ZKL NEWS

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ZKL GROUP

INNOVATIONS FOR GREEN ENERGY

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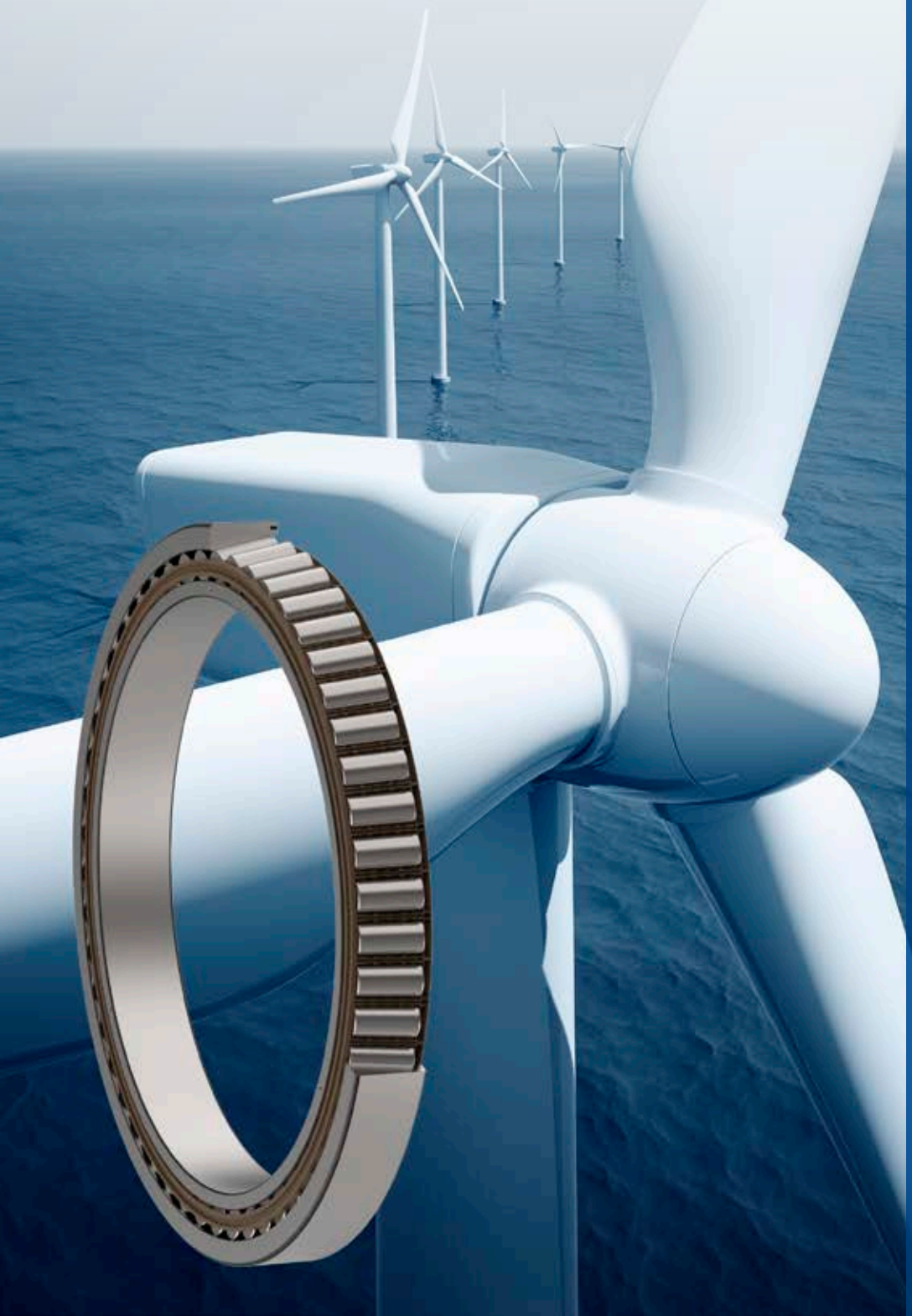

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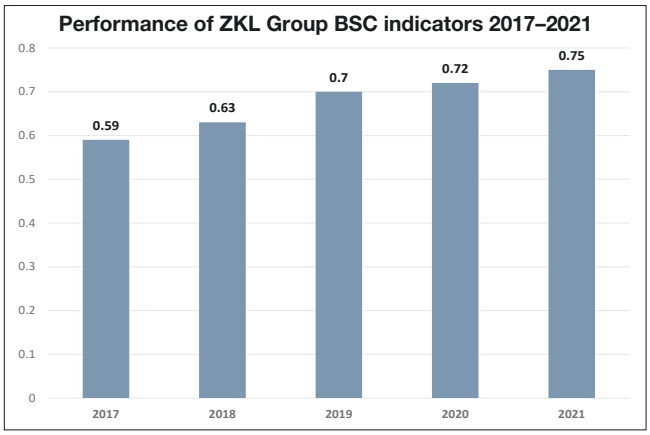
Opening speech

Dear employees and business partners,

I am glad to be able to address you again in 2021 in connection with the publication of a new issue of the ZKL News magazine. We have had a difficult period mainly due to the state measures targeted to eliminating the impact of the COVID-19 pandemic. We in the production, same as our customers in more than 80 countries, have had to deal with this situation. Under these circumstances, we have ensured the stability of sales, production and logistics along with the development of new bearings to our customers. The results we have achieved are displayed at the attached table.

From the comparison of the trend of the indicators, it is important that we maintained the dynamics of sales and, in proportion to this, the profitability. Due to the elimination of the impacts of COVID-19, we also incurred additional costs due to sickness, material supply failures, which caused deterioration in labour productivity. In view of the fact that we have worked under emergency conditions since February 2020, we cannot, after all, consider the annual results to be bad.

In addition to financial indicators, I am glad that we are also better in meeting BSC indicators, the system cross-section of which within all the companies in the Group meets ZKL's strategies. The development of the BSC objectives is shown in the attached graph.



What is the ZKL Group strategy transferred to the BSC objectives?

In short, we supply bearings fully supporting the development of sources for the production of "green energy" in relation to our customers. Production of bearings for wind power plants is growing. In 2016, we produced 150 pcs and in 2020 already 1 303 bearings. Our strategy for 2023 is to produce 2 100 bearings and 2 600 bearings in 2025. It is necessary to add that these bearings have a size ranging from 820 mm to 2 500 mm of outer diameter and weight of up to 3 tonnes.

"Green energy" is also related to bearings for railway wagons, gearboxes for locomotives and trams. To support this programme, we managed to get TSI recertification in 2020 and we expect to obtain European VPI registration in 2021.

To support the development of production of ZKL rolling bearings as an important assembly field of engineering, we are preparing an extensive investment in the modernisation of production of approximately 750 million CZK in 2021–2024 in ZKL Brno factory. Another modernisation of production this time in ZKL Klášterec nad Ohří plant is being prepared for 2022–2023, aiming at increasing the productivity and quality of bearings for rail transport. This investment, coupled with the implementation of new technologies, will significantly increase the competitiveness of ZKL bearings.

Dear employees and business partners, I would like to thank you this way for your cooperation in 2020 and wish you a gradual return to normal life without anti-epidemic measures. ZKL company stays your reliable and promising partner.

Ing. Jiří Prášil, CSc.
General Manager of ZKL, a. s.

Indicator	2018 reality	2019 reality	2020 reality	index 2020/2019	2021 plan
Sales revenues (CZK thousand)	1 068 895	1 112 304	1 183 304	1,06	1 328 177
Operating result (CZK thousand)	406 353	439 329	434 119	0,99	519 003
EBITDA (CZK thousand)	131 715	158 642	159 388	1,00	186 345
Productivity (Added value / Personnel costs)	1,30	1,41	1,40	0,99	1,54

Development of large-scale tapered roller bearings

Development and production of large-scale bearings has been one of ZKL's core programmes for many years. At the beginning, these were radial spherical roller bearings. The growing interest in bearings of larger dimensions was reflected in the further development of new types of bearings such as ball, cylindrical, axial spherical and tapered roller bearings. These were mainly bearings for applications in heavy industry and power engineering.

ZKL – Výzkum a vývoj (ZKL – Research and Development) currently seeks for new applications of large-scale bearings with a long service life for fitting wind power rotor. Development work has been ongoing since 2014 and many dimensional types of radial spherical roller bearings have been introduced into

series production. In the construction of wind power plants, there are several concepts of fitting rotors. One of the prospective fits, for increasing power plant performance, is a housing with single row tapered roller bearings. For this reason, ZKL Group's development capacities are now focused on projects with this type of bearings up to 2.5 metres of external diameter. To ensure the production of bearings in this size with the requirement for high reliability and durability in fits, several development tasks and technological tests must be carried out, both in the field of construction and design, including advanced simulations, as well as in the field of material engineering, heat treatment and production technology itself from semi-finished product to finishing operations. Application of these bearings in wind power plants brings the necessity to optimise rolling contact of elements with bearing ring raceways in a unique modified design. The concept of cages of tapered roller bearings is designed in two variants. In a variant with pin-type cage, and a segmented cage especially developed for this case.

By extending the dimensional technological capabilities of the ZKL Group, as a leading manufacturer of wind energy bearings encompasses the vast majority of applications of wind rotor installations, which is a promise for the future.

Ing. Libor Procházka
Head of the Design Department and Technical Computing
ZKL – Výzkum a vývoj, a. s.

Automated tests of bearings

For the purposes of research-development activities, benchmarking, validation of product design parameters and verification of the quality of ZKL bearing production, ZKL – Výzkum a vývoj, a.s. (ZKL – Research and Development) has its own laboratory for analysis and testing of bearings. The tests are carried out at stands of different sizes, types, and technical solutions, according to the requirements for the relevant test.

The increasing demands on the quality of bearings led to gradual innovation of test stands leading to total automation of the test performed from start-up, bearing run-through, implementation, until the end of the test based on the data on the condition of the tested bearings, or the input requirements for the test.

The stand's central control computer operates all main engines, loads, lubrication, cooling, including scanning and evaluation of the diagnostic data of the samples tested. The computer program has a wide range of options for setting the test course according to special requirements. It is mainly about the control of engine speed, bearing load and setting of lubrication conditions.

The computer obtains data from sensors on the overall state of all subsystems – temperature of lubricating oil and its flow quantity, current pressure in load distributions, temperature and flow rate of coolant and temperature and vibration of individual tested bearings. Based on these data it is possible to evaluate the current condition of bearings, method of lubrication and bearings power dissipation.

All data are recorded and are available for further detailed processing. The test stand is used for testing prototypes, new products, quality control of serial production of bearings produced by ZKL Group production plants and external testing according to customer requirements. The main contribution of the innovation is to refine the test process, extend testing possibilities and improve the quality of the test data.

To assess the quality of the material and its resistance to contact fatigue, a test stand for testing of flat samples is operated. The test stand allows verification of the quality of the material and its heat treatment and research on the impact of the lubricant on the durability of rolling contact.

This test stand is equipped with a computer that records test data and evaluates vibration characteristics of the samples tested. It is possible to detect fatigue damage of the pitting type in the sample's raceway and to evaluate the resistance of the material from the vibrations and specified limits. Research in the field of lubrication, material, and its heat treatment, is the basis for improving the quality of the supplied rolling bearings.

ZKL Group's objective is to deliver high-quality and verified bearings that will meet the demanding requirements of customers in various industries around the world. Testing of bearings is a necessary element of ZKL that enables to achieve this goal.

Ing. Jakub Němeček
Head of Testing Laboratory and Metrology Department
ZKL – Výzkum a vývoj, a.s.

Company ZKL – Výzkum a vývoj, a.s. (ZKL – Research and Development) offers its customers a set of services that complement the sale of bearings.

We offer design services, expert analysis, and application calculations related to general engineering with specialisation in rolling bearings and their accessories.

- Cooperation on the design of your equipment - Engineering, FEM analysis focusing on contact problems and designing special bearings.
- Professional training of all issues related to bearings and their accessories.
- Processing of bearing application calculations.
- Professional supervision during the bearing mounting.
- Metallographic and metrological analyses of machine components.
- Bearing performance tests and special tests according to customer requirements.
- Analysis of the root cause of machine components/bearing failures.
- Forensic expertise in the field of general engineering, specializing in bearings and their accessories and applications.
- Comprehensive verification of bearing quality.
- Bearing remanufacturing.
- Consulting in the field of application engineering with a focus on bearings (e. g. determination of suitable bearings for a given application, recommendation of seating tolerances, etc.).

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Innovation potential of ZKL from the perspective of the ZKL Group Technology Centre

ZKL Group Technology Centre is an independent subsidiary of ZKL – Výzkum a vývoj, a.s. (ZKL – Research and Development). As the name suggests, the main focus of the company is the management of research-development activities, innovation and technical development within the Group. The Technology Centre furthermore covers all the key processes relating to technology and quality. It represents a design organization for the entire Group, performs the activities of the main metallurgist and metrologist, ensures supervision at the group level within the management of the integrated quality, safety and environment system. It performs tasks within applied research and experimental development, validates new products and technologies, ensures application, expert and specialist activities.

We discussed current trends within the Group in the field of technology and innovation and the outlook for the future of technical development in the field of rolling bearings with the Technical Director of the Group and the Executive Director of ZKL – Výzkum a vývoj, a.s. (ZKL – Research and Development) with Dr. Libor Nohál.

CONCEPT OF ZKL

■ ***How would you characterise ZKL Group from the product portfolio perspective?***

Products with the ZKL brand consist mainly of rolling bearings and their accessories, but we also produce tools and fixtures, and the technology centre provides design and expert services to customers, including expert opinions, outside the Group. The application of our products is oriented towards a wide range of customers from different areas of industry. In addition to standard industrial bearings, i.e. catalogue bearings, we also develop and produce tailored solutions of bearings and bearings for technically demanding applications in railway, manufacturing, power engineering or aerospace industries.

■ ***Can you give us some examples?***

These are, for example, thrust spherical roller bearings from the production of the Brno plant, which have now undergone innovation into the premium NEW FORCE standard. This type of bearings at the highest technical level due to the complexity of the internal structure is produced only by the world's top manufacturers and ZKL is traditionally one of them.

Another example of this plant is the programme of bearings for the main rotors of wind power plants. Over the last seven years, when we have been intensively engaged in this segment, we have developed a type line of spherical roller bearings from an internal diameter of 500 to 950 mm. In addition to spherical roller bearings, we have also focused on the project of tapered roller bearings, which are used mainly in the rotors of offshore power plants. The technical level of our products in this segment, comparable to the world's peak, is demonstrated by the growing demand of leading manufacturers of wind power generators from all over the world.

RAILROADS – attractive and sustainable mode of transport

■ ***In addition to wind energy, rail transport is becoming increasingly important worldwide. How is it in ZKL?***

Similarly, bearings for the railway industry have been prioritised for several years in our plant in Klášterec nad Ohří. Here I would like to give examples of products, whether for axles or suspension tubes or traction engines of rolling stock. In this segment we must respect the conservative approach of customers, and so there are long-term development projects undergoing a number of validations and tests. However, the final product has long-term sales, because innovations in the railway segment are taking place rather jumpy. From current projects, I would mention cylindrical roller bearings for traction engines, which have undergone almost five years of development. In addition to the high operating temperature range from -60 °C to 100 °C, it had to stand even at extremely high test speeds. Application of this bearing is found in freight diesel-electric locomotives with a respectable output power of 5 000 kW. Last year we also completed the innovation and TSI certification process of the WJ/WJP axle roller bearings, where we offer our customers solutions with higher performance parameters compared to our competitors. In addition, the application phase of the development of cylindrical roller unit (CRU) with an extended service interval continues this year.

■ ***Do these products have anything in common?***

All these innovations combine several common features. They are products with high added value for end-users, whether measured by reliability, durability, low energy performance or low life cycle costs (LCCs). To a large extent it is an original ZKL solution protected by patent copyright.

This, in fact, characterises the ZKL brand or, more precisely, the whole Group. We bring fast and original solutions with high utility value to our business partner.

ZKL – OWN PATH

How do you achieve these results?

The great benefit of ZKL is that it is a Czech concern with domestic capital and a relatively slender structure. This brings a quick competent decision, which multinational corporations are unable to do. As a result, compared to our competitors, we are able to respond quickly and especially efficiently to the detailed requirements of our customers and thus enable the completion of their product development with our bearings in a very short time, let's say in a couple of months, depending on the complexity of the project. The Group also invests significantly in manufacturing technologies, test and measurement equipment, modern software solutions and digitisation. This brings us the necessary information from the operation and ensures stability and the quality of production in general. And the basis of everything is an excellent team of collaborators, which plays a key role in the process which is, in my view, the most important role.

■ ***The supply of the labour market of technically educated workers is referred to as problematic, how do you feel about this?***

I would say that ZKL has the advantage that we have not underestimated the situation and we have had a programme for recruitment of new young workers in key positions within the Technology Centre for several years. Good cooperation with universities, especially with the Brno University of Technology, contributes to a great extent. We cooperate with universities offering the themes of diploma and dissertation theses, professional lectures or trainee programmes for students with the possibility of transition to full-time work. The study of material engineering, contact mechanics, tribology, technology, metrology, etc., is a good basis for technical work in the development of bearings.

As for our team, I have to say that it is well profiled, both as in terms of age distribution and professional focus. We managed to gradually arrange for personnel replacements of collaborators with younger colleagues after their leaving the company. This brings different perspectives to the team on the problem being solved and often, thanks to this, we can find new original solutions. All the above is supported by the implementation of modern tools of design, validation and metrology. The work on the development of bearings is demanding and requires knowledge of various sciences, with a very good knowledge of mathematics as a working tool of engineering. For a process engineer, knowledge of mathematics is as crucial as is knowledge of writing and reading for a writer. Therefore, I fully agree with the fact that it is a very important appeal for quality, comprehensible and interesting teaching of mathematics from elementary schools to universities. The issue of technical education has not yet been resolved. The number of high-quality students, I believe, is fixed within the society, and therefore it is necessary to not increase the number of technical students, but to motivate the best students to study it.

BEARINGS OF TOMORROW

■ ***You mention modern tools for the design and development of bearings, can you be more specific?***

In addition to the current tools within product design, such as already implemented PLM and CAD systems, they are numerical simulations of finite elements with their own methodological and computational approaches. For the design of bearings and verification of the proposed product parameters we use our own physical calculation model describing the events in the bearing. This model is also used in application engineering for the design of the optimal solution for the customer.

At the same time, we can validate both prototypes and new simulation approaches thanks to our own testing. We also use additive technologies for prototyping, including metal printing. These steps can significantly accelerate the development process and experimentally verify the proposed design solution. In addition, we cooperate on research tasks and the implementation of special tests with research centres and accredited laboratories, both in the Czech Republic and in the world. Thanks to this cooperation, we are able to use expert knowledge and technologies that the Group does not have. The investment in these technologies would not otherwise be meaningful due to the scope of its use. To a large extent, the large scope of cooperation takes place thanks to the grant projects from the EU and the Czech Republic, which strengthens our competitiveness compared to transnational groups.

We invest in the implementation of MES systems and new measuring devices enabling comprehensive geometry assessment, integrated measurement systems in the production process and equipment for 3D optical measurement. Thanks to this, we can design more efficiently shaped components, such as metal cages, and optimise tools for their production. Everything is intertwined, it starts with customer requirements, continues with their assessment, product design, production and verification all the way to the delivery to the end user. Thanks to digital technologies, the information is interlinked within the process.

■ ***So where is ZKL heading for in the medium term?***

The Group's research activities are largely linked to the development of our OEM customers' products. As far as the sector is concerned, we aim at bearings for green energy, railway, aerospace and technological units. New development directions integrate advanced methods of heat treatment, various types of coatings of functional surfaces, optimisation of microgeometry with regard to the possibilities of new production technologies, mechatronics and digitisation. Therefore, we continue, for example, in the development of new roller bearings for wind energy and in the application development of bearings from nanostructure material. These newly developed material structures better withstand damage in the bearing and extend its service life and reliability. The target products are mainly bearings for railways and wind energy. In the long term, part of the offered bearings will be merged into larger technological units either in the ZKL portfolio or within a consortium with our partners.

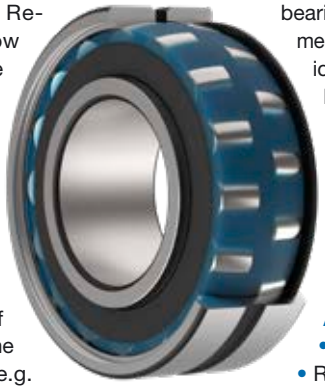
From the point of view of the services offered, the ZKL Group is, thanks to developed application engineering and its own technology centre, a partner to all those who need to solve problems with rotary equipment and machines: Increase their performance, reduce energy consumption or help with design solutions or improve the quality of their products.

Finally, I would like to thank all the employees of ZKL Group for their work, thanks to which we are able to achieve our chosen goals and technologically shift the value of our products.

Ing. Libor Nohál, Ph.D.

Born in Zlín, after studying production machinery, systems and robots at the Brno University of Technology (VUT), he continued his doctoral studies at the VUT Institute of Machine and Industrial Design in Brno in the field of contact mechanics, NDT and diagnostics, where he began his professional career as a researcher. He has worked in ZKL Group since 2013 and worked there as a designer, then head of the Department of Design and Technical Computing and, since 2020, as Executive Director of ZKL – Výzkum a vývoj, a.s. (ZKL – Research and Development) and Technical Director of the Group.

ZKL Bearings with solid lubricant



In the Czech Republic, a well know proverb says „he who lubricates goes“ and such proverb can be applied in the world of rolling bearings more than anywhere else. There are various types of lubrication from the most common – e.g. grease lubrication or oil lubrication, to special dry graphite and disulfide lubricants that provide lubrication function under extreme conditions such as high operating temperatures. In recent years, a number of world-leading producers have launched bearings that have been lubricated in the production with so-called solid lubricants.

Solid lubricant is a polymer material saturated with oil. Polymer matrix fills all the free space inside the bearing, leaving a gap around rolling bodies, cages and raceways. When started up, the bearing is heated which results in reduction of the viscosity of the oil trapped in the porous polymer matrix. The oil is subsequently released from the matrix and reaches all necessary functional surfaces, thus lubricating the bearing. When the bearing stops, the oil is then cooled back to its original state.

Solid lubricant bearings can be used where it is impossible or dangerous to relubricate the bearing. Then in a polluted or moist environment. They have a higher amount of synthetic oil compared to conventional bearings lubricated with grease. This increases their resistance to oxidation. When bearings are greased with solid lubricant, the durability is extended due the fact that the solid structure of the polymer matrix does not cause over-rolling and kneading of the lubricant.

Advantages of solid lubricant:

- It cannot be rinsed out of the bearing.
- Reduces the possibility of the occurrence of impurities inside the bearing by filling almost all of its free space.
- The lubricant is resistant to emulsification. It also retains oil and distributes it evenly to all functional surfaces. All that increases lubrication efficiency and thus extends the bearing's durability.
- Rinsing the bearing, e.g. in the food industry, is no longer a problem if a seal is used in combination with a solid lubricant. During rinsing, the seal is supported by a solid lubricant and prevents moisture from entering.
- Bearings filled with solid lubricant are more environmentally friendly.

Disadvantages of solid lubricant:

- Solid lubricant increases the bearing's friction moment and as a result the reference speed of bearings lubricated with solid lubricant is lower compared to standard designs.

The properties of solid lubricant bearings predetermine their use in a very wide range of industries, such as food and pharmaceutical industries, belt conveyors, agriculture, cableways, port cranes, paper mills, etc.

At the end of 2020, ZKL developed the first prototype of a solid lubricant sealed spherical bearing. It is a bearing type B2-2208. In the first quarter of 2021, these bearings have been subjected to lifetime tests and tests for determination of reference speeds. Test results will then be evaluated, performance parameters will be established and soon it will be possible, for special projects, to deliver ZKL bearings with solid lubricants to the customers. Sealed spherical bearings lubricated with solid lubricant are expected to find their use in machines working in challenging conditions such as belt conveyors fits. For further information, contact the ZKL Technical Support Department.

Ing. Jan Křemen
Head of the Technical Support Department, ZKL – Výzkum a vývoj, a.s.

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ZKL Reality – New housing construction

ZKL Reality, s.r.o. adds new premises to its existing real estate portfolio, which is mainly a housing fund. Due to the current obstacles associated with authorising constructions, construction could not begin until 2020, compared to the originally planned date in 2019, as announced by Director General Ing. Jiří Prášil in Zetkalak in March 2019.

At the end of 2020, the reconstruction of two unused buildings in Klášterec nad Ohří was completed and two new residential buildings with a capacity of 22 flats were built. The flats are already almost all occupied. ZKL Reality is now preparing, together with the adaptation of existing office and production buildings in Klášterec nad Ohří, a modification of the now unused production area. The intention is to build new premises for housing, services and small production. The project is ready to be discussed with the municipality of Klášterec nad Ohří.

In the middle of 2020, the first stage of the construction of an accommodation house, with a plan to start the units in mid-year 2021, started in Brno. The capacity of this house is 52 units consisting of a bedroom and a kitchenette and 2 bedrooms and a kitchenette. The building will be equipped with modern infrastructure, for example in the garage we plan to build equipment for electric cars. After the finishing the construction, preparatory work will begin on another approximately 50 units within the second phase in the upcoming years.

Ing. Jan Harwot
Executive Director of ZKL Reality, s.r.o.

Railways: Cylindrical roller units with extended service interval

In every dynamically developing sector, there is constant emphasis not only on reliability, but also on reducing operating costs and ecology. The railway sector is not lagging these trends behind. In ZKL we consider such trends as an opportunity, and therefore the company ZKL – Výzkum a vývoj (ZKL – Research and Development), together with the production plant in Klášterec nad Ohří, participated in the development of a new concept of cylindrical roller units for railway axles (CRU – Cylindrical Roller Unit). The biggest advantage for end users is extending the service interval of these bearing units to up to 1.3 mil. km. This extended service interval ultimately saves the total costs of operating and servicing railway vehicles. Dimensional and performance parameters of bearing allow it to be installed in already dimensionally standardised axleboxes and axles, so there are no significant interventions in the bogie concept and the need for new certification.

The secret of this increased service interval lies not only in the precise design of the bearing itself, but also in the quality of the lubricant used. The lubricant is usually the most limiting factor for the length of the service interval. For the lubricant to reach the maximum service life, the minimum operating temperature is needed to prevent excessive degradation of the lubricant. Such a temperature reduction is achieved by the high quality of the functional surfaces of bearing components and thus by reducing friction in the bearing itself. Another key to success is the protection of the inner space of the cylindrical roller unit. One more barrier in the form of shield and sealing, protecting the inner bearing space, is added to the units, comparing to the current design of standard pair of cylindrical roller bearings. In addition, the cylindrical roller units have increased protection against penetration of fretting corrosion arising between the external surface of the unit and the axlebox bore, or between the axle and the inner ring of the unit. Equally important is the fact that the cylindrical roller unit is mounted on an axle as a one-piece compact set and there is no exposure of its inner space, which significantly reduces the probability of ingress of impurities and possible fatal consequences.

Characteristics of CRU:

- longer service interval, lower operating costs
- unique geometry of the cage
- simpler mounting and handling
- new synthetic lubricant
- the bearing is lubricated and sealed directly from the production
- optimised internal geometry
- increased reliability and safety

Ing. Jan Hanáček
Application Engineer ZKL – Výzkum a vývoj, a. s.

Innovation company of the Ústí nad Labem Region 2020

The Innovation centre of the Ústí nad Labem Region (ICUK) in cooperation with the CzechInvest and Ústí Region has announced the third year of the competition for the Innovation Company of the Ústí Region for the year 2020, to which we applied. Each year, product, services or technology innovations implemented in the region over the past three years are awarded. An expert jury selected the best innovations out of almost two dozen registered companies in two categories – small and medium-sized enterprises and large enterprises.

Innovation, with which we won the category of large enterprises, was the cylindrical roller unit for railway axles (CRU). Its specific feature is an extension of the service interval up to 1.3 million km at a speed of 160 km/hour of normal service load. This prototype was developed within the framework of the research project “New generation of bearings for railway applications with extended service interval”, which we implemented in the period 2017-2020 under the subsidy title of the Ministry of Industry and Trade “TRIO” programme. The project was also co-solved by ZKL - Výzkum a vývoj, a.s. (ZKL Group - Research and Development) and Brno University of Technology.

The first place entitles us to use the title “The 2020 Innovation Company of the Ústí Region.” We are rightly proud of this title and we will strive to continue developing our innovative potential.

Ing. Jamila Bůchová
Project Manager
ZKL Klášterec nad Ohří, a. s.

Increase of qualitative parameters for spherical roller thrust bearings

Superfinishing is an essential and important operation for proper functionality and lifetime of bearings. This was one of the first lessons I got when I started as a grinding process engineer. This doctrine is more than true. Therefore, it was decided that a machine performing with this operation would also equip the facility manufacturing spherical roller thrust bearings, interest in which has been growing around the world.

In the autumn of 2020, a new superfinishing machine BS 212 was delivered to the ZKL Brno plant. It is a vertical superfinishing machine made by the German manufacturer Thielenhaus, which is designed for superfinishing shaft rings to the outer diameter of 200 mm. It is possible to superfinish not only the raceway, but also the flange. After superfinishing of both above-mentioned rolling surfaces, not only excellent roughness (Ra 0.08) is guaranteed, but also waviness and roundness that are after this operation far below the maximum values prescribed in the drawing of the bearings.

Thanks to the combination of rotary workpiece movement and oscillation of the honing stone, abrasive particles copy a sinusoid which is typical of this type of machining. As a result of the overlapping of individual sinusoids, abrasive particles form traces on the surface of the workpiece that intersect at an angle. Superfinishing tools include superfinishing stone with a grain of up to 800 µm.

This technology means significant strengthening and improvement of the entire process of manufacturing of spherical roller thrust bearings in the segment up to an outer diameter of 200 mm.

Ondřej Mágr
Process engineer ZKL Brno, a.s.

Jotes – rolling elements grinding machine

In 2020, the segment for grinding of rolling elements for large-sized bearings was strengthened significantly. Surface grinding machine JOTES SAB 100ST CNC was supplied for grinding of rolling element side faces.

It is a CNC vertical grinding machine capable of grinding plane rotary surfaces on a rotary magnetic table with a diameter of 1000 mm. The slide shift of the grinding spindle and the rotary table is ensured by means of preloaded ball screws connected with encoders via servo motors, where the shearing of the grinding spindle is supplemented with a linear measuring ruler in order to maintain maximum adjustment accuracy. The machine is completely capped, complies with all safety regulations, and is equipped with oil mist filtration system. In addition, a coolant tank is supplied with the machine, including equipment to maintain a constant temperature of the coolant. Thanks to this, the machine is fully prepared for grinding in three-shift operation.

A great advantage is the possibility of using the existing type tools, which we have for older technology on the Stanko machine, and therefore it is not necessary to retrofit the machine with these tools. The 5S system is currently being implemented throughout the workplace. This machine is an important helper for grinding rolling elements in the segment of large bearings.

Ondřej Mágr
Process engineer ZKL Brno, a. s.

New ZKL representations for the Ukraine, Russia and Turkey markets

The reality of business today is that many small and large companies, as they grow, think about entering other regions, countries and then continents. The first step on this path is the creation of an international distribution network, the growth of which leads to a second step, to the opening of a branch or representation office.

The ZKL Group successfully surpassed the first step of creating a functioning distribution network in more than 80 countries worldwide. It now provides exports of up to 90 % of the company's sales. Based on long-term information from distributors in different countries, ZKL has identified promising markets for its products and systematically opens new representations in key territories. Two new ones for the Ukrainian and Russian markets in 2019 and Turkey in 2020 were added to the already existing representation offices in Argentina, China, India and Germany.

ZKL representation for the markets in the Ukraine and Russia

On 1 September 2019, new office was opened in the Ukraine headed by Evgeniy Mochenko, a specialist with more than 10 years of experience in the field of bearings.

ZKL is growing dynamically and developing successfully. The Ukrainian and Russian markets, which appear very promising, have therefore called for a new representation office to be opened. This is another step towards meeting customers of the ZKL Group, which pays significant attention to improving and developing the level of services and sales support for its distributors and end customers in the region in which ZKL operates. New office will ensure more comfortable work with clients who cooperate with us.

"The opening of a new representation office is an important step in the strategic development of the company. Its main goal is to carry out marketing activities to increase reputation and awareness of the ZKL brand. It is also the creation and support of large end-user projects; Quick resolution of disputed issues and complaints; Identification and elimination of factors hindering the growth of sales in the entrusted region," said Evgeniy Mochenko. "We are also planning to create and implement a logistical system for stable supply of our goods to consumers in the Ukraine," Mochenko added.

Evgeniy Mochenko

Despite the global pandemic, the newly created office has already participated in the exhibition "Industrial Forum" in Kiev with its own stand. It obtained accreditation for deliveries to the largest holdings and announced the creation of an intermediate storage with the best-selling bearings to meet the growing demand of Ukrainian and Russian consumers.

In the Ukraine and Russia, we have recently seen a sustained trend of increasing demand for ZKL bearings. "The year 2020 was a successful year for ZKL in these regions. Sales turnover increased despite the crisis caused by the COVID-19. Moreover, the reorientation of consumers from premium brands to the same quality but more affordable ZKL products is a guarantee of further promotion of our company to the post-Soviet territory markets," assessed the successes of the new dealership Evgeniy Mochenko, the head of the office.

Sedat Dobruca

ZKL representation in Turkey

ZKL office in Turkey was founded on 1 June 2020 in Istanbul. Our long-time business partner, Mr. Sedat Dobruca, has become a representative for the Turkish market. He is an experienced professional with more than 20 years of experience in the sale of bearings and education in this field. "Bearings are family tradition to me," said Sedat Dobruca. "My great-grandfather, my grandfather and my father have already done business in this sector."

Among the important tasks of the branch is the representation of the ZKL brand on the Turkish market in order to become more visible and more known. Communicate with customers and distributors more often. Be close to them and help them solve their specific requirements and issues. Last but not least, an important task is also to increase sales of ZKL bearings on the local market. "I see a potential in heavy industry, machinery manufacturers and agriculture," said Sedat Dobruca. "As a ZKL representative, I will work hard to improve sales and create long-term relationships with customers," he added. "ZKL has made very important investments in recent years and has become a big player in the bearing market. ZKL supplies its bearings to various industries around the world. I am sure that thanks to strong references and production portfolio, we will attract more of the Turkish market."

compiled from the documents
Hana Luxová,
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ZKL Rodamientos S.A. your effective partner in Latin America

With distance but united, we have adapted to the new normality.

The year 2020 began with the difficult political and social situation caused by the rapid emergence of the COVID-19 pandemic in Latin America. All economic activities have been subdued. The unknown situation changed the planned strategy and brought great economic consequences and losses all over the world.

National governments have introduced drastic measures to control the pandemic. Airports, national and international borders have been closed, mandatory quarantines and other isolation measures have been ordered. All of this put us in a situation where it was not possible to carry out the tasks as planned. The new reality made us reflect on the current situation. We started to develop adaptation strategies and techniques with which we would get closer to customers, albeit not directly face to face, but at least remotely. We immediately decided to create an operational team together with ZKL's Technical Support Department. The intention of the team was to offer our customers training and presentation programmes of products, so that we can effectively use the closing time of the economy.

We focused on developing the necessary tools and started providing our customers with virtual training, business meetings and technical assistance. In addition, virtual trade fairs were organised and ZKL was invited to participate. The first was organised by

Pablo Méndez

Silvina Tomassoni

EXPOAGRO. The Mega exhibition of the Argentinian agricultural industry took place for the first time in a virtual way and included ZKL. We also participated in the most important exhibition of the Chilean mining industry – EXPOMIN Virtual. Both exhibitions allowed us to contact new potential customers for business development in the region.

We had little time to analyse the situation we found ourselves in. However, important decisions have been made. ZKL's management came with the right vision and immediately implemented all necessary steps to continue the production and dispatch of bearings in a standard manner. This prevented the risk of shortages or delays in the agreed supply. ZKL acted quickly and all the information shared with clients was effective. The year 2020 was undoubtedly the year when we proved to our customers to be a reliable business partner working together to successfully overcome the world's difficult situation.

Although we still have to get adjusted to the epidemiological situation in 2021, our efforts continue to focus on developing the industrial market and supporting our authorised importers and distributors from all over Latin America. This year, our subsidiary ZKL Rodamientos S.A. will also be in charge of the commercial development of the brand in Brazil. This will enable us to unify the marketing and sales support in the region, including certification and supply agreements between partner companies based throughout the region. We believe that the new business structure will help us meet the needs of the Brazilian market and establish the necessary methods for developing our brand in this South American giant.

ZKL won't stop in Latin America. We are taking all steps to continue to remain the strategic partner your company needs and deserves. Adaptation and fast solutions are the basis of long-term success at this time.

Pablo Méndez
Director of ZKL Rodamientos S.A.

Edson Almeida

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ZKL Klášterec nad Ohří strengthens the production and development of thrust bearings up to 500 mm outer diameter

Recently we have seen great potential in the field of thrust ball bearings with an outer diameter from 190 to 500 mm. We are trying to cope with this trend and the inevitable step is the strengthening and the innovation of the manufacturing and development capacities. We took advantage of the subsidy possibilities of European programmes supporting research, development and innovation activities, namely the "Operational Programme Enterprise and Innovation for Competitiveness" – the "POTENTIAL" support programme. The aim of this innovation strategy was the creation and subsequent development of a development centre.

In the first stage – in November 2020, we acquired suitable progressive production technology for the production of thrust ball bearings with outer diameters from 190 mm to 500 mm. The set of basic technological devices includes a CNC machine for precision grinding of raceways, a CNC machine for precision inner diameter grinding and a CNC superfinishing machine for finishing operations of bearing parts raceways. All three new

generation machines ensure very accurate parameters of the surface quality of raceways and boundary dimensions.

After the commissioning of the development centre, equipped with suitable technology for grinding raceways and bores and for finishing the surfaces by superfinishing, we will have the opportunity and suitable conditions to further develop a range of bearings over 190 millimetres up to outer diameter of 500 millimetres. The quality parameters of the raceways (hardness, waviness) of the bearing were improved, rolling resistance reduced and thus extended service life and reduced energy use during the operation of these bearings. With such parameters, the bearings produced in this way are on the same level as energy efficient bearings of the world-leading competitors.

We started the development centre in January of the following year 2021, when another follow-up project "Rozvoje průmyslového vývoje a inovací axiálních ložisek" ("Development of Industrial Development and Innovation of Thrust Bearings") was approved. To enable a complete and wider research and development of the production process, it is necessary to add two new-generation machines to the production machinery park of the development centre. These machines would be dedicated to the finishing operations of the

bearings' components for large size thrust bearings. Namely a CNC grinding machine for the precise grinding of sides/faces and a CNC grinding machine for the precise grinding of bearings' surfaces. The expected delivery of the machines is planned for spring 2022.

The acquisition of advanced production technologies is the basis for an innovation in mechanical engineering and leads to satisfying higher demands for production accuracy, quality, compliance with strict parameters of bearing surface integrity, as well as increasing productivity.

All these parameters need to be verified at the same time within the development centre. That is why we included three precise measuring devices in the second stage of the development centre programme.

The first is a three-coordinate machine (3D) with high precision (0.1 µm), which measures and scans all shapes with a touch ball at the end of the arm. The device will help us measure large diameters up to 500 mm, raceway pitch diameters, radiuses, more complex shapes, flatness of the faces, etc. We now have devices capable of measuring parameters up to 300 mm diameter. The acquisition of a new instrument will increase the possible range of measurements for new research projects and make the measurement of these parameters more effective.

Another measuring instrument is a roundness, cylindricality gauge – it measures circularity deviations on bearing raceways, measures the cylindricalness of the surface, bores and other rotary surfaces on bearing parts. The flatness of the front faces and other flat surfaces on the bearing parts can also be measured. It ensures efficient and effective measurement of the bearing´s shape within quality checking. It is a highly accurate, computer-controlled device for measuring rotary symmetrical workpieces. It has a high positioning speed, automatic centring and levelling, maximum accuracy, a wider range of possible measurements and the ability to process very heavy workpieces. The instrument increases the measurement range for verification of technological grinding conditions of newly developed bearings with outer diameters up to 500 mm.

The last, equally important instrument purchased within the development centre is a microscope for measuring surface deformations such as roughness or surface structure. It measures different parameters in a very short time – approx. 1 second. It ensures contactless measurements of a large area, covering the necessary measuring area and, together with the measurement, also displays the scanned object. Its use will lead to an increase in the quality of measurement, more efficient use of personnel resources and the performance of the research itself or production. It eliminates human error. The microscope will facilitate roughness control and ensure immediate optimisation of technological processes used and verified in the research phase of the project. By checking and reducing the surface imperfections, we guarantee better bearing performance, reduced vibration level, minimizing friction in the bearing, thereby ensuring lower operating temperatures while running the bearing itself.

The expected date of delivery of the precision measuring devices is during the second half of this year. They will be used to verify the proposed technological conditions when introducing new bearing types of thrust bearings with a diameter exceeding 190 mm. The measuring instruments will be located in a reconstructed and centralised measuring centre located in the manufacturing hall with good access to production technologies. The centre has been used since the summer of 2020 and will now be modernised, expanded, but mainly retrofitted with the above listed measuring instruments.

By purchasing a total of five production machines and three very accurate measuring devices, we will expand the portfolio of manufactured bearings with additional sizes of thrust ball bearings up to 500 mm of outer diameter. This all will enhance competitiveness on the global market.

Ing. Jamila Bůchová
Project Manager
ZKL Klášterec nad Ohří, a. s.

Bearing innovation projects in ZKL Brno

ZKL realises that it is important for the development of the company to continue developing the product portfolio of bearings so that ZKL bearings meet the requirements and expectations of end-users. For this reason, ZKL places great emphasis on the technical development of products and technologies associated with it.

Innovations in ZKL Brno plant can be divided into two basic categories. **The first category is the manufacturing of bearings, which is based on already developed product lines.** In the past, specific technological, manufacturing and control processes were already developed for these bearings, which are necessary for the manufacture of high value-added bearings. At present, the innovations for these bearings are focused on expanding the current product range based on specific customer requirements.

This category includes, for example, **main shaft bearings of wind power plants**. These are double row spherical roller bearings, which are based on double row New Force performance class spherical roller bearings but must meet specific requirements for bearings designed for such demanding application, where the bearing life requirement is 30 years. To meet these requirements, the complete production process of these bearings had to be adapted from the requirements for the initial semi-finished product, through the heat treatment process and machining to the requirements for bearing assembly. Of course, there is continuous inter-operative and final control including inspection of the final parts using NDT methods and 100 % traceability of each bearing up to the semi-finished product. The increased demand for these bearings not only by current customers, but also by new customers around the world and the continuous expansion of the bearing portfolio in this segment clearly demonstrate the successful handling of these requirements at ZKL.

Another example of this category is the production of **split bearings**, both spherical roller and cylindrical roller bearings. With these bearings, the key to success is especially the heat treatment process and the process of dividing the bearing rings. Thanks to developments in these areas in the recent years, ZKL produces divided bearings every year as part of innovation.

Last but not least, it is necessary to mention the production of **large-sized spherical roller thrust bearings of the New Force performance class with brass cages**. Based on the demand of customers from power engineering, ZKL produced 5 spherical roller thrust bearings of the 294 series within the innovation process in 2020, from the hole diameter 600 mm to the hole diameter 1000 mm. Production of such large bearings is complex not only with respect to strict geometric tolerances at competitive costs, but also regarding the handling of workpieces, where one rolling element of the bearing 294/1000EM NF weighs 43 kg and the whole bearing then 3400 kg.

The second category is the development of completely new bearings or innovating whole bearing series on bearings of higher performance classes. As part of the innovation process, these projects develop production technology and control methods in order to meet the requirements of the drawing documentation of the bearings. Two innovation projects were completed in 2020.

The first project was to **innovate spherical roller thrust bearings of the 294 series with a stamped steel window-type cage to an outer diameter of 200 mm to the New Force performance class**. Within this project, a number of spherical roller thrust bearings up to the size of 29418EJ NF were innovated. These bearings are, by its geometry, one of the most challenging rolling bearings as concerns the manufacture. To achieve the required shape of raceways and prescribed geometric tolerances at competitive costs, a combination of hard turning of the raceways with subsequent superfinishing of the surface was chosen for the raceway finishing operations. Through the appropriate choice of technological conditions, this combination helps achieving not only the required geometric parameters of the raceway, but also the required residual stresses in the subsurface layer. Verification of the required lifetime of the bearings thus produced was performed by durability tests on test benches in ZKL - Výzkum a vývoj, a.s. (ZKL - Research and Development).

The second innovation project completed in 2020 was the development of **full complement toroidal roller bearings**. A toroidal bearing is a special bearing that has one row of long, slightly profiled symmetrical spherical rollers and an anuloid-shaped raceway. Thanks to this shape, the bearing allows the mutual tilt of the rings and their axial movement towards each other at the same time. It combines the main advantages of cylindrical and spherical roller bearing. This shape of raceway, however, is very demanding on manufacture, especially in grinding of rolling elements sheath. As part of the development of toroidal bearings, new technological processes were designed and tested to achieve the desired shape and geometric tolerances. As part of the innovation process, prototype series were produced in 4 different toroidal bearings in 2020. By managing the development and technology of production of such demanding bearings, ZKL was ranked side by side of the leaders in the field of the manufacturing of bearings.

Ing. Jiří Šafek, Ph.D.
Manager of Technical and Production Development of ZKL Brno, a. s.

Bearings for rolling mills

Thanks to frequent demands for special bearings used in the steel industry, ZKL gradually expands its range of two-row and four-row roller bearings. Their advantage is a large radial load capacity in support rolls. Another growing category of bearings are two-row and four-row tapered roller bearings, which are especially suitable for the transmission of combined, i.e. radial and axial loads, from work rolls.

The bearings are made of both standard bearing steel and carburized steel, which is particularly suitable for this demanding environment. Most of the bearings made of carburized steel have drilled roller bodies and pin type cages, which allow the use of a larger number of elements in the bearing, thereby extending their lifetime significantly. The pin type cage also increases durability in application in which it reverses the direction of rotation.

Rolling mill bearings are usually produced in higher running accuracy and their raceways have optimised profiles for maximum use of contact surfaces, which also contributes to longer service life of the bearings.

Ing. Martin Špaček
Head of Logistics
ZKL Bearings CZ, a. s.

Innovated axial spherical roller bearing in NEW FORCE standard

Experience from the production of axial spherical roller bearings in the Líšeň plant of the ZKL Group goes back to the 50s of the 20th century. Thanks to more than seventy years of continuous production and extensive know-how, ZKL axial spherical roller bearings now have an important market position and ranks among the world's top.

The aim of ZKL Group is to further keep strengthening this high standard, which is related to investments in production technologies and capacity increases, as well as with the activities of the Group Technology Centre, the company ZKL – Výzkum a vývoj, a.s. (ZKL – Research and Development), which has been systematically working on innovation of axial spherical roller bearings of the new generation in the NEW FORCE standard in recent years.

Until now, bearings of series 294 have been transferred to serial production of the new "NEW FORCE" standard up to an external diameter of 200 mm. This year and the next, introduction of other innovated bearings from the medium dimensional range – from 200 to 600 mm of the external diameter – into series production is planned. In addition to this plan, axial spherical bearings with an outer diameter over 600 mm and especially large size bearings are supplied for OEM projects already in the new "NEW FORCE" standard. These bearings include, for example, the largest axial spherical bearing with the designation 294/1000EM NF produced in the Brno plant in Líšeň.

Within the innovation of each bearing, a complete revision of all bearing components is carried out, which includes, among other things, optimisation of internal geometry by numerical simulation and application of internally developed physical models into the design. Thanks to the modern design approach, it is possible to take into account, for example, operating temperature and lubrication parameters when designing the theoretical life of the bearing. As part of the innovation, thanks to the continuous modernisation of the machine fleet, production accuracy is enhanced and the structure and integrity of the internal geometry surface is improved.

Compared to the standard geometry, the NEW FORCE bearings offer our customers:

- Smoother operation in the fit, especially at higher speeds of rotation,
- Higher service life by up to 40 %,
- Lower friction which leads to lower electricity consumption of the whole fit.

List of innovative type dimensions:
29412EJ NF; 29468EM NF; 29414EJ NF; 29472EM NF; 29415EJ NF; 294/750EM NF; 29416EJ NF; 294/850EM NF; 29417EJ NF; 294/950EM NF; 29418EJ NF; 294/1000EM NF

Ing. David Macháček
Deputy Head of the Design Department and Technical Computing
ZKL – Výzkum a vývoj, a. s.

ZKL NEWS

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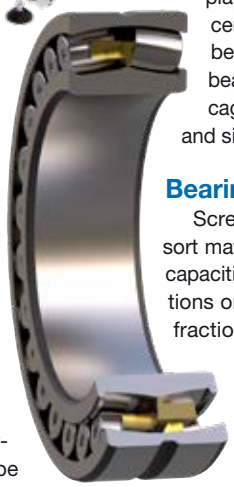
Mineral processing

Stone mining and its processing are among the industries with very demanding operating conditions. The components of machines are exposed to significant temperature fluctuations, high dust, humidity, as well as vibration and shock loads. Service and maintenance is very demanding, and unplanned outages are a constant risk. Component suppliers must keep up with the development of technologies, increasing demands on safety and environmental protection, as well as customer requirements for the most economical operation of equipment. ZKL, a traditional Czech manufacturer of spherical roller bearings for heavy industry, is able to reflect these requirements in the development of standard and special spherical roller bearings, as key components of mining and mineral processing industry equipment. ZKL thus offers a wide range of technical solutions for individual segments of this industry.

Bearings in crushers

Crushers are devices, the purpose of which is to crush stone or other crushed material into the form of grains. There are many designs and types of crushers. The most used are jaw, impact and cone crushers. Each type has its advantages and disadvantages. Jaw crushers have a simple construction, lower operating costs compared to other types, and show high reliability. On the other hand, they are not suitable, for example, for crushing reinforced concrete, the grains of this material show inferior shape properties. The advantage of impact crushers is a large degree of crushing, high performance and excellent grain shape index. The disadvantage of operating this type of crusher is high dustiness, noise level and higher service costs.



For all types of crushers however applies, that the bearings used in them are exposed to high impact loads and excessive dust. Bearing manufacturers are therefore responsible for the introduction of a bearing with the highest possible load capacity and the highest quality of processing of functional surfaces. On the other hand, the user of the bearing is responsible for its regular maintenance, especially for proper re-lubrication, so that there is always fresh lubricant inside the bearing. ZKL fulfils its role by introducing spherical roller bearings in the New Force generation, which are comparable in their performance parameters to premium brands on the market.

Spherical roller bearings of the 230, 231 and 223 series with normal radial clearance or C3 play, are most often mounted on eccentric crusher shafts. ZKL supplies bearings in the EMH NF design, i.e. bearings with a one-piece solid brass cage, for a complete range of outputs and sizes of crushers.

Bearings in vibrating screens

Screens are devices that are used to sort material by fraction at lower material capacities. Screens sort material by vibrations or rotation, while the finer-grained fractions fall through the sieve and the coarse-grained ones travel along the surface of the sieve and return, for example, to the crushing phase. There are several ways to sort material, as in the case of crushing and crushers. There are oscillating screens, drum screens and more. In this chapter we will focus on vibrating screens.

The basic part of vibrating screens consists of vibromotors or eccentrically unbalanced shafts, which cause a circular or elliptical oscillating movement of the entire screen. It is mounted on springs and, by its oscillation, moves the sorted material over the surface of the sieve, which results in its sorting. Experience from the given application shows that common designs of spherical roller bearings with brass or sheet metal cages, which are mounted on eccentric shafts or in vibromotors, do not stand up and premature failure occurs. For this reason, ZKL has developed special spherical roller bearings for vibration applications and designated them with the EMHD2 suffix. The vast majority of these are bearings of the 223 series. An exception may be the bearings of the 222 and 233 series. ZKL offers a range of these bearings with a bore diameter from 40 to 200 millimetres.

Practical experience has proven that the operating temperatures of bearings in the EMHD2 design are 5 to 10 °C lower compared to conventional designs. This has a positive impact on the service life of both the bearing and the lubricant, which allows service intervals to be extended. In general, bearings in EMHD2 design can be recommended for any vibration application. In

> *continued on next page*

Examples of commonly used ZKL bearings on crusher shafts

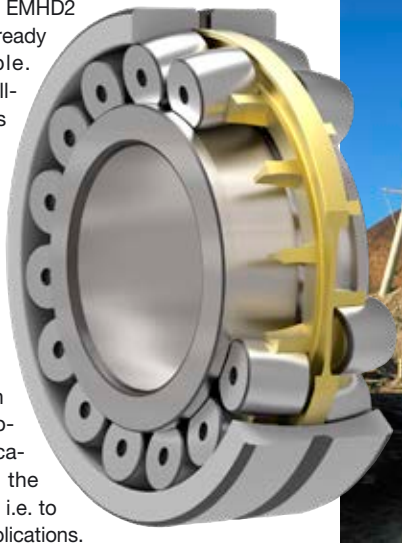
ZKL bearing	d [mm]	D [mm]	B [mm]	C_r [kN]	C_{0r} [kN]
23124EW33MH C3 NF	120	200	62	575	798
22330EW33MH NF	150	320	108	1,520	1,850
22356EW33MH C3 NF	280	580	175	3,840	5,340
23176EW33MH NF	380	620	194	4,380	7,960

Mineral processing

Examples of commonly used ZKL bearings for vibration applications

ZKL bearing	d [mm]	D [mm]	B [mm]	C_r [kN]	C_{0r} [kN]
22314EMHD2 NF	70	150	51	376	402
22320EMHD2 NF	100	215	73	750	842
22326EMHD2 NF	130	280	93	1,180	1,380
22334EMHD2	170	360	120	1,670	2,280

applications with vibration accelerations higher than 5 g, the EMHD2 version is already irreplaceable. Spherical roller bearings of the 223 series have a guaranteed safe mutual misalignment of the rings of ± 3°. However, this information does not apply to applications where the load rotates, i.e. to vibration applications. The maximum permissible dynamic mutual misalignment given here is in the order of tenths of a degree, depending on the lubricant and cooling system used. For more detailed information, we recommend that the Technical Support Department is contacted.



Technical parameters of EMHD2 bearings

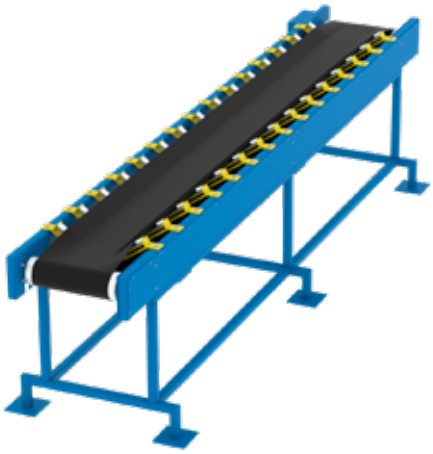
- Increased accuracy of the inner geometry and inner diameter of the bearing.
- Brass cage guided on the outer ring of the bearing.
- Radial clearance C4 at all times.

Bearings in belt conveyors

Belt conveyors are used to transport crushed material over long distances. They are often located in inaccessible locations and are exposed to very adverse weather conditions. Each servicing or unplanned outages thus require significant costs. With these devices, more than anywhere else, customers emphasize the reliability and maintenance-free operation of individual components.

Belt conveyors consist of drive and driven main rollers, tension rollers and idle rollers. Drive, driven and tensioning rollers are usually mounted in spherical roller bearings. ZKL, as one of the world's few bearing manufacturers, offers its customers sealed spherical roller bearings. They meet the strictest requirements for operational reliability. The bearings are equipped with a contact lip seal made of NBR (up to 110 °C) or HNBR (up to 150 °C) and, as standard, are lubricated with plastic lubricant ZKL LVT 2 EP grease (up to 110 °C). The seal prevents the ingress of dirt into the inner space of the bearing and, in combination with a correctly made house seal (the labyrinth house seal and the inner space of the house is filled with plastic lubricant), is an ideal solution for the given application. The practice shows that sealed spherical roller bearings achieve 2.5 to 3 times the service life compared to open spherical roller bearings. Sealed bearings with a smaller inner diameter can be wider than their standard open designs. This fact must be taken into account for potential replacement of an open bearing with a sealed one, and the related parts shall be adapted. Bearings with a larger width are always marked with the prefix "B2-". The mutual tiltability of the rings of sealed bearing is limited in comparison with the open design. It is generally stated that it is safe to operate the bearings with a maximum mutual misalignment of the rings of 0.5 °. ZKL currently offers a range of sealed spherical roller bearings with bore diameters from 25 to 320 millimetres. For detailed information about the range and its benefits, we recommend contacting the Technical Support Department.

Ing. Jan Křemen
Head of the Technical Support Department
ZKL – Výzkum a vývoj, a. s.



Examples of commonly used ZKL sealed spherical roller bearings

ZKL bearing	d [mm]	D [mm]	B [mm]	C_r [kN]	C_{0r} [kN]
B2-2205-2RSN TM NF	25	52	23	47.5	50.2
B2-2216-2RSN TM NF	80	140	40	246	295
23152-2RSH TM NF	260	440	144	2,560	4,130
23164-2RSH TM NF	320	540	176	3,560	6,150

Authorised distributors in the Czech Republic

The sale of ZKL bearings is provided in the Czech Republic in the form of direct deliveries from ZKL to important end users, as well as distribution through authorised distributors. These are long-term business partners of ZKL who have been in close cooperation with ZKL bearing distribution on the market in the Czech Republic for almost 30 years. The authorised sales network of ZKL was established in Brno at a joint meeting of representatives of ZKL and commercial companies from the Czech Republic as early as in 1993.

The cooperation in the sale of ZKL bearing products on the Czech Republic market includes common logistics, including stockholding for customers in regions, implementation of specific projects and presentations, technical support through specialists of ZKL – Výzkum a vývoj (ZKL - Research and Development), and others. In addition to the main facilities, authorised distributors also have other branches located throughout the Czech Republic, thus achieving optimal coverage within the supply of ZKL bearing products to end users.

On behalf of ZKL, we also want to thank our business partners for their long-term good business cooperation, and we believe that it will continue and expand in the next period.

Jaroslav Kammerer
Sales Manager of ZKL Bearings CZ, a. s.

Authorised Distributors		www
AGROZET České Budějovice, a.s.	České Budějovice	www.agrozet.cz
ARKOV, spol. s r.o.	Chrudim-Slatiňany	www.arkov.cz
DAVAZ, spol. s r.o.	Horní Moštěnice	www.davaz.cz
LOID spol. s r.o.	Frýdlant nad Ostravicí	www.loid.cz
LOŽISKA ISKALČUK, s.r.o.	Černčice-Louny	www.loziska-iskalcuk.cz
Ložiska Mělník s.r.o.	Mělník	www.bearings.cz
Ložiska VILIM spol. s r.o.	Olomouc	www.loziskavilim.cz
MATEZA spol. s r.o.	Havlíčkův Brod, Brno	www.mateza.cz
PRAKTIK, spol. s r. o.	Plzeň	www.praktikloziska.cz
Rubix Czech s.r.o.	Praha, Ostrava	www.rubix-group.cz
SAK LOZISKA spol. s r.o.	Horní Tošanovice	www.sak-loziska.cz