

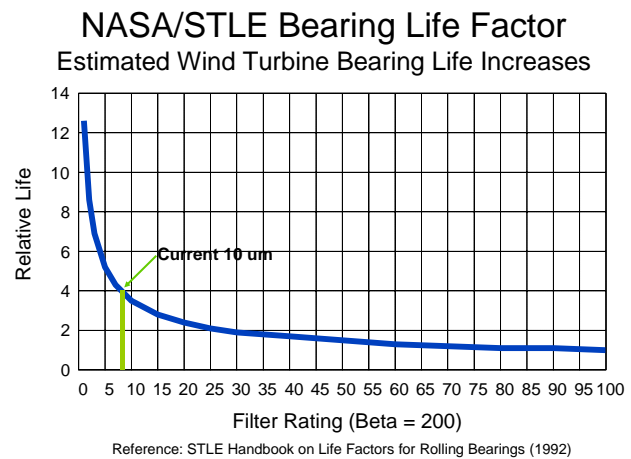
Northern US Wind Farm Success Story

One of the largest renewable energy power utility companies in the world owns and operates several wind farm sites in the northern region of the US. Covering a two-state region, the customer operates 287 Zond Z750 wind turbines with a full output of 750 kW each. The Zond gearboxes utilized Castrol Optigear® A320 oil, which is a synthetic PAO-based (Polyalphaolefin) gear lube. Typically this gear oil is exposed to operating temperatures in the range of 66 °C (150 °F) in a 55 gallon gearbox housing reservoir. The desired service interval for the filter system cleaning this gear lube is 6 months. The filter system protects the gearbox bearings and surfaces from wear.

The Problem

The customer was convinced that they were not getting effective filtration, due to the rather high viscosity gear lube coupled with a small main filter forcing operating in a bypass mode. Thus they wanted to improve the overall system reliability.

The filtration system operates in a bypass mode whenever the filter differential pressure exceeds 25 psi. The system is designed to operate at a flow rate of 12 gpm, with 14 gpm being the maximum. When the current system is filtering properly, the 10 um absolute glass fiber filter delivers extended bearing life, estimated as 4 times longer than without filtration, based on this NASA/STLE Bearing Life Study.



However, every time the system exceeds the 25 psi threshold, bypass operation delivers zero percent efficiency and reduced bearing life. The current filter consists of a single 5” diameter low pressure spin-on element, with 10 um absolute glass fiber filter media. At a



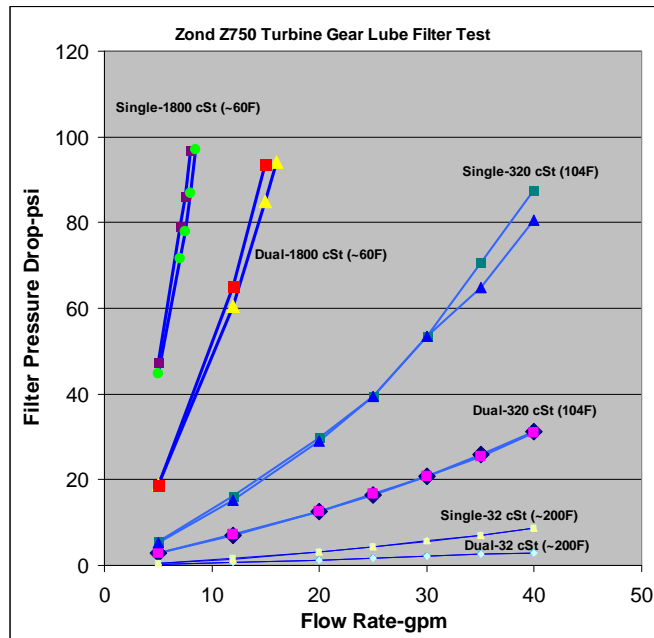
12 gpm flow rate, based on a standard 32 cSt fluid, this arrangement is designed to create only 1.5 psi pressure drop. Our tests averaged a level of 1.55 psi, very near our catalog values. On the other hand, our measurements of a filter assembly, as shown in the photo, at the higher gear lube viscosities of 90 cSt at 66 °C operation (150 °F) averaged ~4.4 psi at 12 gpm. During low temperature operation of 35 °C (95 °F), higher viscosities of 450 cSt force the pressure loss up to 27 psi: into bypass mode. Donaldson verified that high velocities and viscosities during lab testing caused the pleated filter media in the element to permanently bunch and deform, contributing to further restriction increase and reduced life. Target conditions for clean pressure drop would normally be around 2-3 psi to affectively maintain 17/15/12 ISO cleanliness. Unfortunately, bypass operation will be a common occurrence with this system at low operating temperatures, and as the particulate contaminant loads on the filter element.

The Solution

Upgrading the current filtration system to a dual filter head design and 2 of our HBK05 P165876 spin-ons acted to reduce these high viscosity pressure losses. At the 12 gpm flow rate, based on a standard 32 cSt fluid, this arrangement is designed to create only 0.7 psi pressure drop. In this case, at the higher gear lube viscosities, measurements of a filter assembly as show in the photo of 90 cSt at 66 °C operation (150 °F) averaged only 2 psi at 12 gpm, less than half of the single filter design, and within our target range. During low temperature extremes of 35 °C (95 °F), higher viscosities of 450 cSt raise the pressure loss up to 12 psi: well under bypass conditions.



Using the dual filter approach will definitely reduce the time spent in bypass operation. Of course, contaminant loading will add to the pressure differentials described here. This plot summarizes the pressure losses measured comparing single to dual filter designs at three different viscosities.



Conclusion:

The customer requested a filter capable of retrofitting into the existing location, which could alleviate the bypass issues and increase filtration effectiveness.

Since the system will be out of bypass over a much broader viscosity and temperature range, coupled with more media area and lower fluid velocities, the gearbox will achieve better oil cleanliness and therefore longer life. The customer is pleased with these results and has since continued to upgrade their turbine gearboxes to this dual filter design converting over 75 units to date.



Donaldson Filter Housings



Western (Donaldson) Housings



Donaldson Triboguard Filters