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■ **Works Test Certificate for all ZKLDF Bearings**

Affected products:

all ZKLDF bearing series,
catalog series and special bearings

Changeover date:

As of now, subject to selling off the inventory

Starting right away, all ZKLDF bearings are delivered with a **works test certificate** as standard. In the works test certificate enclosed, only the average measuring value of the smaller inner ring is logged, since this diameter is significant for any shaft diameter adjustment to match the bearing diameter.

The works test certificate of the ZKLDF bearing contains the following measuring values:

- installation dimension **H1** of the bearing,
- outside bearing diameter **D**,
- inside bearing diameter **d** of the smaller inner ring.

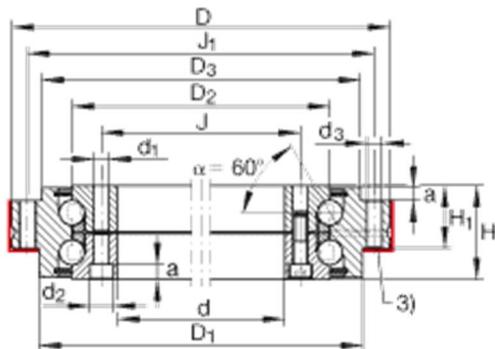


Fig. 1: Diagram of ZKLDF axial angular contact ball bearings

This results in the following key benefits for customers:

- **Free added value for the user:**
The bearings can easily be used as needed with shafts that have different actual dimensions.
- **Minimal additional costs**
- **Version reduction**



Fig. 2: Cross-section of the ZKLDF bearing

Please note the following information:

- All QW51 catalog types, which previously received a works test certificate, will be replaced by the standard bearing.
- Bearing designations and material numbers will stay the same.

If you have any questions please contact your Schaeffler Field Sales Team.

■ **Germanischer Lloyd Is Certifying Test Methods for Calculating Rolling Bearing Rating Life**

Schaeffler has been awarded the **certificate “Assessment of the method to investigate rolling bearing rating life”** by Germanischer Lloyd (GL). For the first time, a basic method was certified and not – as was previously necessary – each individual rating life factor.

The newly revised method describes all calculation and testing procedures that are necessary for determining all reference values affecting the rating life. Thanks to this, time-consuming individual releases for new products and series are now a thing of the past. Less time, lower costs, and proven reliability in the large series are required. For Schaeffler customers, the new certificate implies considerable added value.



Certificate with number GL-CER-002-2015 for the “Assessment of the method to investigate rolling bearing rating life”

Calculating the rating life of rolling bearings – what does it involve, and why is it so important for the user?

Along with **static load safety** and **installation space**, **the calculated rating life** is the main characteristic for rolling bearings. In most applications, the dimension of the bearings depends on the rating life requirements. In some application areas, such as wind power, certification is only given if the calculated rating life is above a minimum value required by the standard. The demand for energy savings leads to downsizing attempts in many applications. Here, even for smaller bearings, it is important to meet the rating life requirements with a reliable rating life prediction.



Fig. 3: Radial bearings in endurance testing – rating life test stand in the Schaeffler research and development center in Herzogenaurach.



Quality – Worldwide and Long-lasting

During certification, Germanischer Lloyd was convinced that Schaeffler will also be able to permanently ensure the rating life factors determined during product development on a global scale. In the process, it was demonstrated that the tested material and process quality was not only valid for the test parts, but also for the entire series. And all around the world, too. Thus, all of Schaeffler's rating life test centers now possess the coveted test seal – for instance Kysuce in Slovakia and Taicang in China, not to mention Herzogenaurach and Schweinfurt.

If you have any questions please contact your Schaeffler Field Sales Team.



■ Schaeffler at the EWEA 2015 Annual Event

With the slogan “**Reliability – Made by Schaeffler,**” Schaeffler presented its range of products and services for wind turbines at the EWEA Annual Event in Paris.



Cost-effective wind turbines need reliable components. As one of the world's leading manufacturers of rolling bearings and a development partner in the sector, Schaeffler has been producing bearing arrangements for wind power for more than 30 years. With such extensive know-how, Schaeffler always offers just the right bearing solution and a holistic concept that increases the reliability of the systems even more.

The following were among the focal points of Schaeffler's presentations at this year's EWEA Annual Event:

- The Schaeffler Wind Power Standard (**WPOS**)
- Achieving Dependable Rotor Bearings Faster – Schaeffler Combines Simulation and Calculation with the “**Astraios**” Large Bearing Test Stand
- Effectively Preventing Premature Failure Due to **White Etching Cracks** – **WEC**-resistant Rolling Bearings for Long-lasting Wind Turbines
- Bearing Solutions for the Main Rotor Shaft: **Asymmetrical FAG Spherical Roller Bearings** for Increasing the Axial Load-carrying Capacity
- Bearing Solutions for Increasing the Capacity in Wind Turbine Gearboxes
- **FAG WiProM**, Mobile Monitoring Concept for Wind Turbines



Fig. 4: Schaeffler booth at the EWEA 2015 Annual Event

■ **The Schaeffler Wind Power Standard (WPOS)**

With the Wind Power Standard (WPOS), Schaeffler has what it takes to meet the increasing demands on the reliability of systems and components in wind power. This top quality standard for products and processes ensures optimum quality and reliability around the world and also offers quality standards for wind power like those that have already been successfully implemented in the automobile and aerospace industries.

To ensure these high standards, Schaeffler relies on close collaboration with the customers and suppliers throughout the process chain. In this way, Schaeffler works together with the customer to develop the ideal solution for each bearing position. The FAG and INA products according to the Schaeffler Wind Power Standard receive the **WPOS** label.

The revised brochure “**Schaeffler Wind Power Standard (WPOS)**” (WPS) is available to you in the media library in German, English, Spanish, Chinese, and French. [LINK](#)



If you have any questions please contact your Schaeffler Field Sales Team.



■ Achieving Dependable Rotor Bearings Faster – Schaeffler Combines Simulation and Calculation with the Astraios Large Bearing Test Stand

Along with years of experience and the extensive system know-how of the specialists at Schaeffler, ultramodern calculation and simulation programs are especially important for guaranteeing optimum wind turbine bearing design. In the process, Schaeffler takes the entire system into consideration, from the individual rolling bearing, its components, and the adjacent construction to the complete drivetrain, which is depicted and optimized using multi-body simulation programs developed by Schaeffler.

In order to develop rotor bearings with the necessary durability and reliability as quickly as possible, Schaeffler combines simulation and calculation methods with measuring results gained with the help of the Astraios large bearing test stand, which became operational in 2011.

Data from Years' Worth of Test Stand Operation

On the Astraios large bearing test stand, Schaeffler tests rotor bearing arrangements for wind turbines of the multi-megawatt class under near-real conditions. In extensive test runs with various bearing arrangement concepts for the rotors, the engineers gathered a wide range of data on the behavior of large bearings, which in some cases is very different from that of small rolling bearings.

Measuring Data for Optimizing Simulation Models

The data is used by Schaeffler in a wide variety of ways. For one thing, the measurements are used to ensure that newly developed bearing solutions are durable and reliable. For another, Schaeffler uses the data to validate and optimize the simulation models, for while calculations on the rating life of smaller rolling bearings can be easily transferred to large bearings, this is not the case for other parameters, such as kinematics or frictional torque. For this reason, simulations in these areas need to be validated based on test results. The developers of simulation models use the measurements gained with the aid of Astraios to compare and fine-tune their calculations for the bearing type concerned. Based on the prior knowledge gathered in this fashion, the engineers at Schaeffler are able to develop new bearing concepts for wind turbines within a very short amount of time and produce the ideal design for the specific application. On the basis of verified simulation models, they can also take their findings on the currently tested diameter of a large bearing and use them for even larger bearings, thereby validating entire product platforms.

Simulation of Complete Wind Turbines

With the new method, Schaeffler is also able to develop holistic solutions for new requirements in wind turbines, such as for the use of entirely new bearing types. For testing under conditions close to those of the application, it is important to

first define what the boundary conditions are so that loads and deformation reflect the operating situation in the field. With the help of software developed by Schaeffler for multi-body simulation ("SIMPLA"), the engineers are able to replicate an entire wind turbine and undertake testing from the wind field right down to the rolling contact. In this way, they can discover the right boundary conditions for validation on the test stand. In a multistage process, the measurements are in turn played back into the simulation models, which then calculate the load and the kinematic behavior of a large bearing.

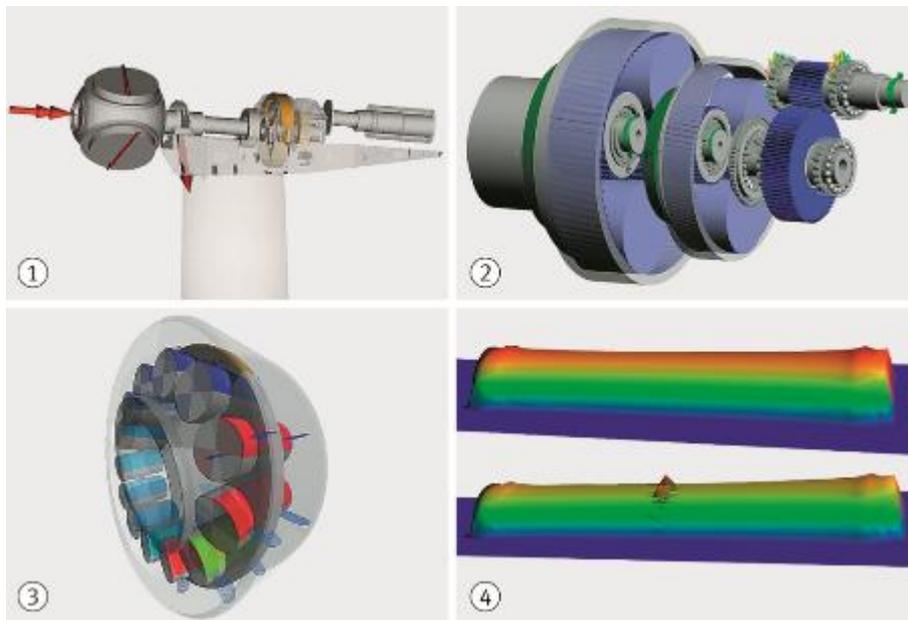


Fig. 5: From the total system to the rolling contact: The Schaeffler calculation sequence offers an extensive range of analyses for optimum bearing design:

- 1 SIMPLA: system simulation**
- 2 BEARINX: bearing design with system awareness**
- 3 CABA3D: rolling bearing simulation**
- 4 TELOS: rolling contact simulation**



Fig. 6: Since 2011 Astraios has been delivering valuable findings that are used for developing new bearing solutions and optimizing simulation and calculation models thanks to its near-real power and torque simulation.

The following marketing materials are available to you for more information on this topic:

- **Video** "Astraios – The Ultramodern, Largest, and Most Powerful Large Bearing Test Stand in the World" [LINK](#)
- **Brochure** "Bearinx® High-level Bearing Design" (PBB) [LINK](#)
- **Brochure** "CABA3D – Insight into the Dynamics of Rolling Bearings" (PCA) [LINK](#)

If you have any questions please contact your Schaeffler Field Sales Team.

■ **Effectively Preventing Premature Failure Due to White Etching Cracks – WEC-resistant Rolling Bearings for Long-lasting Wind Turbines**

WEC-resistant rolling bearings were a highlight of Schaeffler’s appearance at the EWEA Annual Event in Paris. Schaeffler has extensive testing options for generating WECs (white etching cracks), investigating the causes, and developing solution concepts to lower the risk of WECs.

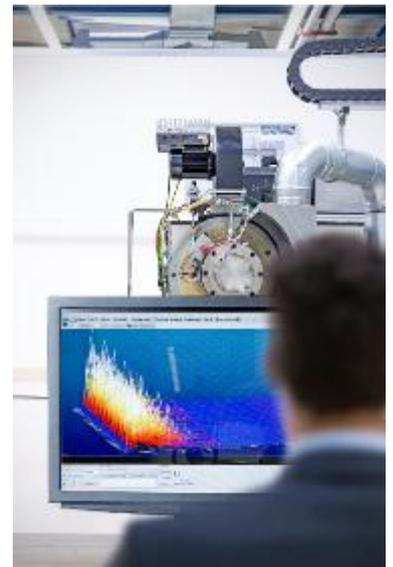
Schaeffler was the first manufacturer to reproduce the dreaded damage from WECs on a test stand. To this end, Schaeffler has a wide range of WEC test stands in which engineers apply extra loads through friction, dynamics, and electricity, which can cause WEC damage to occur. They are therefore in a position to validate simulation methods that analyze causes and develop suitable countermeasures, which – by way of example – may be found in an optimized bearing design, in the selection of a WEC-resistant material, or even in an improved lubrication concept.

Reducing Additional Loads

There are basically two ways to go about solving this. One has to do with reducing additional loads. For instance, friction can be reduced by precisely fine-tuning the **oil quantity and viscosity**. The dynamic bearing load due to vibrations and torsional oscillations can be mitigated. Electric fields affecting the bearings can be shielded. This requires teamwork by all of the partners that manufacture components for wind turbine drivetrains.

Bearing Coatings

The other solution approach involves increasing the bearing’s resistance to WECs. The statistically proven product solution recommended by Schaeffler for long-term prevention of damage from WECs consists of treating the bearings with the **Durotect B** coating system. This is a further development of conventional burnish coatings with an increased performance potential. The coating developed by Schaeffler not only increases **protection against WECs**, but also reduces the **risk of damage from slippage**, improves **run-in behavior**, and provides greater **protection against corrosion**. In around 550,000 through-hardened wind turbine bearings coated with Durotect B that Schaeffler has produced in the last 10 years for use in bearing positions at risk of WECs, damage from WECs occurred in less than **0.02%**.



FE8 test stand for reproducing damage from WECs



All bearing solutions offered by Schaeffler for use in wind turbine gearboxes can also be delivered burnished.



Carbonitrided Bearings for Higher Load Ratings

If a higher load rating is required for the same level of WEC resistance, Schaeffler offers carbonitrided rolling bearings made of the material **Mancrodur with a Durotect B coating**. With carbonitriding, the bearings are subjected to a special heat treatment process in which the surface of the component is enriched with carbon and nitrogen. In this way, the bearings are provided with greater **surface hardness and wear resistance**.

Special Steels Prevent WEC Damage

According to today's state of knowledge, the use of **special steel Cronidur 30** with its high chrome content can rule out the incidence of WECs completely. There is not a single instance of WECs occurring in bearings made of Cronidur 30 that is known after five years on the market in this application. The use of this material also makes it possible to attain a **70% higher** load rating and thus a longer **rating life** and better **protection against corrosion**.

If you have any questions please contact your Schaeffler Field Sales Team.

■ **Bearing Solutions for the Main Rotor Shaft: Asymmetrical FAG Spherical Roller Bearings for Increasing the Axial Load-carrying Capacity**

FAG spherical roller bearings are suitable for extreme loads and can compensate for misalignment and shaft deflections. Schaeffler has consistently been developing these time-tested bearing solutions for providing bearing support for main rotor shafts in accordance with customer requirements in order to further increase their durability and rating life. Thanks to an **asymmetrical bearing design**, not only is the internal geometry optimized, but the axial load-carrying capacity has gone up considerably as well. The asymmetrical spherical roller bearing has a higher contact angle on the axially loaded bearing row and a lower contact angle on the primarily radially loaded bearing row. The **asymmetrical contact angles** reduce sliding movements in the drivetrain by means of even greater axial rigidity in the bearings, further increasing their durability and rating life. **Triondur C**, a stratified, amorphous hydrocarbon layer serves as an added roller coating for reducing friction and providing greater wear protection from mixed friction.



Optimized Inner Geometry for Greater Durability

Both classic FAG spherical roller bearings and asymmetrical spherical roller bearings feature adjusted bearing clearance, close osculation, profiled rolling elements, and a solid central rib. In FAG spherical roller bearings, the optimized inner geometry leads to an overall **reduction in pressure and wear parameters** along with increased **bearing durability**.



It is possible to use an **inner ring** that is adapted to the shaft. This makes it easier to replace bearings professionally and helps to **lower costs**. This allows the rotor shaft to be reused after being overhauled. Coating the shaft with extra material is not necessary.

Asymmetrical spherical roller bearings

The following marketing materials are available to you on this topic:

- **Brochure** “Asymmetrical Spherical Roller Bearing Rotor Bearing Arrangements for Wind Turbines” **(OSP)** [LINK](#)
- **Brochure** “Spherical Roller Bearing Rotor Bearing Arrangements for Wind Turbines” **(OPR)** [LINK](#)

If you have any questions please contact your Schaeffler Field Sales Team.

■ **Bearing Solutions for Increasing the Capacity in Wind Turbine Gearboxes**

High Capacity in the Gearbox: Greater Load Rating with Less Friction

The planetary gear bearing arrangement is an extremely demanding bearing position where high radial loads occur. However, there is only a limited amount of installation space available for the bearing. Moreover, the comparably thin-walled planetary gears become deformed, which can cause the outer bearing ring to spin in the planetary gear.

Thanks to its especially narrow cage design, the **FAG brand high-capacity cylindrical roller bearing** combines the advantages of full complement bearings with those of cage-type bearings. For one thing, there is room for at least one additional rolling element, thereby increasing the load rating. Due to the bearing cage, there is a lot less friction in the high-capacity bearing than in full complement versions.

The direct bearing arrangement enables FAG high-capacity cylindrical roller bearings in X-life quality to take much greater advantage of the installation space than a comparable standard bearing arrangement. With the direct bearing arrangement, the outer ring is unnecessary, and the raceway is directly integrated into the planetary gear. In this way, it is also possible to prevent the risk of outer ring movement.



Cylindrical Roller Bearings with an MPAX Cage

Cylindrical roller bearings with a one-piece MPAX brass cage are frequently used in the output or intermediate shaft of a wind turbine gearbox. Compared to high-capacity cylindrical roller bearings, which are subjected to high stresses and load ratings at comparably low to medium speeds in the planetary stage, the bearings in the gearbox need to withstand very high speeds. The MPAX brass cage is a further development of the FAG MPA and MP1 cage types and is successively replacing them. It is even more resistant to impacts and vibrations than its predecessors and therefore especially suitable for high-demand applications.

The advantages of the MPAX cage are its considerably greater rigidity in the radial direction, its greater resistance to radial centrifugal forces and its lower maximum tension at the pocket corner radii.

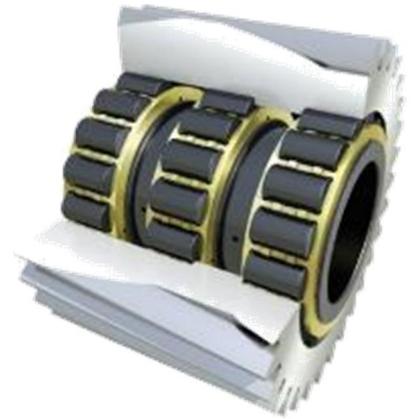


Cylindrical Roller Bearings with Optimized Rib Contact

The use of torus ball cylindrical roller bearings with an optimized contact geometry between the roller end and rib faces makes it possible to significantly increase the axial load-carrying capacity of the bearings. The risk of mixed friction is reduced considerably, and wear to ribs and roller end faces is reliably prevented. The frictional torque and bearing temperature are much lower during operation. This increases efficiency, while at the same time lessening dependence on the lubricant.

Bearings in X-life Quality – with Additional Increased Performance as an Option

Schaeffler is constantly expanding its range of large bearings in X-life quality. In the future, single row and multi-row tapered roller bearings with an outside diameter greater than 635 mm and cylindrical roller bearings with an outside diameter of 320 mm to 1,600 mm will be available as X-life products if requested by the customer. With their improved product qualities and a **load rating that is approx. 20% higher**, they make it possible to **increase performance** and allow for **installation space optimization** and **weight reduction** in machines and systems.



The rating life of the X-life cylindrical and tapered roller bearings can be further increased through carbonitriding. During this special heat treatment, the edge layer of the bearing rings is enriched with carbon and nitrogen. Particularly for extreme operating conditions such as contamination and particle rollover as well as mixed friction and boundary lubrication conditions, carbonitriding produces greater surface hardness and thus better wear protection, which can result in a considerably higher level of system durability depending on the application.

Protection from White Etching Cracks through Durotect B

All bearing solutions offered by Schaeffler for use in wind turbine gearboxes can be delivered burnished. The **Durotect B** layer system reduces the risk of slippage due to damage, improves run-in behavior, and offers protection from corrosion and white etching cracks (WECs).

For more information, see the **brochure** “Bearing Solutions and Service for Wind Turbine Gearboxes” (**PWG**), which is available at the following link: [LINK](#)

If you have any questions please contact your Schaeffler Field Sales Team.

■ **FAG WiProM: Mobile Monitoring Concept for Wind Turbines – Cost-effective and Safe**

Schaeffler offers extensive services and products involving every aspect of condition monitoring, e.g. remote monitoring and diagnostics, offline measurements, endoscopy, thermography, and torque measuring. This makes it possible to lower costs for maintenance measures and increase the availability of wind turbines. An innovation presented by Schaeffler at the EWEA Annual Event in Paris was its **FAG WiProM mobile monitoring device**.

Based on the **FAG WiProS** fixed online monitoring system for permanent monitoring, the **FAG WiProM** was developed for portable use. Schaeffler's FAG WiProM mobile device enables vibrations to be monitored along the entire drivetrain of wind turbines, providing high-quality and meaningful data at an economical price.

A patented GPS function automatically recognizes the location and makes allocating the wind turbine easy and sure. The installation does not require any specialist knowledge and can be carried out very quickly. Thanks to the device concept, reliable communications with the monitoring center are assured even in unfavorable conditions.



Fig. 7: The mobile FAG WiProM device enables vibrations to be monitored along the entire drivetrain of wind turbines.

With the FAG WiProM, Schaeffler is offering a new solution that is perfectly suitable for taking inventory for wind farms, carrying out inspections at the end of the guarantee period, and observing damaged turbine systems. Thanks to the analysis and reporting functions included, the customer receives up-to-date information on the condition of its turbine systems. This is also confirmed by the successful use in the US, where around 2,000 turbine systems have already been measured based on this concept.

If you have any questions please contact your Schaeffler Field Sales Team.



Fig. 9: All products can be exploded and rotated by 360° for easier explanation. Moreover, the user can find the most important advantages and characteristics for each product, along with more detailed information.

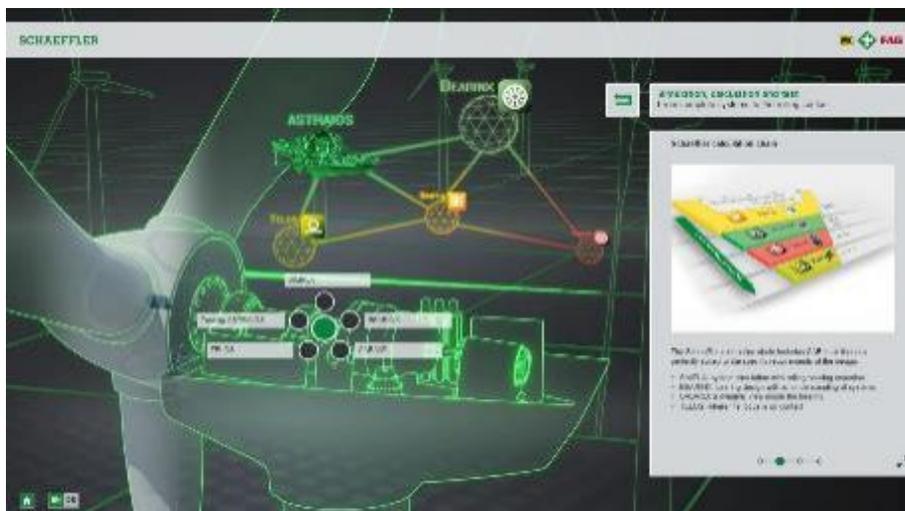


Fig. 10: In addition to the product solutions, the topics of “Simulation, Calculation, and Testing” and “Service” are also covered.

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