

OIL ANALYSIS

Sector: Paper industry.

Asset: Gearbox in the paper machine drying section, high criticality due to direct impact on production, quality, and risk of unplanned shutdown.

Initial situation: During normal equipment operation, the client detected signs of accelerated lubricant degradation and a condition behavior that did not yet justify immediate vibration-based intervention. However, there was concern about possible progressive internal wear in the gears and/or bearings of the gearbox in the drying section.

As part of condition-based follow-up, an increase in ferrous particles, the presence of unusual wear particles, and an upward trend in solid contaminants were observed. Viscosity was still within an acceptable range, but the particle count and the morphology observed in the analysis suggested a condition change that required technical validation and prioritization of actions to avoid impacting the availability and quality of the paper machine.

Work methodology:

- Sample collection and control: the sampling point, extraction conditions, and traceability were verified to ensure sample representativeness.
- Physicochemical analysis of the lubricant: review of viscosity, oxidation, water presence, and general assessment of the oil condition.
- Particle count and cleanliness: evaluation of the solid contamination level to determine severity and rate of deterioration.
- Analytical ferrography / wear assessment: identification of metallic particles consistent with active surface fatigue wear and abnormal contact between lubricated surfaces.
- Technical diagnosis: a condition consistent with the onset of abnormal internal wear was concluded, probably associated with surface fatigue at gear mesh contacts and a secondary contribution from rolling components.
- Intervention recommendation: corrective filtration / condition-based controlled oil change was proposed, along with a scheduled gearbox inspection during a shutdown window and a temporary increase in sampling frequency to confirm the trend.
- Subsequent validation: in the follow-up sample, stabilization of the particle count and reduction of wear material after the initial corrective action were sought.



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Conclusions: Oil analysis made it possible to detect an incipient condition that was not yet manifesting with the same clarity in other monitoring variables. This made it possible to take a planned decision instead of waiting for a functional failure of the gearbox. The main contribution was transforming a weak degradation signal into a concrete risk-based maintenance action.

The recommended intervention reduced exposure to progressive damage in gears and bearings, improved the client's planning capability, and provided technical evidence to justify a scheduled internal inspection without compromising process continuity. As a next step, it is recommended to maintain a combined strategy of tribology + vibrations + operational review to confirm condition stability, protect product quality, and adjust the follow-up frequency according to criticality.

Impact indicators:

- Major failure avoided on a critical asset: estimated.
- Potential unplanned shutdown avoided: estimated 8 to 16 hours.
- Reduction in the risk of secondary damage in gears/bearings: high.
- Associated savings from planned intervention versus corrective failure and production loss: estimated USD 15,000 to 40,000.
- Improvement in maintenance planning capability: from reactive response to scheduled intervention.

