

SKF self-aligning bearing solution for wind turbines

Benefits

- Reduced nacelle weight and total weight on tower and foundation
- Longer bearing service life
- Improved turbine reliability
- Lower production costs
- Reduced maintenance needs during operation

Lower weight and manufacturing costs for manufacturers, higher load capacity and reliability for operators

Improving the performance of wind turbines has typically required design decisions that add weight – and cost – to the nacelle. The SKF self-aligning bearing solution for wind turbine main shafts gives turbine designers an effective alternative that reduces nacelle weight and production costs while at the same time increasing turbine reliability.

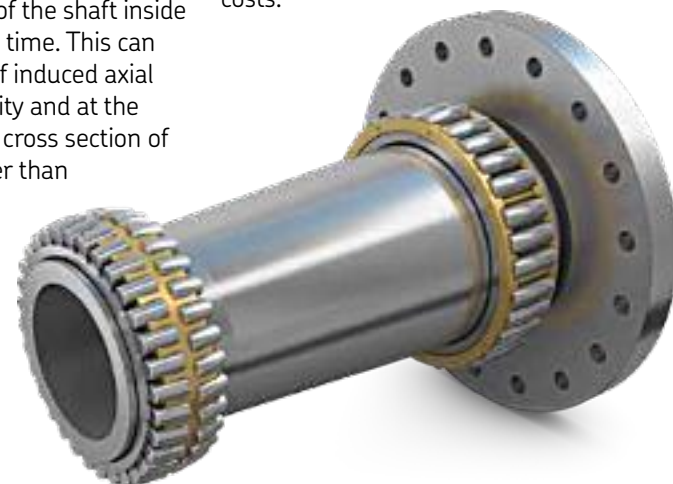
Higher load, lower weight

The SKF self-aligning bearing solution for wind turbine main shafts features a spherical roller bearing in the locating position and a CARB toroidal roller bearing in the non-locating position. The combination offers a very high load carrying capacity in a smaller, lighter housing.

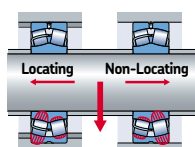
Unlike a conventional bearing arrangement in which friction between the outer ring and housing must be overcome in order to accommodate axial motion, the SKF solution employs a CARB toroidal roller bearing, which is able to accommodate both misalignment and axial displacement of the shaft inside the bearing at the same time. This can eliminate the problem of induced axial loads, improving reliability and at the same time enabling the cross section of the bearing to be smaller than what would be possible with conventional arrangements.



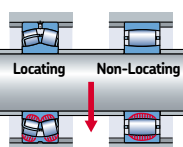
The result? Manufacturers can offer a lighter, more compact wind turbine with greater reliability and lower production cost. Owners and operators benefit from reduced tower and foundation weight, and improved reliability that translates into reduced maintenance and operating costs.



Conventional arrangement



CARB arrangement



A spherical roller bearing in the locating position and a CARB toroidal roller bearing in the non-locating position enables greater load capacity in a smaller, lighter housing.



Applying SKF Knowledge Engineering to improve wind turbine performance

Backed by more than 100 years of rotating machinery expertise and application experience ranging from the earliest wind turbines to the latest designs, SKF is helping manufacturers design the next generation of wind turbines. Below is just one example of how SKF engineers are helping the world's leading manufacturers improve wind turbine performance.

Improving functional safety and reliability



Photo source: REpower Systems AG

With a weight of more than 100 tonnes, the REpower 5M puts enormous loads on its rotor shaft. To handle these loads, the manufacturer chose SKF to install an SKF spherical roller bearing in the shaft's locating position, and a CARB toroidal roller bearing in its non-locating position. Developed by SKF, the toroidal geometry in the CARB bearing enables it

to accommodate misalignment and axial motion in the shaft at the same time, improving functional safety and reliability.

The CARB bearing in the REpower 5M has an inside diameter of 1 500 mm but weighs only 2 700 kg. The extraordinary size of the rotor unit required SKF to design a new induction heater to heat the bearings and the housings prior to assembly. SKF also designed and supplied special split nuts that facilitate assembly and disassembly.

In addition, REpower has asked SKF to provide the SKF WindCon online remote condition monitoring system for future units. Using vibration sensors mounted on a turbine's main shaft bearings, drive train gearbox, and generator, the system collects, analyses, and compiles a range

of operating data that can be configured to suit a wind farm's specific requirements. With CAN-bus interconnectivity to a number of systems typically found in modern wind turbines, such as centralized lubrication, blade monitoring, and gearbox oil condition systems, the SKF WindCon system can help wind farms extend turbine maintenance intervals, manage resources more effectively, and avoid costly downtime. Various parameters can be remotely monitored simply and accurately at any maintenance centre with Internet access, using SKF WebCon software.

“During the development of our offshore wind turbine REpower 5M, we trusted in the bearings from SKF – especially the CARB toroidal roller bearing with its innovative technical features. For a two-bearing solution within large and limited stiff structures, we deemed it to be the best choice for a non-locating bearing. Therefore we decided on the combination of a spherical roller bearing with a CARB bearing for the main shaft arrangement in our 5M. We maintained this design unaltered for the new turbine 6M.”

*Carsten Eusterbarkey
Development & Design
REpower Systems AG*

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