

# Black oxide bearings boost turbine reliability and performance

## Benefits

- Reduced downtime and maintenance costs
- Enhanced resistance to corrosion and smearing
- Improved performance in low-lubrication conditions
- Reduced risk of fretting, micropitting and cracking
- Reduced damage from aggressive oil additives
- Reduced friction and wear

## Applications

### Bearing types used in key wind turbine systems:

- Tapered roller bearings
- Cylindrical roller bearings
- Spherical roller bearings
- CARB toroidal roller bearings
- Ball bearings

## SKF surface treatment adds layer of defense against unplanned downtime

Wind turbine bearings must endure widely varying temperatures, speeds and loads, plus exposure to contaminants, moisture and chemicals. These conditions can limit bearing lifecycles and increase already high operation and maintenance (O&M) expenses.

Black oxide coated bearings from SKF can help. Featuring an enhanced black oxidation surface treatment applied to the rings and rollers, these bearings help cut turbine O&M costs by enhancing bearing reliability and performance. Suitable for new installations or as a replacement for conventional bearings during maintenance routines, black oxide coated bearings from SKF offer manufacturers, operators and maintenance providers an affordable solution for improving turbine uptime.



## Protection from the causes of premature bearing failure

Black oxide coated bearings from SKF can deliver significant performance improvements at an acceptable cost. They can resist a range of damaging operating conditions. They offer better performance in poor lubrication situations because their treatment delivers improved lubricant adhesion and enhanced smearing resistance. The risks of fretting, micropitting and cracks can be limited. Corrosion and chemical-resistant, black oxide bearings reduce the effects of moisture and aggressive oil ingredients. They also help improve friction behavior and reduce wear, particularly under mixed friction conditions.

## Proven, cost-effective performance

More than 50 000 black oxide coated bearings are operating in the field, boosting reliability and contributing to lower overall operating and maintenance costs. Our enhanced black oxidation surface treatment is just one of a number of cost-saving, high-performance solutions that SKF has developed during our extensive involvement with the wind energy industry.





## Advanced technology for greater reliability

Since 2006, SKF engineers have been at work defining optimized treatment specifications for our own black oxidation process. It has allowed us to develop surface treatments that are individually tailored to bearing type, size and application, thereby extending the benefits of black oxide to large bearings.

### A better black oxidation process

The black oxidation process used by SKF involves a chemical reaction at the surface layer of the bearing steel. Performed in an alkaline aqueous salt solution at defined temperatures, the process can require up to 15 different immersion steps, resulting in a dark black surface layer about 1-2  $\mu\text{m}$  thick.

It is a thin black layer that delivers a significant performance upgrade to a broad range of bearing types and sizes used in wind turbines – up to 2,2 m in diameter, and up to 1 000 kg per individual bearing component.

### Slashing bearing failure rates by up to 70%

SKF helps wind gearbox manufacturers extend bearing lifecycles dramatically. For one wind gearbox manufacturer, the improvement was impressive. In a sample of 1 000 standard cylindrical roller bearings in a gearbox application, the manufacturer reported a failure rate from 40 to 70% after two years. In a sample of 1 150 black oxide coated cylindrical roller bearings from SKF for a similar application, the failure rate was 0,1% over the same period!



*Shown, left to right:*

- Separable high-capacity cylindrical roller bearing
- Spherical roller bearing
- CARB toroidal roller bearings

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