



Customer Success Story

We pioneer motion

Asymmetric spherical roller bearings

Increased performance and reliability for wind turbines

Within high-performance wind turbines, the rotor shaft bearing support – where the locating bearing is subjected to high loads – performs a vital function. Stringent reliability requirements and a general increase in the number of bearing failures provided the impetus for Schaeffler to optimize its spherical roller bearing design. The result? The development of the asymmetric spherical roller bearing (ASRB) design.

Benefits

- Improved performance under high axial loads
- Improved load distribution
- Reduced contact pressure and axial displacement
- Less wear, friction and damage
- Longer operating life

Customer

One of the largest owner/operators of wind turbines in the Americas

Sector

Wind Energy

Application

Rotor main bearing

Solution

Asymmetric spherical roller bearing

What drives our customers ...

Challenge

The main bearing is one of the primary components in a wind turbine's drivetrain system. In addition to supporting the shaft, which transmits the torque from the rotor blades to the gearbox, the main bearing carries all the loads acting on the rotor hub. Due to the high levels of thrust generated in this environment, conventional symmetrical spherical roller bearings used as main shaft support bearings experience uneven internal load distribution between the roller rows, causing one row to be overloaded. Additionally, because the rotor shaft turns at low and variable speeds, a mixed film lubrication is generated. This results in a metal-to-metal running condition, which leads to a high rate of surface wear, poor performance and premature bearing failure. Consequently, the bearing's service life ends up being significantly shorter than the requested 20-year lifespan.



Surface damage on a conventional spherical roller bearing that was caused by mixed lubrication and uneven load distribution

Harsh operating conditions for wind turbines

- Random severe loads (axial, radial and moments) depending on wind/weather
- High axial/radial load ratio (up to 50%)
- Impacts
- Vibrations
- Low rotor speed (~15 rpm)

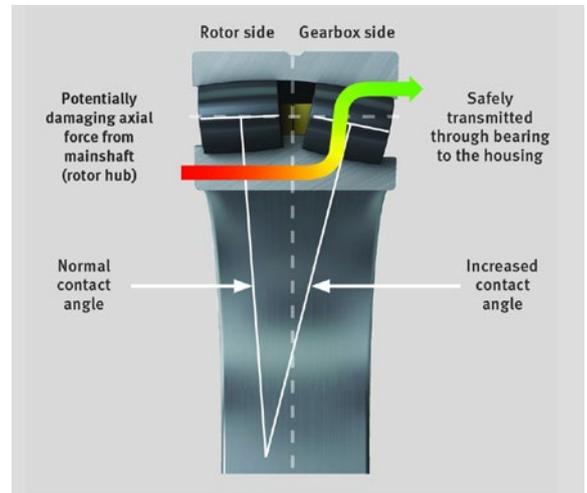


What Schaeffler has to offer ...

Solution

To protect against high-thrust loads while maintaining misalignment characteristics, Schaeffler developed the Asymmetric Spherical Roller Bearing. Interchangeable with standard spherical roller bearings, this design refers to the bearing's different contact angles that improve load distribution between both bearing rows, reduce contact pressure and friction torque, and increase axial stiffness by approximately 50%. The unique design also improves rolling motion while minimizing sliding.

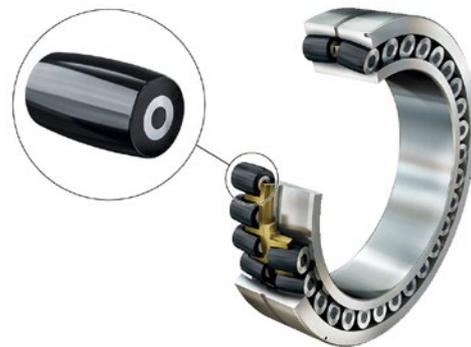
Additionally, to eliminate the premature surface wear of all running surfaces due to insufficient lubrication, the rollers feature Schaeffler's proprietary Triondur C coating. Designed to protect the roller and raceway surfaces during operation under very poor lubricating conditions, this feature can also be added to conventional spherical roller bearings.



Cross section of ASRB showing the load transfer



Rotor shaft of a wind turbine



Rolling elements coated with Triondur C

Optional customer-specific features

- Durotect B coating to increase the level of stability against WEC
- Inner ring bore diameter can be adjusted for shaft reconditioning
- Durotect CK-coated bore to reduce shaft fretting and save on repairs

Summary of asymmetric spherical roller bearing features

- Asymmetric contact angles
- Adjusted internal clearance
- Profiled rolling elements
- Triondur C-coated rollers
- Rigid central rib
- Two-piece brass cage
- Lifting bolts
- Leveling plate

What makes it special ...

Schaeffler Wind Power Standard

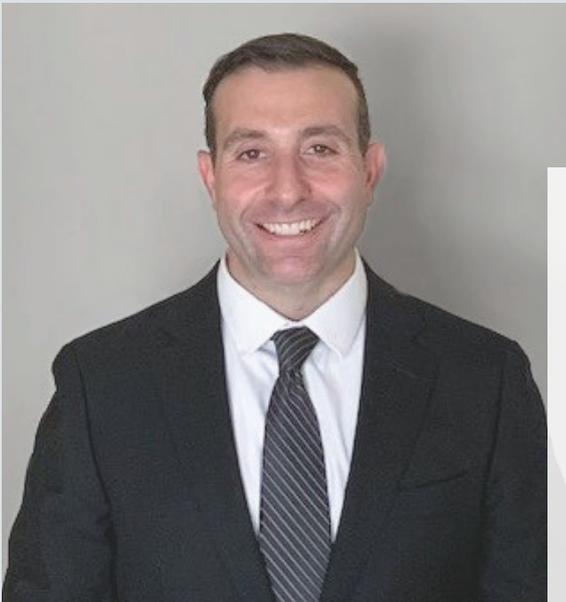
Asymmetric spherical roller bearings for wind turbines are also offered with the Schaeffler Wind Power Standard, which represents the highest quality standard that ensures optimum quality and reliability worldwide.

Characteristics

- High-quality supplier development
- Strict monitoring of quality and testing
- 100% ultrasonic inspection
- Comprehensive documentation with defined change process
- Full traceability from raw material to finished part
- Coordinated, transparent processes

The Schaeffler Wind Power Standard is a promise of quality. Schaeffler works with its partners in the wind industry to develop the optimum solutions for every bearing position inside the wind turbine. A comprehensive selection of special rolling bearing greases and a wide range of services and products for maintenance and condition monitoring round out Schaeffler's portfolio of offerings to the wind industry.

Innovations such as the asymmetric spherical roller bearing are designed to offer reduced maintenance costs and increased wind turbine availability. In other words, greater productivity and profitability for wind farm operators – and plenty of clean, reliable power for their customers.



Schaeffler's asymmetric design was the result of working with US wind customers to learn that almost all of their failed main bearings exhibited the same downwind raceway damage. After selecting a spherical roller bearing for its superior misalignment absorption capability, Schaeffler shifted the contact angle to adjust how the load was being distributed where the downwind raceway would handle the thrust loads more uniformly – thereby creating an asymmetric raceway configuration!

Ryan Greenfield
Industry Manager Wind at Schaeffler