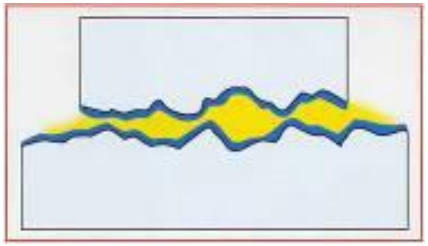
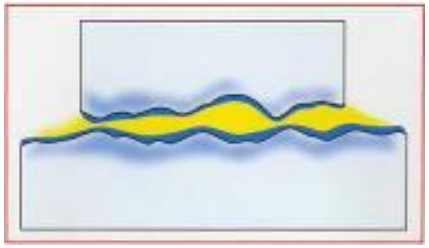
ADDITIVE PERFORMANCE DURING THE TEST

Castrol Optigear Synthetic X uses a special Molybdenum compound as one of the means of achieving low coefficient of friction and long life of the gears. This compound is designed to be activated by high specific loads, helping to equalize surface roughness and leading to gear surface improvement. Its main purpose is to minimize micro-pitting and wear on gear teeth. As such, the Moly content will drop over time in the gear oil as it creates a protective layer on the gear surface. A sufficient level of Moly is built into the product to ensure the highest gear protection is maintained over the life of the oil.

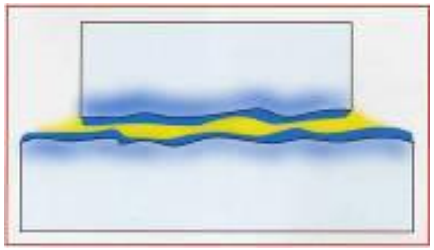




Step 1: Build up of load and pressure activates the additive combination to form a protective layer.



Step 2: Compression of the protective layer occurs at increasing loads. The coefficient of friction is improved



Step 3: At increasing loads, additives diffuse into the metal surface whereby the peaks flow into the valleys of the rough metal surface, creating a micro-smoothening effect. This produces a very low coefficient of friction and spreads the gear load over a much larger surface area.

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EXCELLENT GEAR PROTECTION REMAINS AFTER 4 YEARS OF SERVICE

At the end of the 35,000-hour test, Optigear Synthetic X 320 samples were submitted for performance testing to compare to typical results for new oil.

SRV Friction Behavior Test [DIN 51834-2]

Sample	SRV Coefficient of Friction	SRV Wear Scar Diameter
New Optigear Synthetic X 320	0.070 - 0.090 avg	0.50 - 0.60 mm
Turbine 19 (35,000 service hrs)	0.086 avg	0.45 mm
Turbine 63 (35,000 service hrs)	0.084 avg	0.48 mm

After 4 years in service, the coefficient of friction and wear protection of Optigear Synthetic X are like new!

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RECOMMENDATIONS

Castrol Optigear Synthetic X was formulated to provide maximum protection to the gears & bearings while resisting breakdown over time, thus minimizing oil maintenance needs.

As indicated by the molybdenum levels and wear protection results, the additive system actively protects the metal surfaces even after 4 years of service.

CONCLUSION

The results of the 4-year field test verify the findings in the lab that Optigear Synthetic X provides:

- Very long oil life
- Exceptional wear protection
- Low foaming characteristics
- No sludge

Even after the 4-year field test, the used Optigear Synthetic X continues to perform similar to new oil.