



ZKL GROUP RESEARCH AND DEVELOPMENT:

**A 20 years history
of bearings' development**

Read more on page 3



RESEARCH

AND

DEVELOPMENT

SIMULATION

AND

ANALYSIS

DESIGN



Bearings for renewable
energy resources

page 5



Bearings for concrete
mixer trucks

page 9



Bearings for dirty
environment

page 12

Read further in this issue:

The distribution
network in India *page 6*

Introducing:
LOID spol. s r.o. *page 7*

The distribution network
in Russia *page 11*

Opening speech



Dear business partners,

The ZKL Group has entered the year 2019 with an increase in demand and orders, especially for innovative spherical and cylindrical roller bearings, which are successfully used in the

locomotives driving on the Trans-Siberian Railway or in wind power stations and other applications. On the other hand the constantly increasing demand means also a great challenge to us while ensuring sufficient production capacities. We do have enough machine capacities built, but the key to achieve a full optimization is to stabilize the machines' staffing. The long-term low unemployment rate on the Czech market, resulting in the lack of qualified technicians, sets us ambitious goals to be fulfilled. In addition, the possibility of obtaining qualified staff from abroad is much more demanding in terms of time and bureaucracy if compared with neighboring states' situations. For the reasons outlined above, the following steps are to be taken:

- stabilising the existing skilled workers in the ZKL Group;
- ensuring recruitment of qualified staff both domestically and abroad;
- automation of manufacturing processes.

In order to stabilise our employees and recruit new ones in 2019, we will focus also on new projects, which will be focused on enhancing and fulfilling ZKL Group's personnel policy objectives. One of these includes a plan for the construction of a residential building in Brno-Líšeň with approx. 110 residential units. We believe that the project will attract young employees including their family members, offering them modern rental housing and placement of their children in nursery schools and the like.

Indicator	2017 reality	2018 reality	2018/2017 index	2019 plan
Revenues from sales (CZK thous.)	1 053 295	1 083 676	1.03	1 176 997
Added value (CZK thous.)	383 400	406 353	1.06	481 504
Result from operations – EBITDA (CZK thous.)	122 948	131 715	1.07	165 707
Productivity (Added value / Personnel expenses)	1.30	1.30	1.00	1.48

We plan to begin the construction of a residential building in Q III 2019 with new residents – employees of ZKL – being able to obtain permanent housing in the middle of next year. In a similar way we are working in another city of the Czech Republic with a tradition of bearing production in Klášterec nad Ohří where we have been preparing a construction of a hostel and reconstruction of a smaller residential building that should be completed by the end of 2019.

Another important measure to ensure the production capacities is the automation of production processes control. Our goal is to introduce automation to the operation in the production of bearings that is not just about handling manufactured semi-finished products, but mainly about remote control of machines. The principle is that the operator's eyes and surveillance will be replaced with sensors, scanners and other technical means that will watch over the operation of the machine and the process of machining or grinding. The system will bring higher quality of work, productivity

and promotion of the machine operator's role to a "Master" manager of the manufacturing process in a factory hall. That change in the management of the manufacturing processes is being prepared in cooperation with a reputable engineering organisation with which ZKL has been introducing the PLM ("Product Life Cycle Management") system which should be launched in the first half of 2020.

The beginning of each calendar year is associated with a 2018 annual accounts statutory audit taking place. It is therefore the right time to inform you about the results we have achieved in 2018 compared to the previous years.

The comparison shows clearly that in 2018 we have improved results especially in terms of labour productivity and efficient management of the manufacturing processes.

In conclusion, I would like to thank you all for your cooperation, wishing that you will keep being loyal to us in the periods to come.

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



Visualization of a ZKL residential building in Brno

ZKL's 2019 participation in trade fairs



The most traditional form of presentation of the ZKL brand includes the participation in fairs and exhibitions in the Czech Republic and abroad. The main objective is to present, besides the standard product range, also new products and services that ZKL offers its customers, thus supporting the subsequent sale in those territories.

Among the traditional trade fairs that must not miss the ZKL brand is one of the most important European trade fair Hannover Messe and the domestic International Engineering Fair in Brno. This year, the presentation will focus on special projects that ZKL – Výzkum a vývoj, a. s. (R&D) has played a significant part in, in particular in designing the structural solutions of individual products and their mounting in applications. Innovations in the field of railway bearings will be introduced at the ZKL stand at the domestic Czech Raildays fair in Ostrava.

We cordially invite you to the following trade fairs:

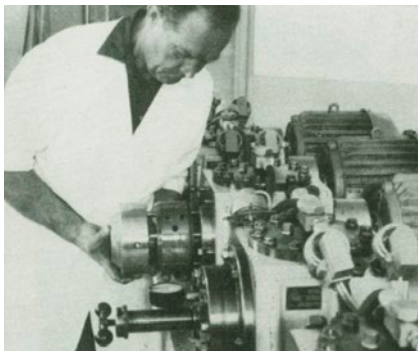
March 12–15, 2019	Expoagro – Buenos Aires, Argentina
April 1–5, 2019	Hannover Messe – Hannover, Germany
May 29–31, 2019	China International Mining Expo – Beijing, China
June 11–13, 2019	Czech Raildays – Ostrava, Czech Republic
September 10–13, 2019	Polska Technika Górnicza – Katowice, Poland
September 16–20, 2019	PERUMIN – Arequipa, Peru
October 7–11, 2019	MSV – Brno, Czech Republic

Ing. Hana Luxová
marketing and PR
ZKL Bearings CZ, a. s.

ZKL – Výzkum a vývoj celebrates its 20th anniversary

In 2017, we celebrated 70 years since the start of the manufacture of bearings in the ZKL Brno factory, last year we commemorated the centenary of the foundation of Czechoslovakia and even this year we have a reason to celebrate and look back. 20 years ago, the modern history of the research and development of the ZKL Group began to be written. On the occasion of this important event, we asked our long-time colleague Ing. Vladimír Zikmund to recall the past 20 years, since he significantly contributed to the development of the strategy of ZKL – Výzkum a vývoj, a. s., in the head of which he had stood for several years. Although Ing. Zikmund no longer works at ZKL, the "engineering" heart of his still beats for the ZKL brand.

In early May we will mark 20 years of the existence of ZKL – Výzkum a vývoj, a. s. in Brno. The company aims primarily at expert technical support of the ZKL Group, which is the largest Czech manufacturer and supplier of roller bearings. This support lies mainly in designing new types of bearings, technical sales support and testing. The past 20 years confirms the contribution of the company to maintaining high prestige of the ZKL brand in the domestic and global market with roller bearings. This is enabled by great support from



Testing laboratory

the ZKL management that is aware of the need for continuous expansion of the product range to meet the needs of the market. Significant role play also the experience and professional skills of the technicians and engineers who followed the long evolution of bearings in Brno.



Historical photograph of the production plant ZKL Brno (year 1967)



Building of the Research Institute for Roller Bearings in Brno

The history of the development of roller bearings in Brno dates back to the early years after World War 2, when it was decided to introduce the production of bearings in Zbrojovka Brno. Subsequent tremendous development of the production of new types of bearings for the needs of the post-war industrial development in Czechoslovakia led to the establishment of new manufacturing facilities in the Slovak Republic, where the centre of the new grouping of ZVL plants for the production of bearings moved later in 1965 with the headquarters in Považská Bystrica. Rapidly evolving bearing production required sustained and coordinated technical development that in 1953 led to the founding of the Research Institute for Roller Bearings in Brno. This had started the history of that evolution which continued after the privatisation in May 1999 in a new company which became part of ZKL. The corporation integrates and coordinates the activities of domestic companies engaged in the development, manufacture and sale of ZKL bearings. Following that connection, ZKL – Výzkum a vývoj, a. s., has been working closely with the manufacturing plants ZKL Brno, a. s. and ZKL Klášterec nad Ohří, a. s. and primarily with the trading company ZKL Bearings CZ, a. s. It has been also working on various

projects with Brno University of Technology. The ever-increasing need for bearings, their quality, development of new types and the sales technical support show that this development institution is still urgently needed.

The activity of ZKL – Výzkum a vývoj, a. s., is divided into three areas:

Design and Calculation Department: In cooperation with other specialised divisions it provides for technical development and acts as the chief designer in the field. It prepares and provides design documentation on the entire range of roller bearings, including special bearings and prototypes. Part of the development process is computational analyses of newly designed bearings. Optimisation of internal bearing geometry through those analyses is also one of the supporting pillars of the new generation of bearings – NEW FORCE.

Technical Support Department: Provides technical support to ZKL bearings dealers and their customers in the form of technical consultations and trainings on the use, assembly and lubrication of bearings. Designs new bearings and their placement depending on the specifications of customers. Apart from the preparation of tender drawings, also carries out calculations of bearing life or analyses of gearboxes in a specialised calculation software. Works closely with business companies in promoting ZKL bearings through participation in trade fairs and conferences of distributors at home and abroad. Is responsible for product range catalogues and bid specifications for new bearings.

Testing laboratory: Performs comprehensive assessment of the quality of bearings, performance tests and bearing limiting speed tests. Includes a modernised metallographic and metrology laboratory. The testing laboratory manages documents containing methodologies for testing, metrology and regulations of metallurgist for the ZKL Group. Expertise and instrumentation of the testing laboratory are

> continued on page 4

ZKL – Výzkum a vývoj celebrates its 20th anniversary

> continued from page 3

also used by a number of external companies operating in the production and sales of bearings, their assembly and use. After enrolling the company on the list of expert institutes in 2016, the testing laboratory is authorised to issue judicial opinions, adding to the credit of that specialised division.

With the twenty-year support of ZKL – Výzkum a vývoj, a. s., ZKL Group has achieved many positive results that are worth recalling. How many new types of standard and special bearings have been introduced into serial production during that period of time in both ZKL manufacturing companies must be obvious to everyone only from comparing the current catalogue of the product range and the ZKL catalogue valid twenty years ago. The new edition of the catalogue with a significantly expanded content as well as the range of bearings is a clear evidence of that. New ZKL bearings found a place in many engineering products, such as axles of modern railway vehicles, mining equipment, wind power plants or perhaps marine gears. Some new products were also awarded at prestigious international engineering fairs in Brno and Nitra. For example, the NEW FORCE new generation bearings that have become the new ZKL bearings standard were awarded the Gold Medal at the MSV (International Engineering Trade Fair) in Brno in 2008. The development however continues to progress. This is illustrated for instance by an exhibit registered in the competition at MSV in Brno in 2018, which was a new spherical roller thrust bearing NEW FORCE 29412EJ, which was for the first time ever designed with the use of the additive metal 3D printing SLM technology. A number of new projects in which ZKL – Výzkum a vývoj, a. s. participates, have been assessed by independent commissions and recognised to be subsidised by the funds for the support of research and development of various programmes of the Ministry of In-

Ing. Vladimír Zikmund (*1955)

- He studied at the Faculty of Mechanical Engineering of the Technical University in Prague in 1980.
- He devoted his career from the graduation to the development of roller bearings.
- In the years 1980–1999 at the Research Institute for Roller Bearings (VUVL) worked as a researcher in the development of bearings for aerospace industry, chief designer and director for development and quality.
- In the years 1999–2015 in ZKL – Výzkum a vývoj, a. s. (R&D) worked as a researcher in the development of automotive bearings, chief project manager and head of design.
- In the post of director of ZKL – Výzkum a vývoj, a. s. , he worked in the period 9/2000–3/2010 and 9/2013–10/2015.
- Is married and has two adult sons.



dustry and Trade and other providers of subsidies. To promote the sales and position of the ZKL brand, a number of company employees participated in technical presentations and participation in trade fairs in the Czech Republic, Slovak Republic, Germany and also in Argentina, Brazil, USA, China, India and other countries of the world.

ZKL – Výzkum a vývoj, a. s. also participated in the successful certification within the Group, whether it is the Group certificate ISO 9001:2015 or, for example, a successful transition from the

IRIS standard to ISO/TS 22163:2017 for the railway industry in ZKL Klášterec nad Ohří, a. s.

I wish ZKL – Výzkum a vývoj, a. s. that it manages to continue to collect knowledge from the operation, from other manufacturers, use new computational methods and manufacturing technologies. This is the only way it will be able to keep giving ZKL roller bearings such parameters that increase the reliability and efficiency of their operations. And it will certainly be appreciated by customers worldwide.

Ing. Vladimír Zikmund



View of the production plant ZKL Brno (year 2011)

Bearings for renewable energy resources

Renewable energy resources are among the priorities of the European Union and therefore of the Czech Republic as its Member State. Those energy resources may include the production of electricity from water, wind, solar radiation, biomass and biogas, or energy of environment utilised by heat pumps, geothermal energy and energy of liquid biofuels. In the Czech Republic solar power engineering, wind power stations and historically hydroelectric power plants are among the most widely used renewable resources. The ZKL Group places great emphasis on reducing the carbon footprint through designing their products, as well as through optimising their manufacturing processes.



Bearings for hydroelectric power plants

An area where you can find a wide range of ZKL products are hydroelectric power plants of different types. In addition to spherical roller bearings for mounting horizontal shafts of turbines, there are also special bearings for mounting a quick-closing flap. They serve for regulation the supply of large amounts of water to pumped-storage power plants utilising the Francis turbine. The flap must be able in the event of an emergency to quickly disable the turbine. The flap is mounted vertically in the two spherical-roller bearings 232/750CF of NEW FORCE standard and is supported with an axial joint bearing.

To illustrate the massiveness of the whole structure it has to be said that the bearing weighs more than three tonnes, and one rolling element (spherical roller) weighs over 25 kg. The bearing internal design was optimised using modern design methods, which include the finite element method calculation. Because of that, the bearing 232/750CF would ensure safe rotating of machine components with a weight corresponding to more than five fully loaded coal wagons, or for example 390 cars of lower middle class.

The optimised design conforms to the requirements of the NEW FORCE premium brand for machining quality of functional sur-

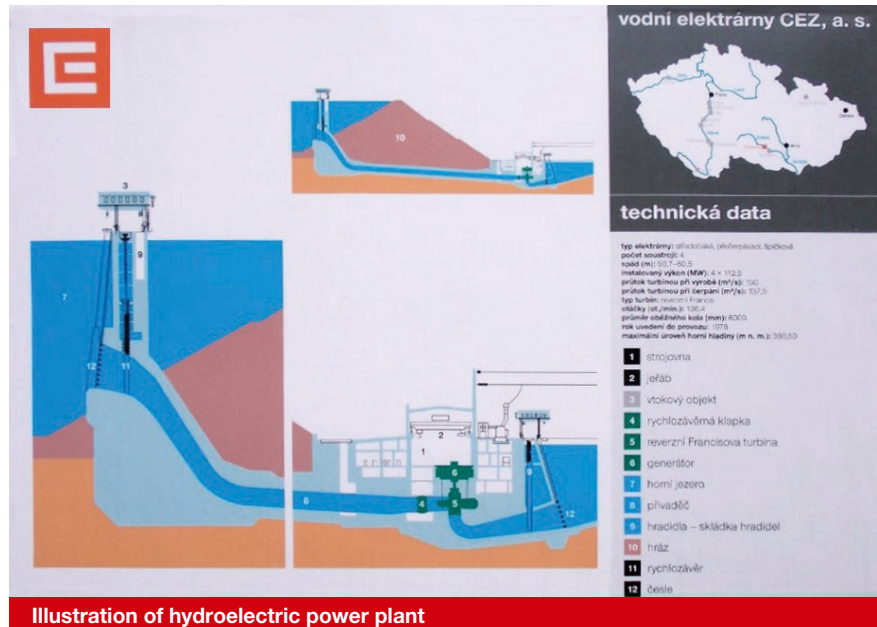


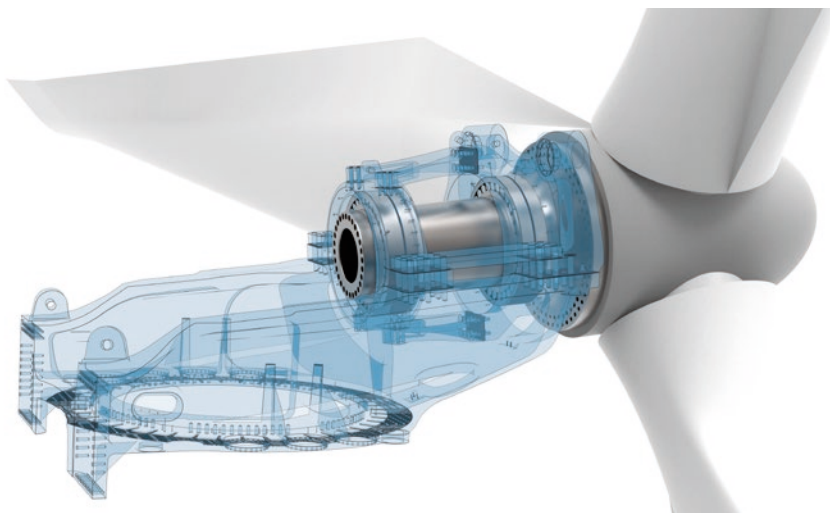
Illustration of hydroelectric power plant

faces, their high precision and quality of the material used for the individual components. Bearings guarantee high quality also through modern manufacturing machines for turning and grinding operations that operate in the ZKL Brno manufacturing plant.

Several pieces of those bearings were in 2018 delivered to two power stations in the European Union and we believe that they will bring their users many years of safe operation.

Ing. Libor Nohál, Ph.D.
Head of Design Department
ZKL – Výzkum a vývoj, a. s.

Bearings for wind power plants



In recent years, the ZKL Group has focused on working with customers from the power engineering sector with wind power engineering currently being in the imaginary spotlight among all the power engineering sectors in terms of the bearings sales turnover. The connection of the concepts ZKL Group and wind energy has reasonable grounds – ZKL Group, a traditional manufacturer of large-size spherical roller bearings and wind energy – where one of the most popular concepts of mounting the main shaft of the wind power plant is right in a pair of spherical roller bearings. ZKL Group currently supplies 3 pairs of spherical roller bearings in tens of pairs per month. With the bearing size at least 500 mm of the inner bore diameter, it is no exaggeration to speak of mass production. These three pairs are formed

by bearings 230/750 and 241/500, 230/800 and 241/530 and 230/900 and 231/630, the first of the pair being always the axially free bearing and the other of the pair the axially located bearing. The largest of them – 230/900 – weighs respectable 1170 kg and the outer diameter of the bearing is 1280 mm. The height of the main shaft axis ranges, depending on its power, from about 80 m to 100 m above the surrounding terrain. With this in mind, any replacement of those bearings is very demanding both technically and financially. Therefore, this application puts great emphasis on reliability. Bearings are fitted on wind power plants of 2.0 MW to 3.3 MW power output. In practice it means for a 3.3 MW power plant that at full power output the power plant can continuously supply a small Czech town of about 10,000 households.

The fact that the ZKL Group managed to work its way up in the field of wind power engineering among the major suppliers, was not the result of short-term efforts, but a long process of commercial and technical negotiations. Each pair of bearings manufactured in the factory ZKL Brno, subjects to a complicated certification process consisting of a customer audit of the production and calculation reports containing calculations of service life and contact stresses. In the case of the largest wind power plants, standard customer requirements include the calculation of the service life of main bearings, including the effect of the deformation of the related components (the bearing housings, the main shaft and the support gondola frame). In comprehensive reports, customers are delivered calculations of sometimes thousands of load spectra, which in turn result in a comprehensive picture of the calculated bearing life according to the standards ISO 281 and ISO 16281. Currently there is an ongoing process of development of a new pair of bearings for 4.5 MW power plants, which are equipped with bearings of inner diameter 950 mm or 900 mm and a weight of up to 1500 kg. The ZKL Group thus continues the trend established 3 years ago, successfully paving the way through wind energy. In 2018 alone there was an increase in the sales of bearings for wind energy 30 % compared to 2017 and the outlook for 2019 is an increase by up to 100 % in comparison with 2017!

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

Environmental policy in ZKL Klášterec nad Ohří

There is an integrated system of quality and environment established in ZKL in Klášterec nad Ohří. In 2017 the company was successfully re-certified in accordance with the ISO 14001:2015 standard, and in 2018 the company underwent a supervisory audit. Environmental protection is one of the priority tasks of the organisation. Environmental policy aims at reducing the burden on the environment resulting from our manufacturing activities and especially at preventing environmental pollution. Major emphasis is placed on the prevention of pollution in all activities of the company and employees now regard environmental protection as an integral part of the everyday workflow. Attention is focused mainly on solving environmental issues in the area of air protection, water management and, last but not least, waste and packaging management.

In recent years there has been a significant optimisation of the waste management system. Introduced was a set of measures aimed at the consistent separation and effective waste storage. At present, we sort a total of 22 types of waste. We managed to get customers for sorted plastic and paper waste, we sort small electrical waste and an authorised company buys waste oils from us for subsequent disposal. All the listed wastes are consequently re-assessed – recycled – and not only that we do not have to expend funds for their disposal, but we even get paid for some of them.

In its manufacturing operation our company generates several commodities of hazardous wastes and those came under scrutiny in

2018. Ways were sought to eliminate those costs while reducing the environmental burden. A major achievement was a purchase of a press for contaminated packaging materials. Those are packages containing hazardous substances and in recent years the costs of their disposal were relatively high. Therefore, a hydraulic baling press Orwak 3210 that best meets our requirements was purchased in August 2018. "Orwak" is very compact, the area for the press is less than 1 m²; the pressing cycle lasts only 13 seconds and is mainly intended for pressing bulk materials, e.g. cardboard, paper and various plastics including films. The intention of the pressing was to increase the total volume of waste (in one shipping container) on one hand, and on the other hand to reduce the cost of transporting those wastes.

Consistent sorting of packing material and the purchase of the press proved to be environmentally and economically effective in a short time. In 2017, 38.61 tonnes of packaging contaminated by hazardous substances were generated and 51 container removals carried out. In 2018, just 17.52 tonnes of that packaging were generated and only 10 container removals carried out. Reducing the production of hazardous waste and reducing the frequency of shipments, hence reducing CO₂ emissions, is a major environmental benefit and the cost savings additionally needs to be mentioned, along with early return on the investment in the pressing machine.



The aim of the above listed systematic measures is to follow the principles of environmental policy, continue to reduce production of waste and consumption of resources, thus reducing the impact of our activities on the environment.

Ing. Lenka Schrepferová
Quality and EMS Manager
ZKL Klášterec nad Ohří, a. s.

Introduction of the ZKL Bearings CZ distribution network in India

The Republic of India is the seventh largest and, with more than a billion people, the second most populous country in the world. After China, its economy shows the greatest growth and is therefore regarded as the regional power and one of the potential global superpowers. For those reasons, India is the destination of business activities not only at the governmental level but also directly at the level of individual businesses.

The proof that India is an important market also for ZKL is building a ZKL Bearings CZ Representation Office in Mumbai. The sale of ZKL bearings in India is implemented through two authorised distributors, each of which having its own dealer network covering the entire territory of India.

ZKL Bearings (India) Pvt. Ltd. is among the long-term business partners. In 2003 it became the authorised distributor of ZKL bearings for the territory of the Republic of India. The company headquarters and the central warehouse of ZKL Bearings (India) Pvt. Ltd. are located in Calcutta and regional offices in Chennai, Mumbai and Delhi. The company has also dealers located in cities like

Pune, Nagpur, Raipur, Rourkela, Ahmedabad, Vapi, Vizag, Bengaluru and Kanpur. Through its extensive network of authorised dealers spread across the country it thus provides added value and offer logistics solutions to the Indian industry.

The activities of ZKL Bearings India Pvt. on the Indian market helped get ZKL bearings to all parts of India, making them renowned and desired there.

Contacts to the company headquarters:
B-3/1A Gillander House, 8 Netaji Subhash Road, Kolkata-700001, West Bengal
E-mail: marketing@zklandia.com
kolkata@zklandia.com

CZ Bearings India LLP, based in Mumbai, is the second authorised distributor of ZKL bearings in India. Though the company has officially become our authorised distributor only in 2019, the cooperation between the two companies has been taking place for a longer period time. The young, energetic team of CZ Bearings India LLP seeks to spread the awareness of the ZKL brand in the Indian



market and plans to expand further in the near future.

Contacts to the company headquarters:
501, Symphony Premises Co-Op Housing Society, Nehru Road, Vile Parle (East), Mumbai – 400 057
E-mail: sales@czbearings.com

We thank our partners in India for their up-to-now cooperation and look forward to new joint projects.

Bipin Kulkarni
Commercial Director
ZKL Bearings CZ Representation Office

Introducing an authorised dealer of the ZKL bearing products in the Czech Republic: LOID spol. s r.o.

In 2008, the owners of LOID spol. s r.o. set a goal to become the distributor of the best-selling brand of bearings in the Czech Republic. For eleven years the company has been supplying ZKL bearings to end customers in the region of Ostrava and businesses across the Czech Republic. Professionalism and personal approach are the values that are pride and joy of the company.

The first years of sales of the bearing assortment of ZKL took the form of cooperation with the authorised sales network of the ZKL brand in the country. Thanks to the successful results in the sale of ZKL bearing assortment, in 2016 LOID joined direct cooperation with ZKL and for 2019 has already acquired the status of an authorised ZKL brand dealer in the country.

"The beginning was not easy but, thanks to our customers, over time we have earned our place in the market with bearings. Our intention was to move further and offer our clients ZKL bearings under the most favourable conditions.



And it worked; LOID has become an authorised distributor of ZKL," says Iva Dulavová, the executive director of LOID. "One of the main benefits for our customers we consider the possibility of training and technical support by ZKL directly in their company," she adds.

Customers buying ZKL bearings have a unique opportunity to see the ZKL facilities in Brno during the training/presentation, including the manufacturing plant, a certified testing laboratory, and they can also try out assembling and disassembling of bearings in a specialised workshop.

As we continually strive to develop and improve our services, in 2017 we created a clear portfolio of bearings and accessories for our customers in the form of a wholesale e-shop – LOIDSHOP.CZ. Here there is all the available inventory and current information on special events, support from LOID, and the like.

We believe in the successful development of the cooperation between ZKL and LOID in the sale of the ZKL bearing assortment on the Czech market in the next period and we would like to thank all the members of ZKL Bearings CZ, a. s., as well as our customers for their cooperation and support.

LOID spol. s r.o.



Establishing cooperation with a new authorised distributor in Latin America – Centro Industrial de Honduras de S.R.L.



We are pleased to introduce our new authorised distributor headquartered in San Pedro Sula in Honduras. This is a young, very active and dynamic company C.I.H. (Centro Industrial de Honduras de S.R.L.), which operates in the industrial area and uses the experiences of its partners, Mr Oscar Rene Rivas, Mrs Lidia Xiomara Rivas and Mrs Marcela River.

C.I.H. is a supplier of bearings primarily to the following industries: mining, cement, sugar and oil processing industry, power engineering, textile and building industry.

C.I.H. also provides its customers with an added value in form of services, laser levelling of belts and straps, dynamic balancing and industrial ultrasound.

We firmly believe that our business cooperation initiated during 2018 will continue to deepen and develop. ZKL will continue to back our new authorised distributor up with all sales and technical support, which will certainly contribute to strengthening the position of the ZKL brand in that territory.

Pablo Méndez
President

ZKL Rodamientos S.A.

ZKL NEWS

ZKL Group Quarterly
This Issue: March 2019

Run by Editorial Board

For needs of ZKL Group published by ZKL, a. s., Jedovnická 8, 628 00 Brno

Phone: +420 544 135 403

Fax: +420 544 233 484

Editor in Chief:

Ing. Hana Luxová

Registered at Ministry of Culture of Czech Republic under Ref. No. E 11989.

Type Setting and Print:

Ideal Graphics s. r. o.
www.ideal-studio.cz

Development of railway production not only in the ZKL Group

In the Czech Republic, railway industry represents one of the stable pillars of the economy with its 200 years of tradition. Same as at the national scale, also within ZKL the production for the rail segment forms an important part of the production. The production of this type of bearings successfully continues the long tradition that is not the only pillar of business development in this sector, but is significantly supported by investments in the development of new products, purchase of modern technologies and reconstruction of manufacturing facilities. This technological development is a prerequisite for ensuring the competitiveness in a dynamically developing railway industry. In the Czech Republic the turnover of this industry is over CZK 70 billion with a growing proportion of exports that exceeded half the production in this sector.

In 2018, several development projects were completed to the stage of operation of a new type of bearings at the end customer.



The most interesting products include a pair of roller bearings for traction motors of diesel electric locomotives PLC 31-11-14 and PLC 31-10-17. The structural design of the bearings uses a massive one-piece brass cage guided on rolling elements. Another successful project was the completion of a new variant of tapered unit TBU 130x230x150, which passed the tests according to the requirements of the EN12082 standard, and is currently in trial operation at the customer's.

Among the most commercially viable territories of ZKL bearings' sales for railway applica-

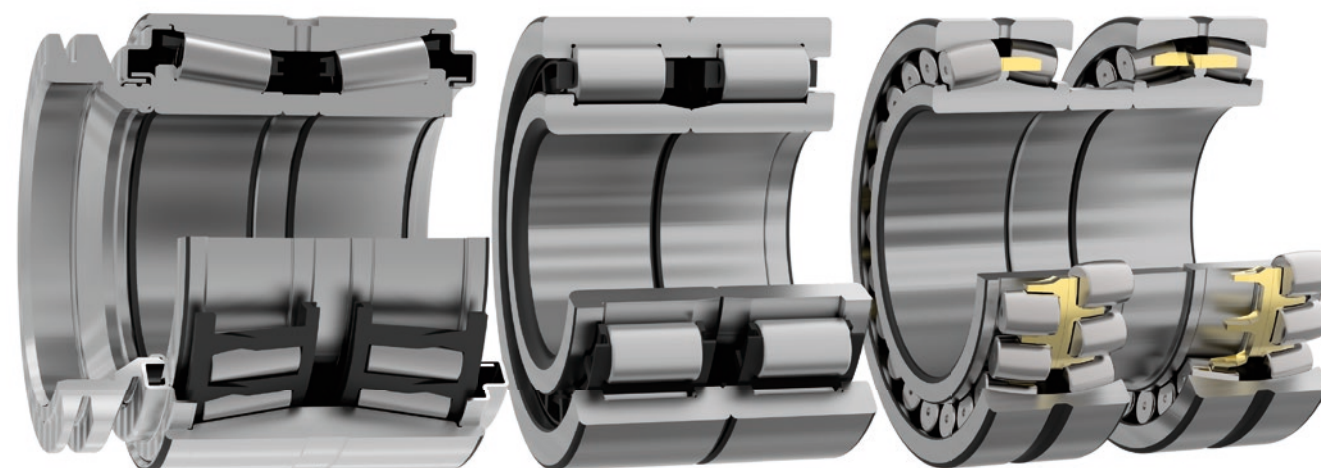
tions were in 2018 the Czech and Slovak Republics, other European countries and the Russian Federation. As concerns the series production, stable base for sales of railway products is represented by cylindrical roller axle box bearings type WJ/WJP 130/240 (PLC 410-33/34.2) or WJ/WJP 120/240 (PLC 410-13/14.2), tapered roller bearing units TBU 130x230 (variants of PLC 810-13), cylindrical roller bearing unit CBU 120x215 (PLC 410-53/54.2) and various cylindrical or spherical roller bearings for traction motors.

The ZKL Group places great emphasis also on the commercial development of new mar-

kets. An example might be the development of cooperation and trade in the railway industry in North America.

Within the Economic Diplomacy Project, ZKL participated in a business mission of Czech companies in Canada in Toronto and Montreal. The mission was organised by the Consulate General of the Czech Republic in Toronto, the Czech Embassy in Ottawa and the Ministry of Industry and Trade of the Czech Republic in cooperation with the Association of Czech Railway Industry (ACRI) and was supported by the Canadian Association of Railway Suppliers. In addition to the participation in the conference and the CUTA Fall Conference and Transit Show exhibition a number of B2B meetings were held with transport companies, engineering companies, end users and repairers of not only rolling stock. In Canada, similarly as in Europe, particularly noticeable is the increase in rail freight transport and the associated growing demand for new vehicles and components. It also allows for the development of transport infrastructure for suburban traffic around Toronto and Montreal.

Ing. Libor Nohál, Ph.D.
Head of Design Department
ZKL – Výzkum a vývoj, a. s.



Main bearings for concrete mixer truck gearboxes

Nowadays, when there is a great development of the building industry, there are also growing demands on the amount of concrete transported from the concrete mixing plant to the construction site. This transport is provided by special vehicles called concrete mixer trucks. These are trucks that are equipped with a rotating drum, where concrete mixture is transported. In order not to alter the consistency of the concrete transported, during the transport the concrete must be mixed which is ensured by slow rotation of the drum during the transport. The key element here is therefore to ensure high reduction of the speed of the drive unit – hydraulic motor onto the drum of the concrete mixer truck whilst ensuring the transmission of large torques. This is achieved by a planetary gearbox that reduces the speed from the value of about 2 500 rpm at the input shaft (the speed of the hydraulic motor) to max. 20 rpm at the output shaft (concrete mixer truck drum speed) at a torque transfer of approximately 80,000 Nm.

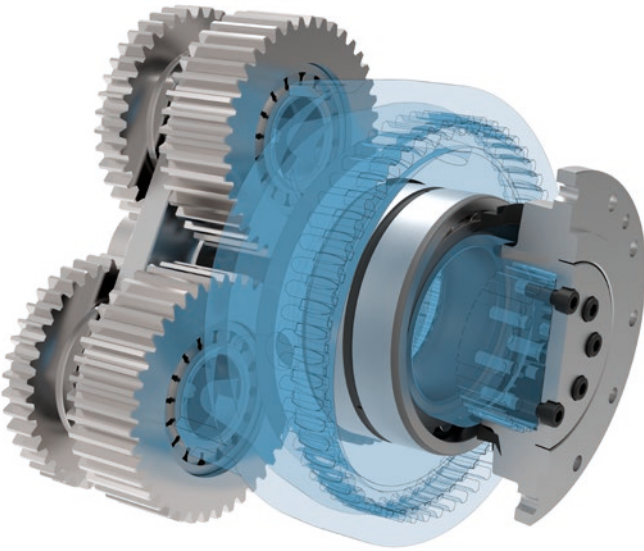
If it is true that the planetary gearbox is a key part of the concrete mixer truck, then the main double row spherical roller bearing is the heart of the gearbox. The reason for this is that the bearing must be able to trans-

mit all the load from the rotating mixer truck drum, including dynamic loads caused by the drive of the vehicle. Under the worst operating conditions that are achieved when driving downhill when the mixer truck additionally brakes, then the load of the bearing may reach up to 60 % of the basic dynamic load rating of the bearing. With regard to the operating conditions and the way how the bearing is mounted, it must be additionally able to ensure mutual tilting of the inner and outer ring of $\pm 4^\circ$. Regular spherical roller bearing is not capable to provide such big mutual tilting of rings. For this reason, bearings developed for this application have an outer ring of the bearing wider than the inner ring. While on the one hand this adjustment can provide the desired tilt, on the other hand it brings difficulties in the manufacture of the bearing itself. To be able to assemble the bearing with a stamped metal cage, the outer ring of the bearing has to be divided transversely. The bearing can then be customised to fit the customer's need, or not to be furnished with a clamp that pulls the outer rings together and facilitates the customer handling of the bearing.

ZKL has been dealing with the development and manufacture of special bearings for supporting the drum of concrete mixer truck for years. Historically other designs of the execution of main bearings were created – e.g. a special double row ball bearing with spherical surface of the outer ring, until the development has stabilised on a double row spherical roller bearing with symmetrical spherical rollers and a wider outer ring. The successful development of cooperation with leading European manufacturers of gearboxes for concrete mixer trucks led to a breakthrough at the turn of 2018 and 2019, when ZKL signed a contract with a customer for the manufacture of 3 dimensional types totalling tens of thousands of units per year.

Ing. Jan Křemen

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



Introducing new methods to increase productivity continues

Last year a project for the implementation of 5S in manufacturing workplaces was initiated. It is a method of lean manufacturing that involves

revision of instruments, tools, documentation at the workplace and workspace layouts. After that changes are proposed within a team where the

subsequent state is recorded so that it can be maintained. At the same time the maintenance plan is reviewed. Changes involve both maintenance workers specialising in mechanical components, electricians and operators of the workplace. The result is a new maintenance plan that has a visual form.

Last year the implementation of 5S method began in some workplaces for grinding rings for mass production and at the rolling elements turnery. Now the main focus is on the turnery and grindery of rings for non-series production. Each workplace is evaluated weekly and at the end of each month the team receives feedback on the compliance with the 5S elements and maintenance, and proposals for further improvements are discussed. Putting the 5S methods into practice we see as a positive result, as we get requests to implement the same system to other workplaces.

Stanislav Kozel

Quality Management Department supervisor
ZKL Brno, a. s.



Latin America

we continue to build sales networks with the aim of further growth in the region



In Latin America we are moving and working in a highly competitive market. Our efforts here will be in the coming period aimed at opening and obtaining new business opportunities, especially in the Pacific region. It is now recognised worldwide for its growth and for cooperation between markets which it only forms. We must attract attention and gain the interest of potential customers so as to become part of the group that has made responsible contribution to attaining the common goals while maintaining mutual respect.

To achieve that, we must continue the path we have taken in the last year. It means, to be as close as possible to users and consumers of

bearings that are, after all, our end customers, who are constantly demanding new and alternative solutions that would effectively accompany their projects. For this purpose and based on proven experience, this year we will participate in selected trade fairs and exhibitions within industries such as mining and agriculture. Step by step, we have been trying to gain position and recognition in those industries not only as a supplier of bearings, but also as a supplier of various solutions and their development.

Therefore, in 2019 we will find ourselves, figuratively speaking, "directly at the machines", i.e. making visits and attend meetings and negotiations with end customers from both the initial

assembly and maintenance. Direct contact is essential to us, as we need to get the information about the needs of our customers first hand. Knowledge and understanding will bring us more possibilities and more opportunities.

Our presence in the market and with end consumers further aims at supporting the excellent work of our official importers who have made great efforts in the distribution of our bearings. Thanks again to each of them, whether they are long-term traditional importers or new importers from countries such as Ecuador and Honduras, with whom we have started working together only in 2018. We want to thank them for their trust and at the same time we want to say to them that in the new period that has just begun we will be present in the markets with the aim of working together as a team.

Pablo Méndez

President

ZKL Rodamientos S.A.



Installation of a new packaging line for ø 32 mm to ø 115 mm bearings

One of the strategic goals of our company ZKL Klášterec nad Ohří, a. s. is the constant pursuit of technological modernisation and renewal of the existing machinery, expansion of the manufacturing capacities and also the initialisation aimed at improving the quality parameters of packaging of the manufactured products. Therefore, we decided to purchase a new packaging line that consists of a packaging machine MOONLIGHT and a cardboard wrapping machine MCTN 2000. The contractor is a foreign business partner – lman-pack, and the total cost for the realisation of the investment is about CZK 9 million.

This new packaging line will replace the existing technology that no longer meets the required expansion of the production range, and will be installed into the existing production flow that consists of a conveyor system, laser marking of bearing components, preservation and further at the exit section of another conveyor with an installed ink marking of the boxes.

During the manufacturing followed by thorough pre-acceptance tests on predetermined representatives, the contractor abroad was pushed considerably by us to be particular about the quality of the packaging of the test production delivered, air exhaust, hermetic closure of the sealed foil, keeping the defined manufacturing pace,

installation of all the safety features, optimisation and unification of the conversion components.

Before the delivery of the packaging line preparatory works were carried out, such as disconnection and displacement of the existing technology, making power service lines, installation of lighting, correction of the preservative and conveyor system, as well as some minor alterations to the entrance to the shipping sector.

After the delivery the line was immediately placed into a prepared manufacturing area and the assembly and installation operations were initiated. The acceptance of the packaging line in ZKL Klášterec nad Ohří, a. s. was launched at the beginning of week 4 in 2019, took one day

and satisfied in its entirety the defined technical and acceptance criteria.

At present the packaging line is after the end of the 14-day trial operation during which no defects were found preventing the acceptance for permanent operation. The so-far trouble-free operation, simplification and acceleration of the line adjustment, along with the compliance with the quality parameters, these are all reasons that assure us that this investment will again be in all aspects a permanent and substantial improvement of our entire manufacturing process.

Josef Jánoš

*Management and Investments Manager,
OHS and FP ZKL Klášterec nad Ohří, a. s.*



Introduction of the authorised network in Russia



Although the Russian Federation is the largest country in the world, including a large part of the Eastern Europe and almost the whole of northern Asia, there is no doubt that the aim of almost every manufacturing company is to have its presence there. Becoming a successful and reputable European manufacturer is however a long-term process, since business relationships do not form in a few months.

ZKL Bearings CZ can already classify directly between those European manufacturers who have succeeded in establishing their name and brand in the Russian Federation and now, in order to maintain the highest level of services, granted the status of the "authorised ZKL brand distributor" to several major companies, among which are (in the alphabetical order):

Inpromservice LLC headquartered in the capital of the Russian Federation; the company is an established supplier of industrial products to customers both from the Russian Federation, as well as abroad, since 1992. It has extensive experience in working with the OEM (Original Equipment Manufacturers) and MRO (Maintenance, Repair, Overhaul) customers from steelmaking, mining, railway and engineering industries. Its representation offices are located in Moscow (Russia), Pavlodar (Kazakhstan) and Tashkent (Uzbekistan) and employ more than 40 employees. As a partner of the ZKL Group since 2006, Inpromservice has been able to provide significant business opportunities not only in the distribution of the standard ZKL products, but also in the development of new types of bearings for the needs of OEM customers.

address: office BV6, Fadeeva str. 4a, Moscow, 125047, Russian Federation
 contact: Mikhail A. Korshunov
 email: korshunov@inpromservice.ru
 web: www.inpromservice.ru

In the European part of the Russian Federation on the left bank of the Volga River, specifically in the town of Samara, there is another authorised distributor of ours **OOO NPP "Promtek"**. The company is a major supplier of bearings not only for industrial enterprises, but specialises also in the supply of cutting tools, machining centres and CNC machine tools, as well as provides a wide range of engineering services. Among the priority clients of the company are the largest Russian and foreign businesses, representatives of the aerospace industry, oil production and other sectors of the national economy. The company supplies roller bearings to industrial enterprises from such segments like engineering, petrochemical, chemical, metallurgy and food industries and other segments.

address: Zavodskoye Shosse, d.53A, Samara, Samarskaya oblast, 443052, Russian Federation
 contact: Daniil Nikolaevich Muraviev
 email: info@npp-promtek.ru
 web: www.npp-promtek.ru

In the East of the European part of the Russian Federation near the Ural Mountains there is yet another of our authorised distributors –

the company **OOO NPP "TIK"** located in the town of Perm. The research and manufacturing enterprise "TIK" began its history in 1961, currently employing about 300 people, and has a manufacturing and storage area of 6400 m². The company specialises in the development and manufacture of vibration sensors, diagnostic systems for rotating equipment, bearings quality management systems and supplies of ZKL bearings. The first steps of our cooperation have begun in 2009 and have been successfully continuing until today. The company supplies almost all industries except agriculture.

address: Marii Zagumennykh str., 14A, 614067, Perm, Russian Federation
 contact: Kuliev Nikolay
 email: kuliev@tik.perm.ru
 web: www.tik.perm.ru

We would like to thank to all of the above mentioned companies for spreading the good reputation and the ZKL brand awareness not only in the Russian market, and we appreciate the excellent long-term cooperation and look forward to new joint projects.

Mgr. Lucie Horváthová
 Export Manager OS 33
 ZKL Bearings CZ, a. s.



Mini projects in ZKL Brno

We always associate the beginning of the year with different resolutions or reviewing the past year. The year 2019 is already in full swing and within the 2018 balancing we have also evaluated the so-called "mini projects". What are they about? It is one of the tools that helps us improve the timeliness of



deliveries, reduce the percentage of rejects, eliminate the risk of occupational accidents or manufacture bearings more efficiently. We're talking here about projects which by their prefix MINI define their scope. Well, they are no fundamental changes in areas such as procurement, logistics, etc. The projects are targeted directly at our workshops and ongoing processes in them. The advantage of this model is that we are able to realise a particular mini project in a short time, and see success in the short term.

Who sets and defines the goals of "mini projects"? The answer is: their members. They are colleagues of middle management and line managers. They come with the intention to change – improve – something, and ultimately, together with the company management, evaluate the impact of the expected changes that is precisely described and expressed in values. One is the quantity of units per month, another one is the project's savings in CZK, or perhaps a reduced number of hours worked per unit of production (quantity, volume in CZK). Each project has a cover sheet that defines the intent, goal, intermediate steps, members and team leader and, of course the financial reward, because we appreciate the initiative. We are building on active approach of our colleagues and their strengths.

Roman Zouhar
 Executive Director ZKL Brno, a. s.

Sealed spherical roller bearings



Not many world manufacturers of bearings offer its customers a special product that, if the selling price was a few tens of percent higher than the price of a standard product, would save in comparison with the standard product the operating costs by hundreds percent. ZKL Group has such a product, and the product is a sealed spherical roller bearing. The advantage over the standard spherical roller bearings is an integrated seal that prevents leakage of grease from the bearing and also protects the bearing from dirt ingress into the bearing and grease contamination. Thanks to that the grease life in the bearing is extended and the amount of grease for the potential re-lubrication of bearing is reduced. The product finds its use especially in applications where during operation there is increased humidity or dust, the tension rollers of belt conveyors in mines, quarries or cement plants, or in pressing and drying cylinders in paper mills and the like. As well as the standard open variation, sealed spherical roller bearing is able to some extent to

maintain relative tiltability of the bearing rings. ZKL generally states in their catalogue the tilt value of $\pm 0.5^\circ$, but in many cases that value is higher and it is always recommended to contact the Technical Support Department to verify it. Likewise, we suggest that you contact the ZKL Technical Support Department when customer shows interest in training in the installation of these products, or should the customer require any further information related to the maintenance and operation of those (under certain conditions the bearings are able of absolutely maintenance-free operation).

ZKL Group began with the development of sealed spherical roller bearings in 2013 and by the end of 2018 a total of 30 dimensional types were released into the production. The potential of those bearings is of course much higher. However, as always there is a rule, that demand determines supply and therefore new dimensional types are released, primarily in the case of larger projects with reference customers. Among the largest is

a Brazilian company Vale which ZKL Group already supplies with 12 dimensional types of sealed spherical roller bearings – for example 22234-2RSHK TM NF or 23164-2RSHK TM NF. Vale is one of the largest global players in ores mining (the largest producer of iron ore and nickel in the world) and power engineering which employs 80,000 employees worldwide. Currently the ZKL sealed spherical roller bearings are mounted to the tension rollers of belt conveyors in the logistics centre of that mining giant – in the city of Vitoria at the Atlantic coast. From there, the mined material is distributed by cargo ships all over the world for further processing. It is in dusty environment and when exposed to moist ocean air that the ZKL sealed spherical roller bearings reach outstanding results. After 5 years of operation the service life of the bearings has shown to increase 2.5 to 3.5 times, compared to standard open bearings. Hand in hand with these results, the aim is to expand to other manufacturing units of Vale, but also towards other customers worldwide.

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



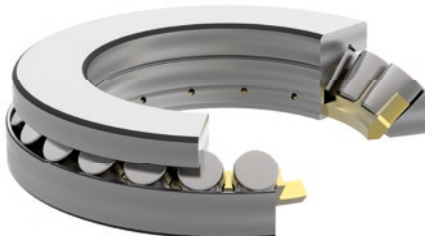
Spherical roller thrust bearings in air preheaters

Regenerative exchangers are heat exchangers that use waste heat to preheat another medium. Those exchangers are often used in thermal power plants, where they make use of waste heat for preheating of air which promotes the thermal reaction (combustion). Thanks to regenerative heat exchangers thermal power plants achieve higher efficiency.

Regenerative heat exchanger consists of one or several discs that are mounted in an enclosed space. One half of that disc is connected to exhaust gases (hot medium) and the other half is connected to the incoming air (heated medium). Rotation of those discs leads to efficient heat exchange between the media, thereby to preheating of the air which enters the thermal reaction.

Regenerative heat exchangers generally operate in harsh conditions, which not only leads to

large fluctuations in temperature, but also to the occurrence of combustion gases and possibly other impurities. For this reason the bearings that allow rotation of discs must meet high quality requirements. Challenging conditions prevail even as far as load is concerned – spherical roller thrust bearings carrying the entire weight of the rotating discs are exposed to high loads that reach up to 50 % of the basic dynamic load rating of the bearing. Another phenomenon of



this application is very low but constant speed. At low speed no hydrodynamic lubricating film usually forms between the rolling elements and the bearing rings, and therefore there is direct contact of the surface roughness of the rolling elements and rings. This also increases the demands on the quality of the bearings, especially on the roughness of the raceways.

ZKL manufactures large-size spherical roller thrust bearings 29488 NF, 294/800EM NF, 294/850EM NF and 294/900EM NF for regenerative heat exchangers for a major company engaged in the design, manufacture and maintenance of equipment for the power engineering and is one of the largest companies of the kind worldwide.

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