Advanced high-speed bearings for Electric Vehicles

CASE STUDY

PIABEVBA4EN

Background

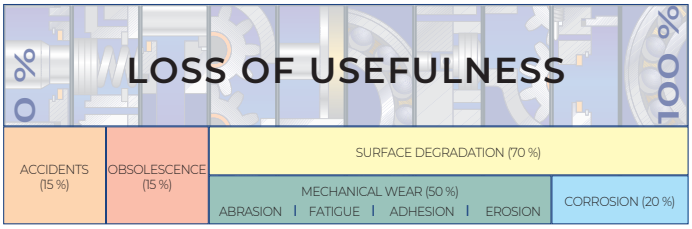
The most recent reports on the Automotive Industry predict that Electric Vehicles will account for more than 30 % of the new car sales in key markets by 2040 – up from 5 % in 2020.

This fast-growing market represents technical challenges for many OEMs and Tier Suppliers as it also corresponds to a significant demand for larger capacity battery packs and/or improved efficiency to allow for greater flexibility when purchasing electric vehicles.

To meet these requirements, automakers are pursuing smaller and lighter automotive components, and developing faster, higher output motors operating at higher efficiencies. Accordingly, bearings used in powertrains, especially in electric motors, are being subjected to increasingly higher speeds, enormous mechanical and acoustic constraints and performance demands – up to 30,000 rpm, or three times the speed of typical industrial motor.

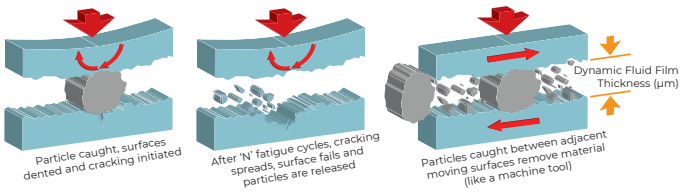
A major bearing company has developed a new range of advanced high-speed and silent ball bearings requiring new production processes and new part-washing lines capable to achieve and maintain over time a fluid cleanliness level corresponding to Class 4 per SAE AS4059 E standard.

Life Expectancy Factors



Presented at the American Society of Lubrication Engineers, Bearing Workshop.

Bearings – Typical components subjected to Fatigue & Adhesive wear mechanisms Contamination reduces bearing life expectancy through fatigue and abrasive wear.



Fatigue Wear Effects:

- Spalling failure of component
- Misalignment/vibration
- Noise

Abrasive Wear Effects:

- Dimensional changes
- Leakage
- Generated wear = more wear

Problem

Compared to its traditional bearing production (even for the most critical ball bearings required by the industry), the manufacturer had to significantly upgrade its production standards, especially its washing capabilities. The fluid cleanliness specification in the final washing stage had to be ≤ Class 4 per SAE AS4059 E standard.

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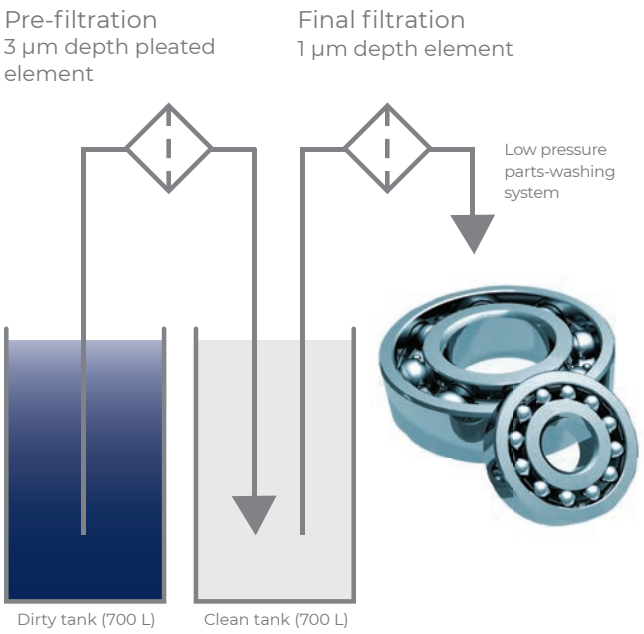
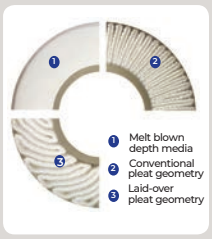
Pall Solution

To meet the technical specification and minimize the operating cost as much as possible, the final washing system was fitted with a 2-stage filtration solution as shown on the right.

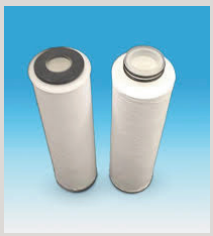
A Profile® UP 3 µm absolute-rated filter element was installed on the line filling the clean tank. Its depth pleated filter medium configuration was a very cost-effective solution to ensure Operators a high contamination retention capacity with a high filtration efficiency.

The objective of the Profile II 1 µm depth filter element installed on the washing system itself was to guarantee a super clean wash fluid at its point of use. The steadiness achieved over time of the fluid cleanliness level (class 2) maximizes the performance of the overall washing process.





Design it Build it Keep it CLEAN



Profile II filter elements

Profile UP filter elements

Conclusion

With the Pall Profile filter solution installed on the 2-stage washing system, the cleanliness of the advanced high-speed bearings meets the specification of the manufacturer.

Cleanliness is a key factor to avoid any premature catastrophic failure once the bearings operating on the Electrical Vehicles and maximize the life expectancy of these highly critical components. Cleanliness has also a direct impact on the noise generated by the ball bearing, especially at ultra-high rotation speeds.

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