



# Developments in wind turbine rolling bearings

*The **RKB Group**, the Swiss premium-class bearing manufacturer, is daily committed to conceiving and developing leading-edge solutions for the wind energy industry. This implies important investments in innovation and research, with particular attention to design optimization, heat and thermochemical treatments, and manufacturing technology as a whole.*

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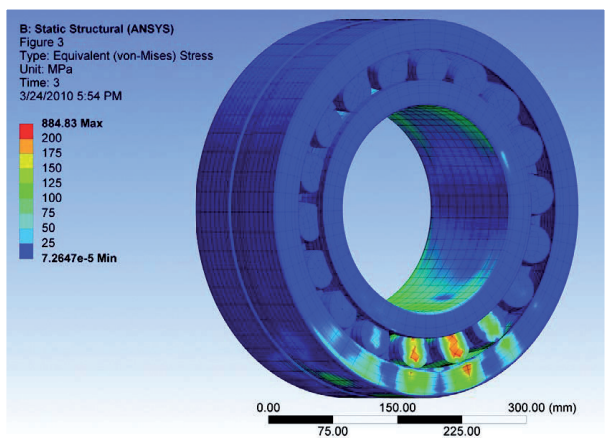
**T**he sources of renewable energy are also called sources of alternative energy as the energy produced in this way is the main alternative for energy resulting from exhaustible sources. In the economy of this century, renewable energies are holding a prominent position. In particular, the wind energy has recently experienced remarkable spreading, in virtue of its inexhaustibility and cleanliness. Of course wind energy plants may also have undesirable effects such as noise, occupancy of large areas of open space and visual impact on landscape. However, the positive aspects of this type of application (e.g. the non-introduction of several million tons of pollutants and greenhouse gases into Earth's atmosphere) widely compensate for all possible drawbacks. Over the last years almost all wind industry manufacturers have been focusing on producing innovative design turbines able to operate even at low wind speeds (3 m/s) and gener-

ate more and more power. The unceasing advancements of blades, nacelles and speed multipliers have allowed to collect wind energy at higher and higher altitudes, also thanks to the improved capacity of the tower to support the weight of the entire system.

## "The Alternative Power"

In an increasingly competitive sector, the RKB Group, with Executive Headquarters and Technological Center in Balerna (Switzerland), has decided heavy investments in Research & Development to efficiently satisfy the requirements of the alternative energy industry, which is becoming more and more demanding in terms of performance and cost-effectiveness. In order to optimize wind energy applications, RKB engineers rely on Catia software system to create the 3D models of the assembly and on Ansys Workbench Platform to evaluate the behavior of the bearing by means of the FEM (Finite Element Method) analysis. Besides, the RKB Group has purposely designed

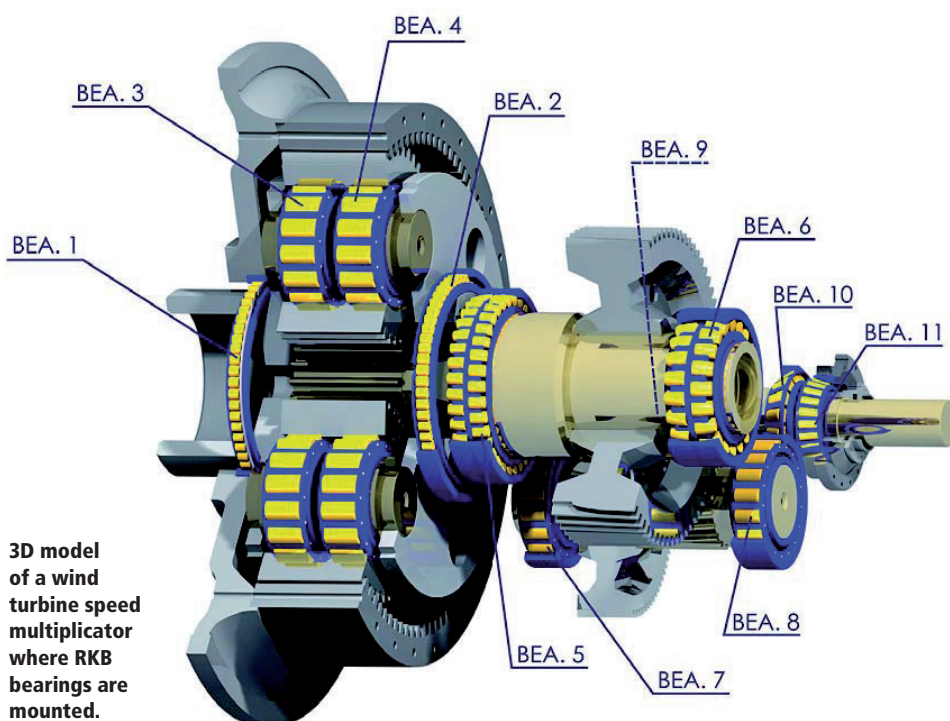
and developed specific software tools (MTDS, RRLC, NON-HERTZ etc.) to determine and study bearing most crucial parameters, such as rating life, force and stress distribution, misalignments, recommended fits and lubrication, Hertzian and non-Hertzian loads and so on. These PC programs are extremely useful when designing the complex applications of the wind energy sector since they make possible to properly and simultaneously consider all the factors affecting the behavior of the bearings mounted in the assembly. Naturally, all calculations are performed according to the most advanced and recent international standards. As is evident, the service life of a wind turbine depends also on the life of the bearings that have been installed. For this reason the operation of wind turbine bearings should be efficient and reliable even under unfavorable environmental conditions. The life of a wind turbine is normally guaranteed for almost twenty years. However, a general inspection procedure is advisable every four years in order to assess the conditions of gears



**FEM analysis of an RKB self-aligning roller bearing for a wind application.**



**RKB single-row full complement cylindrical roller bearings: conventional and with RKB Anti-Wear Treatment.**



**3D model of a wind turbine speed multiplier where RKB bearings are mounted.**

and bearings and to replace worn parts. In addition, in order to reduce total weight and have a less costly maintenance, rolling bearings of the RN type, having the planet wheel body in place of the outer ring, are often used on the planet wheels of planetary units. This way, when it becomes necessary to grind the rolling races in the planet wheel body, the side clearance, with respect to the bearing assembly, will be higher than expected for the application. As the cost to replace the whole set is much higher than that to substitute one or more bearings, the

RKB Group relies on its long-standing know-how and production flexibility to manufacture, starting from the original dimensions, customized bearings featuring the MRO parameters required by the application, thus avoiding production drawbacks. The bearing steel cleanliness as well as the correct performance of the heat treatment cycle represent further crucial factors to extend bearing life and ensure premium-class reliability. In more detail, the most important treatments that RKB performs on its wind turbine bearings are:

- the *RKB Anti-Wear Treatment (AWT)* that, when applied to rollers and/or outer and inner ring races, reduces friction on elements and extend bearing life even in harsh conditions. This treatment is commonly applied to cylindrical and tapered roller bearings, particularly full complement ones, as well as to self-aligning roller bearings;
- the *RKB Isothermal Bainitic Hardening Treatment (HB)* that is an austempering-type treatment within which bearing rings are quenched from the austenitizing temperature to a temperature slightly above that at which martensite forms, which is the lower bainite transformation zone. In contrast with martensitic structure, bainite structure has small compressive surface stresses which induce small tensile surface stresses in the as-quenched surface layers. In this way, the incidence of ring cracking is reduced considerably. It is generally applied to the inner rings of rolling bearings that are drive-fit mounted on high speed or low speed shafts.

In the present economic context, the RKB Group allocates important human, technological and economic resources to the development of applications for the alternative energy sector. "The Alternative Power", the slogan coming with the Swiss Group name, not only leads to think about a business model alternative to the competitors' one, but effectively emphasizes RKB's calling for renewable energies to become the focus for the future.

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