

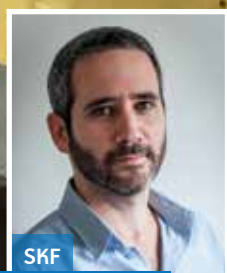
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Bearing NEWS

BEARING INDUSTRY MAGAZINE

SPECIAL EDITION

ISSUE 202018 • P918438



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EITAN VEELY

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EXPO
& B2B
meetings**

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Online BEARING EXPO & B2B MEETINGS in 2021

Together with this new special edition of the BearingNEWS magazine, I am pleased to announce the online BEARING EXPO & B2B MEETINGS event on 15 – 17 March 2021. BEARING EXPO & B2B MEETINGS is a unique chance and perfect opportunity to catch the moment and expand bearing and power transmission companies digital presence worldwide through this first ever, top tier online organization.

Do not let the travel restrictions thwart your product launch or B2B meeting plans during 2021. BEARING EXPO & B2B MEETINGS will cover speed networking meetings with manufacturers, distributors, solution providers, OEM and MRO companies. Attendees will be able to communicate by one-on-one video meetings, search for products and solutions at the exhibition area, join the commercial and technical presentations or shoot their questions during “ask the expert” panels.

Further in this issue, you can read the first part of our exclusive interview series regarding the application of artificial intelligence and machine-learning in the bearing industry. The first interview is held with Eitan Vesely, the AI Offering Manager at SKF. He explained us how machine learning-based predictive maintenance changes the game in the bearing industry. A must-read

interview that highlights the current technological level and where the bearing industry is heading to.

Mergers & Acquisitions

More than ever before, small, and medium size bearing, and power transmission companies are willing to move into strategic mergers and long-term partnerships. An overview of M&A projects and specific acquisition searches by ICT Advisory Division can be read on page 40-41.

What's Rolling..

What's rolling further in the bearing industry? A brief summary of the latest news updates, more details about key companies and trends in the global bearing industry... and special case studies can be read in this issue of the BearingNEWS magazine.

I hope that you will enjoy it!

Kenan M. Özcan
Editor in Chief



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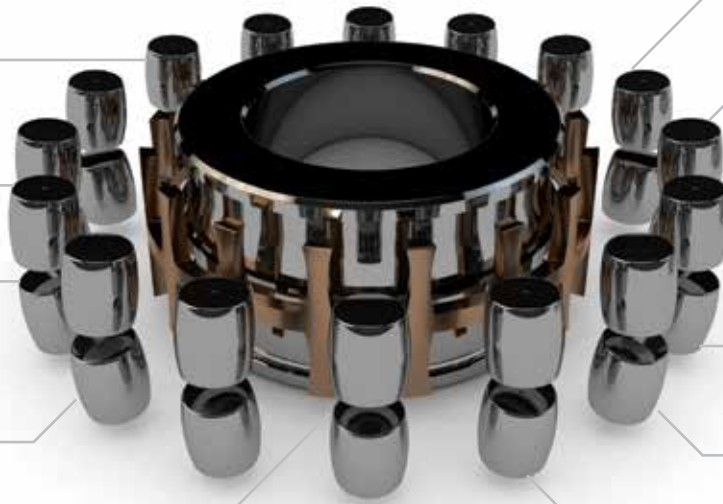
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A close-up photograph of a colony of ants on a green leaf, with the text 'Bearings for productivity' overlaid in large white letters.

Bearings for productivity



Get to know our bearings at www.koyo.eu

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Thin Section Bearings

Boost Medical Device Performance

When a major manufacturer of medical machinery needed to minimise the size of its equipment it turned to Oxford-based Carter Bearings for some solutions.



—Blood centrifuges are just one of many medical device applications in which thin-section bearings from Carter have delivered design advantages

*—Thin-section bearings from Carter are
available in sizes from 1" OD up to 40" OD*



With hospital space at a premium even before the advent of any surges in demand, the need to maximise ward, bed, theatre and laboratory space by minimising the size of medical machinery has rarely been of greater significance than it is today. Unsurprisingly, just as personal electronic devices and household electrical items have got both smaller and thinner over recent times, the combination of clever design and advances in materials technology has seen the physical size of many vital medical and laboratory devices reduce too.

So when a well respected manufacturer of proprietary disinfection and decontamination cells recently needed to design all-new medical devices as part of a larger installation, attention turned to an aspect of design frequently overlooked in many industrial applications where size doesn't really matter. The challenge was finding the thinnest possible bearing that could also allow the critical machinery it was installed in to deliver the highest positional accuracy over an extended lifetime. The design brief centred around applying these joint demands of reduced space and high precision into two key parts of the new cell.

The first application was a medical decontamination device for the containment of potentially contaminated matter in the form of human tissue or blood samples from patients. In this project, the bearing was required to facilitate precision rotation in a design that permitted ease of operator use to reduce the possibility human error. The second application in the cell was on an associated blood analyser, which called for a super thin bearing that could provide the required accuracy and precision to the testing element of the analyser: high positional accuracy was vital in order for the unit to provide accurate test results, whilst at the same time streamlining workflow and easing maintenance. The design of both devices demanded ultra-high positioning precision combined with the ability to deliver consistent repeatability over a lengthy service life. Additionally, the design brief also required the smallest possible physical size for the machines, together with a stipulation that the blood analysing device was required to spin inside a maximum radius of just 14".

Engineers at the Silverthin Bearing company, (part of the Mechatronics Group and represented in Europe by Oxford-based Carter Bearings) conducted trials using a shortlist drawn from its range of potentially suitable high precision thin section bearings before recommending the perfect match for the application.

Mel Meader, Technical Operations Manager at Carter Bearings and UK Silverthin expert observed "All Silverthin bearings are manufactured to ABEC Standard using premium quality materials that are sourced only in the United States. This provides users with an absolute guarantee of the material integrity and therefore the longevity of a Silverthin bearing, and is a key reason why they have achieved such a reputation for high accuracy and long service life". Mel points to another recent medical device application as a further example of the accuracy that can be delivered by Silverthin bearings. "They were specified for use in a laser eye scanning machine, helping to move the scanner from the absolute centre of one eye across to the precise centre of the other with positioning measured to within microns" he says.

Silverthin precision thin section bearings are manufactured in a variety standard configurations, and can be specified as either sealed or unsealed units depending on individual design requirements. In the case of the medical device applications mentioned here, sealed units were specified given the environment in which the machines must work. Precision thin section bearings are available in four types from the company to suit most applications.

In environments with axial loads present in one direction, the A-Type angular contact ball bearing is recommended, and this bearing also works well in radial or combined radial-thrust applications. However, Silverthin points out that the A-Type bearing should never be used alone to support moment loads or reversing axial loading. For these applications Type C Radial Contact bearings are recommended: they are designed with deep ball grooves specifically to withstand high loads. Although this bearing is used primarily in applications with radial loads, it can also withstand moderate axial loads, reversing axial loads, and moment loads too.

However, for applications where significant moment loads will prevail, Silverthin recommends that designers consider its Type 'X' 4-Point Contact precision products.

The X-Type, or 4-point contact, ball bearing is ideal for moment loading applications and is designed with 'Gothic arch' raceways to create four contact points between the balls and the raceways. This design is stated to be excellent for moment loading and also reversing axial loading. Carter says that the X-Type bearing can be used for other light loading conditions, but is not recommended in place of the C- or A-Type bearing for pure radial loads.

As a general rule, Silverthin advises that when specifying this type of bearing for use with axial or moment loads combined with radial loads, the application speed (rpm) should be carefully considered. The engineering department at Carter's Oxford facility has extensive data available and can supply information on combined load and limiting speeds. Carter can also advise on radial bearing use with combined radial loads with axial or moment loading and for limiting speeds and separator selection. Mel Meader continues "Although in the medical applications discussed here single thin section bearings were used, it is not uncommon for two A-Type bearings to be used as a duplex pair to suit the demands of certain installations. There are many different configurations for duplex bearings which designers can benefit from, and these are shown in our (readily available and free) data sheets. We can provide application advice on all aspects of thin section bearings and are particularly well set to deal with design challenges where space is at a premium and repeatability with absolute accuracy is vital over prolonged periods of time with high usage".

Thin section bearings from Silverthin are supplied by Carter in sizes from 1" ID to 40" OD and have been specified for uses that are as light as miniature gimbal mounts on satellites right up to 40" OD items used on large rotary tables in both civilian and military applications.

More information from: Mel Meader, Carter Manufacturing 0044 1865 821720 or visit www.carterbearings.co.uk

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How to avoid hidden costs by using precision bearings

As industrial companies are looking to save costs across their system and plants, one of the most important actions a manufacturer can take is to consider the total cost of ownership (TCO) of its components. In this article, Allen Dowers, VP Sales & Applications Engineering at The Barden Corporation explains how this calculation ensures engineers can avoid hidden costs and operate as economically as possible.

TCO is a well-established calculation that, in today's economic climate, is more significant than ever before. This accounting method assesses the whole value of a component or solution, weighing up its initial purchase cost versus its overall running and lifecycle cost.

A lower value component may seem more attractive initially, but it can give a false sense of economy as it may require

more frequent maintenance, and these associated costs can quickly add up. On the other hand, higher value components are likely to be of higher quality, more reliable and therefore have lower running costs, resulting in a lower overall TCO.

TCO can be heavily influenced by the design of the component or sub-assembly, even if that component represents only a small fraction of the total cost of a machine or system. One component that can have a significant positive impact on TCO is bearings. Today's high technology bearings offer many improved features that enable reductions in TCO to be achieved, providing benefits to both OEMs and end users – despite an overall higher bearing price.

The whole life cost is made up from initial purchase price, installation costs, energy

costs, operation costs, maintenance costs (routine and planned), downtime costs, environmental costs and disposal costs. Considering each of these in turn goes a long way to reducing TCO.



Engaging with the supplier

Arguably the most important factor for minimising TCO is involving suppliers from the outset of a project. When specifying components, such as bearings, it is vital to engage with the component manufacturer at the beginning of design process to ensure the part is fit for purpose and will operate with minimal losses and provide a low total cost of ownership without hidden costs.

Low losses

Friction torque and frictional losses are a major contributor to system efficiency. Bearings that exhibit wear, excess noise and vibration, will be inefficient and consume more energy to run.

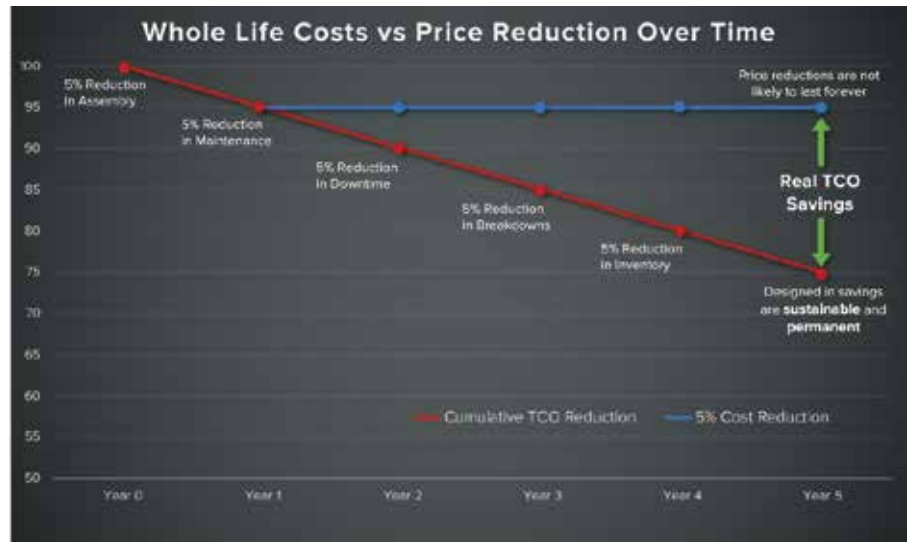
One way to use power efficiently and reduce energy costs is to consider low-wear and low-friction bearings. These bearings can be designed to reduce friction by up to 80%, with low friction greases seals and special cages.

There are also some advanced features which add further value over the life of a bearing system. For example, super-finished raceways improve bearing lubrication film generation, and anti-rotation features prevent bearing rotation in applications with rapid changes in speed and direction. Including bearing systems that require less power to drive, will be more energy efficient and save operators significant running costs. Furthermore, bearings that exhibit higher friction and wear will risk premature failure, and associated downtime.

Reduce maintenance and downtime

Downtime – both from planned and unplanned maintenance – can be extremely costly, and can quickly escalate, especially if the bearing is in a manufacturing process that runs 24/7. However, this can be avoided by selecting more reliable bearings capable of delivering high performance over a longer-life time.

A bearing system comprises many elements including balls, rings and cages and to improve reliability each part needs to be carefully reviewed. In particular, lubrication, materials, and coatings need to be considered so bearings can



be best configured for the application to provide excellent long-life performance.

Precision bearings designed with high quality parts will deliver excellent reliability, contribute towards reducing potential bearing failure, require less maintenance and resulting downtime.

Simplified installation

Additional costs can be incurred when purchasing from and dealing with multiple suppliers. These costs in the supply chain can be streamlined and reduced by specifying and integrating components from a single source.

For example, for bearing components such as bearings, spacers and precision ground springs, designers would typically liaise with a couple of suppliers, and have multiple sets of paper work and stock, taking up time to process and space in the warehouse.

However, modular designs from one supplier are possible. Bearing manufacturers that can incorporate the surrounding components in one final part simplifies customer installation significantly and reduces the parts count.

Adding value

The influence of an improved design in reducing TCO can be significant as designed-in savings are often sustainable and permanent. For example, a 5% price reduction from a bearing supplier held at that reduced price over five years is not

likely to last beyond that point. However, a 5% reduction in assembly time/costs, or a 5% reduction in maintenance costs, breakdowns, stock levels etc over the same five-year period is much more desirable to the operator. Sustained reductions over the life of the system or equipment are worth far more to the operator in terms of savings rather than a reduction in the initial purchase price of the bearings.

Conclusion

The initial purchase cost of a bearing is very small considering the costs of its lifetime. While the initial purchase price of an advanced bearing solution will be higher than a standard bearing, the potential savings that can be achieved throughout its lifetime more than outweigh the initial higher cost. An improved bearing design can have value-added effects for end users, including improved logistics, improved reliability and operating life, reduced maintenance or assembly times. This ultimately results in a lower TCO.

Precision bearings from The Barden Corporation are highly reliable, therefore last longer and are more economical with overall lower cost. To minimise total cost of ownership, avoiding hidden costs is crucial. Contacting the component supplier at the start of the design process will make sure the bearing is properly selected and will provide a long, reliable life.

For further information visit www.bardenbearings.co.uk.

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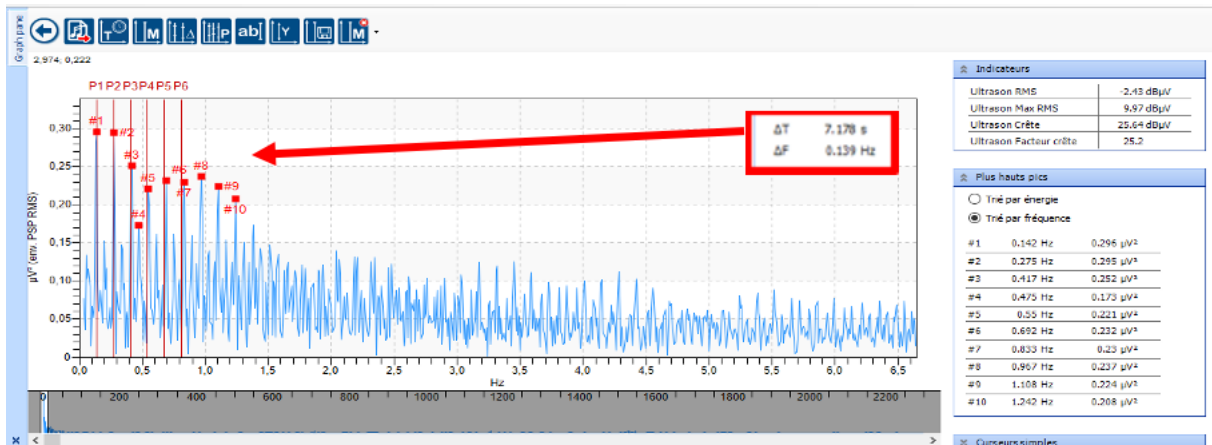
Low Rotation Speed Machine Control Using Ultrasound

The founding principle of predictive maintenance could be **“better safe than sorry”**. It requires sound knowledge of the machines, taking into account of early signs and economic realism.

Today, predictive maintenance is based on different technologies that maintenance departments can use to assess failure risks, frequency ratio and severity level.

But it's another matter when it comes to selecting the right analysis tools, the right technology and the right indicators for the early detection of a failure on a rotating machine, in particular low-speed machines. Ultrasonic technology is used to issue this diagnosis, as it can be easily and efficiently implemented.





Recently, SDT International took up this challenge on a rotating machine with a rotation speed of 8 RPM. More than a week earlier, the maintenance department of a world-renowned company had detected unusual noise on a strategic production asset. The sudden stop of this machine would have led to the complete shutdown of the production site. Not to mention the financial cost of replacing these 4 bearings, the time required for the procurement of these specific bearings and the cost of the maintenance labour. There was a dual stake here: control the condition of these bearings and attempt to detect the origin of this noise. A diagnosis could be issued using the new ultrasonic measuring instrument,

SDT340, and its FOCUS mode that can generate sampling frequencies up to 256 K samples per second.

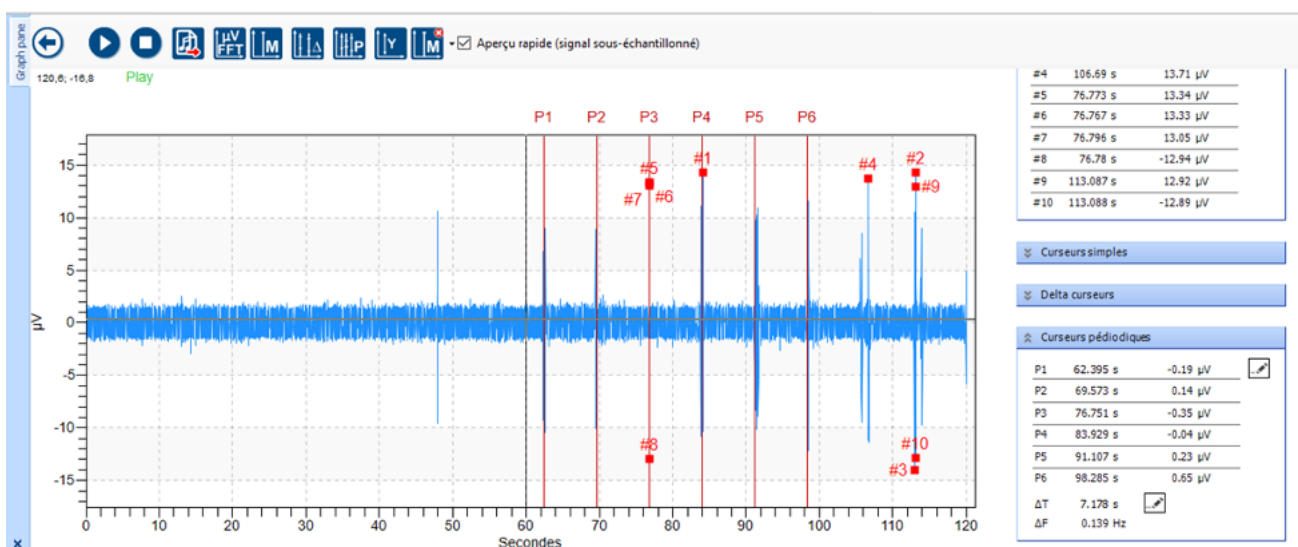
The spectrum shows an impact at the rotation speed (0.139 Hz) of the shafts of the rotating machine, along with its harmonics. Sub-harmonic frequencies can also be observed at 0.5 x the rotation speed, which is a characteristic spectrum for a rotational clearance due to friction or significant impacts. No impact due to bearing frequencies are observed. Our diagnosis is confirmed by the time spectrum.

The time spectrum shows that the observed impacts are indeed associated with the rotation speed of

the shafts of the machine at 0.139 Hz, i.e., a rotation speed of 8.34 RPM.

In terms of energy, these impacts are not necessarily constant for each shaft revolution (time signal recorded over a period of 2 minutes). The encountered problem is due to the wear of the shafts and of the disks that are mounted onto these shafts and generate friction. Now, the maintenance department knows the origin of the noise and the condition of the bearings, which just need to be monitored on a periodic basis.

For further information please visit www.sdtultrasound.com





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For more information on McGill cam followers or other McGill products, visit:

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World's Most Dependable Water Lubricated Bearing

It is somewhere no engineer or maintenance team wants to be – staring down the shaft at another failed bearing. Regardless of the circumstance, you are faced with costly unplanned repairs, all because of repeated bearing failures.

Fortunately, there is a bearing solution that is unmatched in longevity, reliability, and performance in extreme operating environments: Lignum vitae. It does not rely on oil, filters, coatings and other costly equipment or material that require ongoing maintenance contracts and expensive repairs.

Bob Shortridge the founder and President of Lignum Vitae North America sat down to provide us with answers to some important questions.



to extreme and dynamic operating environments with less than perfect shafts. It is startlingly that simple. Many hydro plants are over 100 years old and many ships are over 30 making ongoing maintenance more challenging as time goes by.

Unfortunately, there is no current ranking system for water lubricated bearings but instead industries rely on the G-77 Block on Ring Test. This test is conducted in a laboratory setting at 70 degrees on a balanced, polished mandrel at a set speed with deionized water. In other words, an environment that does not exist in the real world. This test, however flawed, is where all data is obtained for large rotating shafts without consideration of water quality, PH, temperature, impurities, imbalance, or alignment.

Unlike many composite or oil-based bearings available today, our bearings are water lubricated, require no filtering, are produced without harmful VOCs, toxic metals, or chemicals, and remove the risk to air, water, and landfills.

Tell us about Lignum Vitae North America

Lignum vitae was founded in 2005 when a friend asked if I was interested in bidding on 2 ½ tons of lignum vitae material at the Norfolk Naval shipyard pattern-makers shop. Having knowledge of the material I won the bid and was immediately intrigued with the weight and density of the wood.

Research lead me to some of the most brilliant engineers Thomas Edison, George Westinghouse, the US Navy, the Army Corps of Engineers and the Society of Naval Architects and Marine engineers, making me recognize the significance of lignum vitae. Never did I imagine a heavy wood could be central to solving the most challenging water lubricated bearing problems facing today's industry. As it turned out the market was ripe for a new product and the reintroduction of the world's FIRST and most dependable water lubricated bearing. I learned later the challenges associated with building a business model around a bearing capable of surviving the entire life of the machine and may

not be replaced in my lifetime.

Lignum Vitae North America is the exclusive global supplier of premium water lubricated seals and bearings for the marine, water treatment and hydro-electric industries worldwide.

Lignum vitae holds the highest environmental ranking for NSF/ANSI 61: Drinking Water System Components – for water treatment plants.

Our engineered ABS / DNV-GL approved bearings are only manufactured with genuine lignum vitae, known to be the most steel friendly material for shaft bearings, in a way that is sustainable, renewable, easily replaced, economical, environmentally friendly, and most importantly time proven in everything from aircraft carriers to hanger bearings.

What makes lignum vitae material so different from other materials?

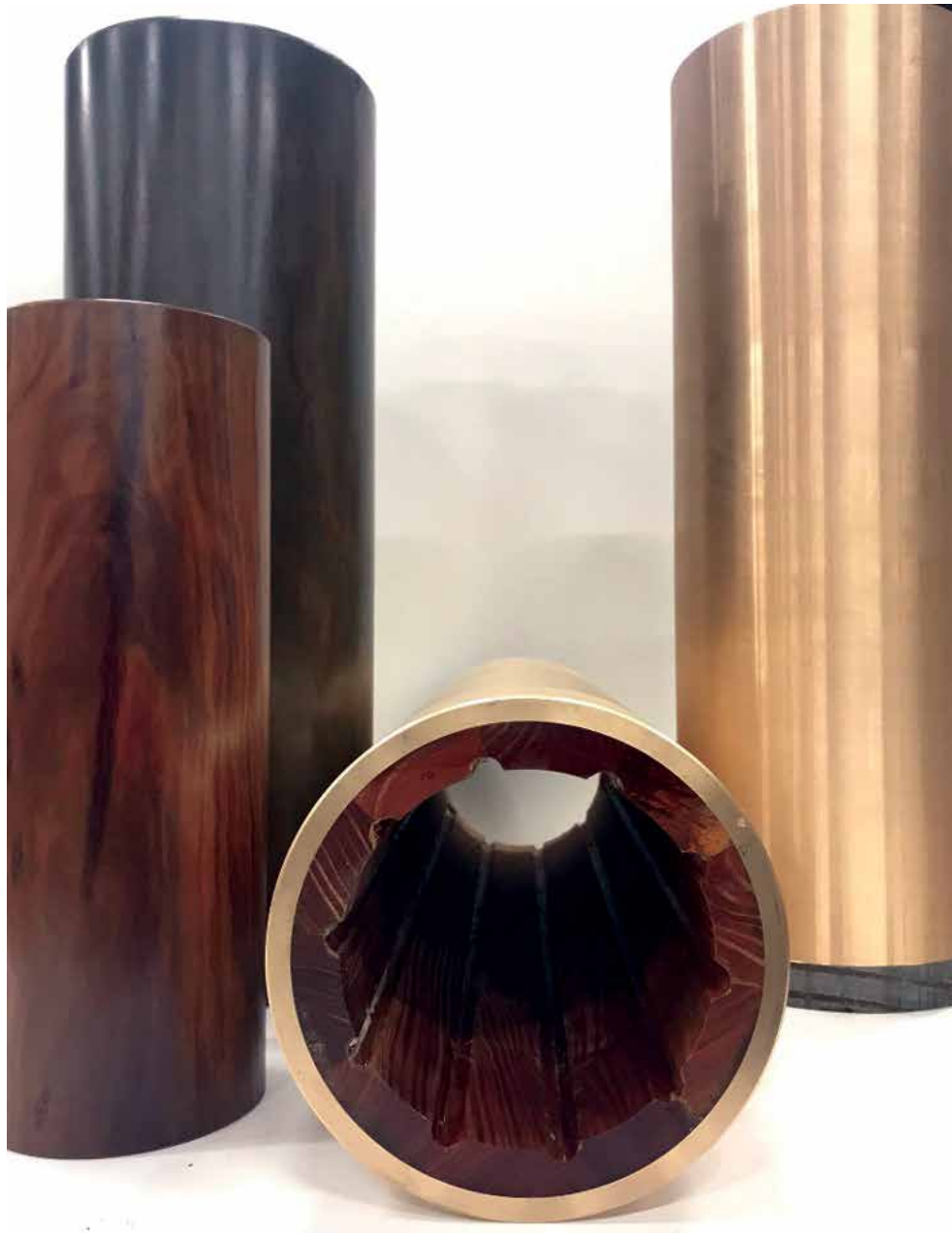
Bearings made from lignum vitae, simply put, are self-lubricating in water and conform by self-healing. The nature of the material is inherently able to adapt

What does it mean to conform?

It is the only material that conforms to an imperfect shaft and operating environment without costly shaft removal offering the long-term performance that operators require.

Each Bearing solution has a different molecular structure with different strengths and weaknesses. Metallic bearings require oil or grease and are subject to failure with just 2% water intrusion. Even after 100 years plastics and polymers remain an ongoing experiment with over 30 different chemicals in play attempting to overcome friction, add lubricity, adjust hardness, avoid scoring, avoid swelling and seizing shafts, the experiment continues to this day.

Lignum vitae is an anomaly of Nature and is the only known wood with no silica and thus is free from abrasion; it has an innate lubricity originating from Guaiac resin imbued in every cell; and a hardness like aluminum, based on its long-chain tenacious molecular cellulose structure. The mixture of the smooth resin bound up in an extremely dense cellulose structure



yields a natural bearing material with a high lubricity and a massive compression strength. Manufactured plastics have not achieved the required cell by cell, molecule by molecule formation nature provides which instead results in voids of structure, tenacity, and lubricity.

How can operators determine if lignum vitae is the right solution for their needs?

Call us and ask. Our business has been built by focusing on problem machines with repeat failures. Our basic philosophy revolves around the idea that if we can get

your “problem machine” operational we have an opportunity to earn more of your business. We are problem solvers at heart – and we are not satisfied until we have found the right solution. Everyone on our team shares a singular passion – to identify a challenge, and then dig in until we can find the solution – and we’ve heard from our customers that this collaborative and personalized approach sets our team apart.

Our 13,000 square ft. facility features state-of-the-art technology to meet the growing global demand and enhance production capabilities. With an eye toward solving problems our R & D is

uncovering additional uses of lignum vitae. Recently our team went to work when a valued customer revealed having mechanical seal failures within minutes and hours of startup. After months of trials and testing, LVNA is now producing mechanical seals in unlimited diameters. Our robust seals will operate in both wet and dry applications and could care less if a fingerprint gets on it.

Short service life, degradation, and poor performance issues in synthetic or composite bearings and seals do not have to be the new norm in today’s environments.

The background of the entire image is a blurred industrial setting. In the foreground, a worker in blue overalls is partially visible, standing next to a long, white industrial machine. The machine has several black rollers and a long metal rail extending from it. In the background, there are more industrial structures, including a yellow forklift and various pipes and lights, all out of focus.

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PICARD
VILLAGES • ROULEMENTS • BEARINGS



Friedrich PICARD GmbH & Co. KG in Bochum, Germany, is renowned for its bespoke linear motion technology solutions and for offering its customers service of the highest quality. One of the reasons for this is its in-house PICARD linear motion technology centre, which covers an area of roughly 600 sq m (6,500 sq ft).

Equipped with two fully automated cutting machines and expertly qualified personnel, the centre provides first-class customer service. Located in Germany's Ruhr region, it boasts many key strengths, including a comprehensive stock of linear rails and shafts from six premium manufacturers along with corresponding guiding carriages, traceability of all rails by data matrix codes (DMCs), a linear rail configurator, and exceptionally quick delivery.





An outstanding product range

The centre's extensive assortment includes ball bearing slides and roller guides, miniature guides, flat and telescopic slide rails, as well as shaft guides, from premium manufacturers BOSCH Rexroth, INA, THK, NSK, SCHNEEBERGER and EWELLIX, along with the corresponding guiding carriages and ball bushings. PICARD stocks all standard sizes, from 7 to 65 millimetres. Guideways and shafts can be supplied up to a length of 7,000 millimetres.

With the linear configurator provided in the PICARD online shop, customers can fulfil their particular requirements quickly and easily by entering the rails they require, along with quantities, precise lengths, as well as the offset space ahead of the first borehole. Prices and availability are then instantly displayed. The ordered rails are cut precisely to size and securely packed. All ball bearing rails and roller slides that are cut to length in the PICARD linear motion technology centre also feature a chamfer, which makes it easier to insert the guiding carriages that durably protect the tight-fitting seals. At PICARD, precision cutting and professional packing are included in the price of every order.

Truly exceptional customer service: linear configurator also available as a plugin

To enable PICARD customers to offer the same service to their own customers

when ordering a linear rail or shaft, PICARD provides them with the option of integrating its Lineato linear configurator as an iFrame in the customer's own online shop. This means that each dealer's end-customers can configure the rails they need in the desired quantity and with the required dimensions. Parts availability is also queried via API interfaces with the PICARD system and displayed in real time, along with price information when required. The linear configurator is available in 14 languages, and its colours can also be adapted to the customer's corporate design. After all, PICARD always delivers the very best service.

Perfectly planned logistics

The logistics provided by Friedrich PICARD GmbH & Co. KG is also highly sophisticated – and exceptionally quick. The following applies to all linear motion technology orders up to a length of 2,600 millimetres: If the customer orders by 7 p.m. from Monday to Friday, PICARD ships the order the same day - with guaranteed delivery the following day by UPS Express. When a rail is required on the same day, PICARD can provide courier delivery up to a length of 4,000 millimetres; if necessary, even to the end-customer directly. Anything quicker is practically impossible.

Precise DMC labelling of all PICARD linear rails

Since December 2020, all linear rails and shafts supplied by PICARD are lasered



with a data matrix code label. The code corresponds to the article identification of the WBA manufacturers. All DMCs can be read with the WBA's authentication app, as well as with PICARD's own ProScan system, which was specially developed for verifying and serialising products. This DMC scanning procedure ensures precise traceability of all PICARD rails. It also enables a product's technical information such as dimensions, boreholes, product illustrations, and manufacturer to be called up. This type of labelling is an exceptional step forward, as not even the manufacturers themselves mark their rails with such specific identification.

With its linear motion technology centre, PICARD has once again demonstrated its spirit of forward-looking innovation – and thereby strengthened its position as a preferred partner of the specialised trade.



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IKO Super Slim Crossed Roller Bearings

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New! CRBT 105, 155, 205, 305, 405, 505 A

Thanks to **IKO**'s technological expertise in miniature bearing production. Ultra High rigidity, yet compact as they are, the rigidity is increased 3 to 4 times compared to double-row angular contact bearings.

Crossed Roller Bearings are have alternately crossed at right angles rollers between the inner and outer rings. The orthogonal array of rollers allows the bearing to handle complex loads from any direction.



IKO

experts in
MOTION





— An impressive new factory which will meet the needs of international customers will be built in the coming months.

CSC BEARING - New "Precision Bearing Production Project" started

CSC is strongly growing! The New Precision Bearing Production Project in Changshu was just kicked off.

With a total investment of over 200 million in RMB and an extension of space by more than 25,000m² to the already existing 130,000m² this new plant is a key project for CSC Bearing.

The new factory is a milestone for CSC in order to enlarge the output of precision bearings and to offer a wider range of products. Smaller bores, new materials and advanced bearing designs will be offered in the future. The completion and operation of the project will meet the needs of international and domestic customers in aerospace, intelligent manufacturing, machine tool spindles, medical care, food machinery and other fields, and provide customers with better services.

CSC Bearing is once again standing at a new starting point of development. It will expand the production capacity of precision bearings, enhance the

core competitiveness of CSC Bearing products, meet the national industrial development direction and requirements, and meet the needs of customers worldwide. CSC is convinced that this

new building will further improve the precision bearing quality level and become the first echelon of precision bearing manufacturers preferred by domestic and international customers.



Meeting clean energy directives – CSC goes green!

An increasing global demand for natural resources and the inherent challenges accompanying this demand pose a great task for manufacturing companies. Fortunately, at CSC sustainability isn't just a catch word. The new CSC factory will meet clean energy directives and by that not only improve the environment and preserve natural resources, it also enhances the competitiveness in a global market. To be more precise: at CSC sustainability covers the four areas energy, sourcing, water and waste: An encouraging sign for the future!



– CSC Europe GmbH in Germany



– KAT CEO Stefan Besendorf on the left and CSC Europe CEO Dr. Markus Wolf next to the new testrig).

New Highspeed – Testrig

In cooperation with the company KAT (Kraus Automatisierungstechnik GmbH) CSC Europe GmbH in Germany expands its test facilities with a Highspeed Testrig for spindle Bearings Oswald Bayer, Senior head of R&D developed this more advanced test

rig together with KAT and states “This is a big step forward enabling us to test spindle bearings with a revolution speed more than 2.5 Mio ndm value (grease lubricated) and thus get more precise information for further improvement of new bearing generations.”

New grinding machines

CSC is continuously investing in high-end production equipment to meet customer needs when it comes to having higher machining efficiencies and higher machining accuracies. Therefore, in October a contract with the German company G&N for new grinding machines was signed emphasizing once more that the demand for quality is a high priority in the CSC production process.

Investing in the future – CSC Europe GmbH

The CSC office in Germany is responsible for R&D and quality guidelines, logistics and customer support all over Europe.

In order to be prepared for the future and to provide customers with the best possible service, CSC has invested massively in Germany in recent months: A spacious warehouse with a large selection of different bearing types, enhancing logistics capabilities, offices and an enlarged Research & Development Center with its own measuring laboratory have been built there. And there will be more: Managing director Dr. Markus Wolf is very pleased to announce: “In addition to the large selection of spindle bearings made of steel and ceramics, CSC Europe will also offer a wide range of high-speed bearing types directly from stock starting in 2021, such as HC, HS, HSS or HCS.”



— In September, the foundation ceremony for “New Precision Bearing Production Project” was held. CSC President and CEO Zhu Keming (picture) gave the starting signal for the new factory.

About CSC

For more than six decades, CSC Bearing has been a manufacturer of rolling bearings, deep groove ball bearings and high precision bearings with currently annual sales of approximately USD 100 million and more than 1000 employees worldwide. CSC operates offices in Europe & Asia: On an area of over 130,000 sqm, CSC manufactures rolling bearings for the world market.

Join the team!

Currently CSC Europe is looking for passionate and dynamic ‘Area Sales Representatives’ in Poland, Northern Italy, France, the UK, Scandinavia and Benelux Countries. Interested parties should have a technical understanding sales experience in bearings and enjoy working with people. Working place would be the homeoffice in the respective country with the appropriate equipment being provided by CSC. All CSC employees will receive intensive, individual training and professional training measures: Interested? Please contact us at jobs@csc-bearing.eu or call Ms. Nicole Zink at +49 9383 873 9001

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CSC is a producer of high- and superprecision bearings with an annual turnover of almost 100 Mio. USD worldwide. EU Headquarter, R&D center and warehouse in Germany.



CSC

CSC Bearing Europe GmbH



Machine learning-based predictive maintenance changes the game in the bearing industry

On 7 October 2020, SKF announced AutoML, software that uses artificial intelligence (AI) to accurately predict mechanical failures in order to optimise maintenance and production processes.

AutoML (Automated Machine Learning) applies Machine Learning algorithms to real-time process data to identify anomalies and warn technicians of evolving asset failures. AI is responsible for choosing which machine learning models are applied and maintaining these models while they run in production. This capability enables quicker modelling and higher accuracy.

Almost a year after it was acquired by SKF we spoke to the Co-Founder of Presenso, Eitan Vesely (now AI Offering Manager at SKF) to learn more about the latest AI technology, how it will benefit SKF's customers and how it will affect the future of the bearings industry.



Eitan Vesely,
SKF AI Offering Manager

Has AutoML already been widely applied to customers or is it still in the early stages of adoption?

The technology has been applied to several customers, including those that Presenso was working with before the acquisition — but it has not yet been widely applied. We are in the early days of scaling the project. Right now, we're at the point where we're starting to look at hundreds and thousands of machines per customers.

How will artificial intelligence affect the overall accepted manufacturing models?

First of all, the effect would be on creating a streamlined production process. So customers are able to use AI and other predictive maintenance technologies to help run a continuous production process with significantly less, or even zero, unplanned downtime.

What is AutoML and how does it work?

AutoML stands for Automated Machine Learning. One of the bottlenecks in upscaling any solution or technology is manual labour. So if machine learning is deployed by human data, with scientists working with the data and manually building AI models, they would then need to manually maintain and configure them to ensure that they perform correctly. AutoML takes around 95% of the work that human data scientists have to do and automates it. So we're pretty much unlocking the bottleneck for scaling AI models and AI solutions.

How can you create the synergy between process data and vibration data, or between Presenso and SKF?

That's a good question. First of all, there are different types of failure modes that are predicted by each set of data. For example, there is a range of failure modes that go unseen by vibration data alone and this is where the process data comes in handy.

What we have been able to prove in the last few months is that using both vibration and process data extends the scope of failures that are able to be predicted. Secondly, the value comes

“ We're talking about connecting and monitoring the performance of hundreds of millions of bearings. ”

from contextualising one's findings.

Let's say that an anomaly is identified in the vibration data, now we have the capability to contextualise it with the process data. Basically, we have two different models looking at the same process, which enables us to better understand the events that are seen in both sets of data, creating strong synergies between both aspects.

How do you foresee AI technology changing the bearing industry as a whole?

First of all, we're talking about connecting hundreds of millions of bearings (with millions more being added every year) to the rotating equipment performance offered. On these scales, AI acts as an enabler and plays a very important part in the process of serving our customers on these magnitudes.

What's the difference between SKF AI and Enlight AI?

SKF AI has several responsibilities, one is to develop our offers to the customers in order to support and serve their rotating equipment performance offer.

The second responsibility is to internally automate the work that is being done today on data — in order to upscale it and make internal processes more efficient.

The third responsibility of SKF AI is to find solutions that will optimise the efficiency of our operations, mostly on the manufacturing floor and

increase quality assurance. Enlight AI on the other hand is one offer, or one responsibility, under SKF AI.

Could you summarise the benefits of SKF AI and Enlight AI for customers?

Through Enlight AI, we're able to predict more failures, further in advance, by using the combination of process and vibration data. Furthermore, we're able to cross-examine the data-driven conclusions with the knowledge of human SKF experts. With that, we're able to predict a much broader scope of failures for our customers.

In terms of SKF AI, there is a lot of work going on to automate manual work in order to upscale our ability to serve more customers and more machines. We're also using it to develop solutions that will optimise the efficiency of our own manufacturing.

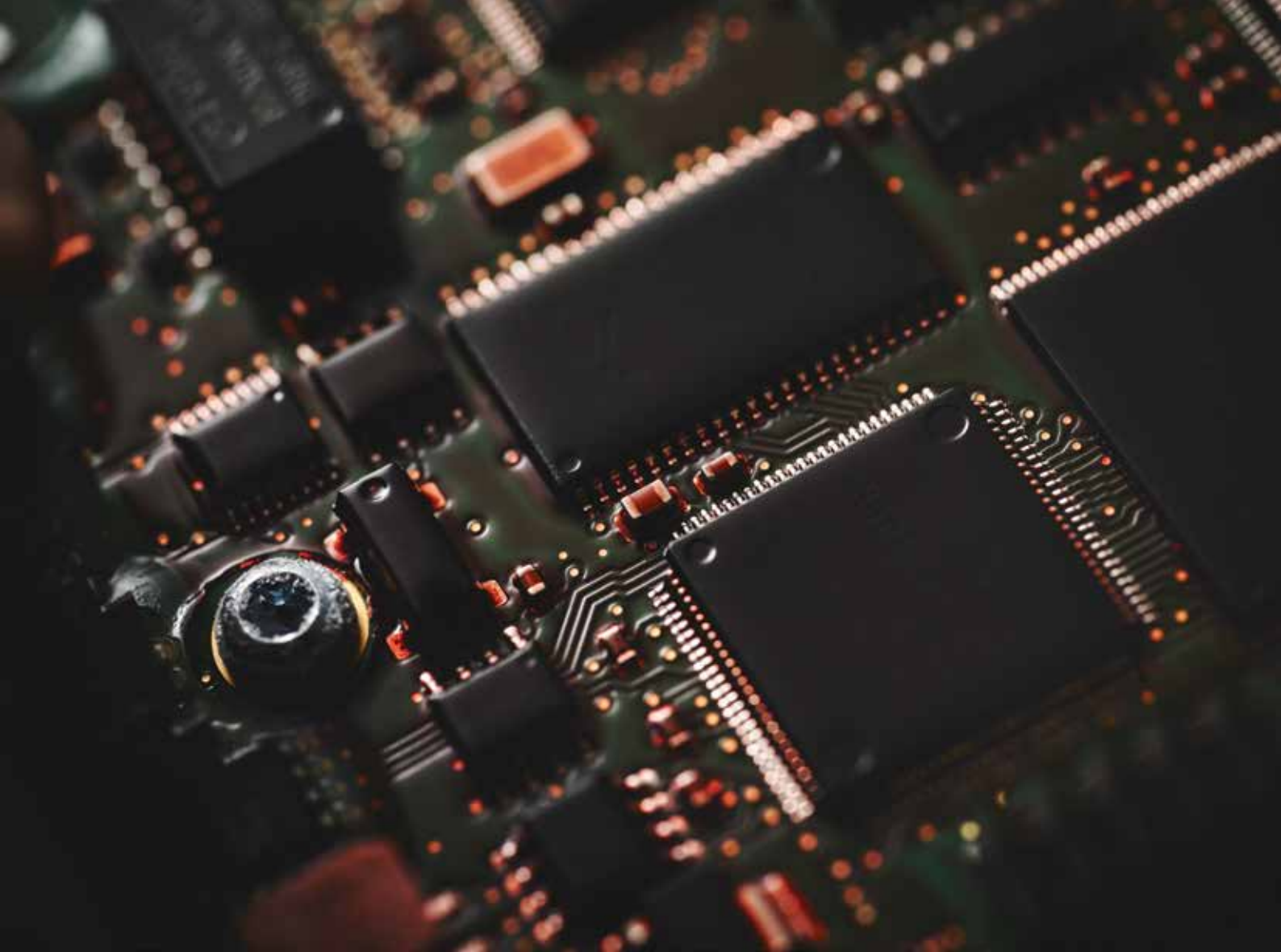
Moreover, quality assurance will eventually shorten lead times and close the loop with the market needs in the minimum amount of time.

Are SKF's AI offerings economically applicable for small and mid-sized manufacturing companies?

First of all, there are offers within SKF that are being built and targeted to small and medium-sized companies, which are not necessarily AI.

When it comes to Enlight AI, it really depends on the level of maturity of the customer. Usually, we need these

“ Enlight AI is focused mainly on the process industry. So the manufacturing of pulp, paper, steel, cement, chemicals, oil and gas, etc... ”



customers that have DCS systems and data acquisition systems, which most medium to large size enterprises do, but when we look at small businesses, it really depends on their maturity.

However, Enlight AI is focused mainly on the process industry. So the manufacturing of pulp, paper, steel, cement, chemicals, oil and gas etc. Usually, these are industries of the medium to large corporates that we're working with.

Are there any additional costs when implementing SKF or Enlight AI?

The implementation is quite straightforward. Enlight AI only needs data, so customers would need to hire IT staff in order to provide the interfaces required to retrieve the data.

With that in mind, I would say the additional investment is slim when

it comes to AI. Usually, Enlight AI is installed as part of a larger REP (Retaining Equipment Performance) contract, so there are other efforts from the customer's side.

But with the division or guidance of scalability that comes as a result of Enlight AI, the implementation effort is relatively small by comparison.

How does the algorithm for machine learning work for bearing applications?

Simply put, for the first phase of AutoML, the software needs to select the best performing modelling tool because there is a set of AI algorithms, each with its own advantages and disadvantages. The software starts by selecting which AI tool it wants to work with on the data. Then there's the model generation phase, where the tool selected will be used to generate a model that represents the data being analysed.

Once we have the model in place, there is the part of the software which takes the models generated and extrapolates them to predict upcoming behaviours. When a difference is detected between the predicted model and the actual data, this is flagged as an anomaly.

These anomalies are then used for the prediction algorithms, the algorithms that make the less layer where they take the anomalies detected. They then extract patterns from these anomalies, so multivariate across sensor patterns — these are all indicative features that are then fed into the failure prediction algorithms in order for them to alert whenever they detect an evolving failure.

An interview by Thomas Johnson, editor at Bearing News magazine



Mergers & Acquisitions

ICT Advisory Division is the financial, legal and technical consulting company with specific know-how in Mergers & Acquisitions projects in the Bearings and Power Transmission industry.

Here below ICT Advisory Division reports the current open projects of companies which are on sale, with short company description and rough indication of yearly turnover, profitability and geographical location.

Short Title	Description	Customer industry	Production type	Transaction Type	Yearly Turnover (mEUR)	Evaluation (mEUR)	Region	ICT Advisory Division code
Bearings Distributor	The company has long history in bearings distribution in Italy, with 160 active customers and 1400 clients in data base. Main served industries are power transmission, automotive, tooling machines, agriculture machines and wood machines.	Automotive / Tooling Machines / Agriculture / Power Transmission	Distribution	Turnaround	3,5	N.A.	Italy	IT20_U
Bearings, belts, chains and gears distributor	The seller is a distributor in Northern of Italy with long history in bearings sector. Due to lack of succession, the owners want to sell the company. The company is official distributor of primary brands and has also its own second brand of bearings.	Power transmission / heavy industry / Agriculture	Distribution	Breakeven / Turnaround	4	N.A.	Italy	IT20_ZB
Bearings manufacturer - Plant in Eastern Europe	Historical company, well known brand, with manufacturing plant of Cylindrical Roller Bearings, Spherical Roller Bearings and bearing components	Oil & Gas / Railways / Wind Power Plants / Mining / Agriculture	Production & Trading	Profitable	50	N.A.	Europe	IT20_ZC
Bearings manufacturer - Plant in Eastern Europe	Historical company, manufacturer of high quality bearings - mainly Tapered Roller Bearings and Deep Groove Ball Bearings	Oil & Gas / Railways / Wind Energy / Metallurgy / Elevators / Agriculture / Mining	Production	Profitable	3	N.A.	Europe	IT20_ZD
Sliding bearings manufacturer - South America	Manufacturer and wholesaler of bearings and self-lubricated bushings in bronze and in composite	Energy / Automotive / Aerospace / Marine / Steel Mill / Mining	Manufacturing	Profitable	2,5	N.A.	South America	IT20_ZF
Bearings grinding and lapping machinery manufacturer	High quality manufacturer of precision grinders and lappers to process any type of bearings components: inner and outer rings, rollers, shafts, spacers.	Bearings / Automotive	Manufacturing	Profitable	23	N.A.	Europe	IT20OA_No1



M&A searches of ICT Advisory in the Bearings and Power Transmission Industry

Its team of engineers, chartered accountants and lawyers work together to assist the companies who aim to sell their business or who want to grow their companies by acquisitions, mergers or joint-ventures.

In similar way, investors ask ICT to assist in their acquisition projects. ICT Advisory Division shares on the following table the list of some of the open acquisition searches.

Investor Type	Investment Focus	Transaction Type	Min Investment Value (mEuro)	Max Investment Value (mEuro)	Sales - Yearly Turnover range (mEuro)	Country Focus	ICT Advisory Division code
Company	Sliding or Rolling Bearings manufacturing plant, both profitable and in need of Turnaround. Also distributors specialized in sliding bearings are of interest	Purchase of Majority of shares	N.A.	N.A.	0 - 10	Europe - South America - USA - India	IT2o_Z
Company	Power Transmission distributors: profitable business, special situations and companies who need Turnaround	Purchase of Majority of shares	N.A.	N.A.	20 - 200	Europe	IT2o_ZA
Industrial Holding	Bearings and technology distributors and industrial solutions providers with industrial niche products with international market potential. Business must be profitable	Purchase of Majority of shares	0	50	1 - 100	Any country in Europe	IT2o_NAJ101
Company	Miniature and/or ceramic bearings distributor or manufacturer, with strong specialization in niche products. Also companies working in bearings repair and in technical ceramic components may be taken in consideration.	Purchase of Majority of shares	0	4	1 - 5	Worldwide, with focus to Europe and America	IT2o_NBB01

Many other projects are available also in other sectors (like Automotive, Aerospace and Industrial).

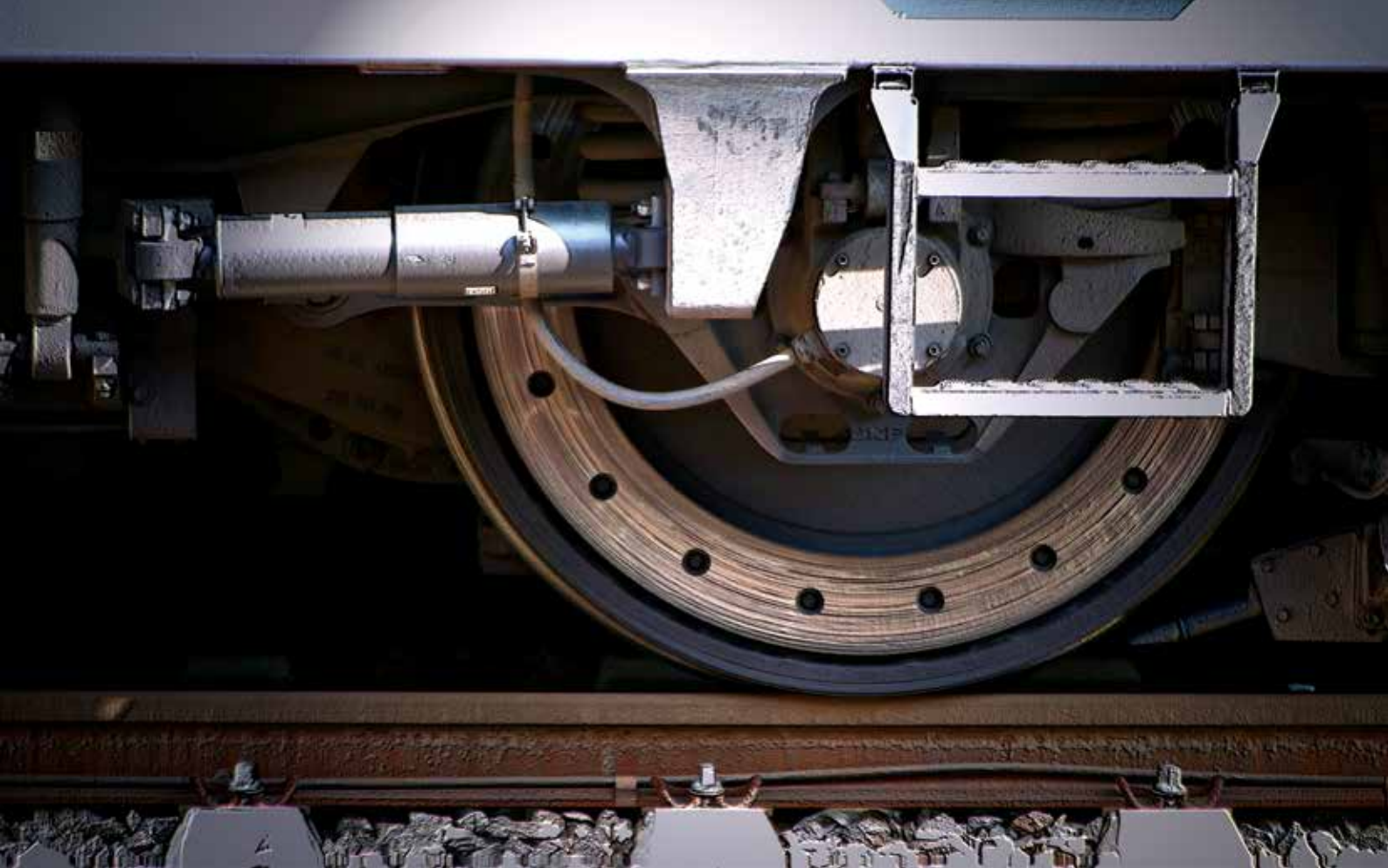
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Smart Bearings: The demise of slow-comotives

According to the TUC, the average rail commute in the UK takes an average of 2 hours and 11 minutes, each day. Also add to the equation that, in 2018, more than one third of trains failed to arrive at stations on time due to technical faults, and you're left with one very miserable commuter. Chris Johnson, managing director of industrial bearing supplier SMB Bearings, considers the future adoption of smart bearings and their impact on Industry 4.0 and the UK.

Bearing designs have stayed fairly consistent for decades. There have been new developments in the form of bearing materials like ceramic, hybrid and plastic; and new lubrication options are now available in the newly-discovered material, graphene. But, a new development could surpass even these: a collaboration between bearings and the Industrial Internet of Things (IIoT) that could provide value both across production processes and entire operations.

Digitalisation is making a major change in how maintenance can be executed. Specifically, with the adoption of IIoT-based smart bearings that can self-diagnose impending faults and failures using sensors integrated into the bearings themselves. These sensor bearings are different from traditional solutions, which usually involve a standalone sensor mounted near the bearing. Instead, the sensor is integrated to measure bearing speed and direction, which is then relayed to a control system.

Sensor bearings work through a magnetic pulse generator ring. Alternating poles are mounted to the inner rotating ring, while the outer ring carries the sensor housing. As the inner ring rotates, the generator ring passes over the stationary magnetic sensor and detects the change in magnetic polarity. This generates an electrical signal that is then processed and converted into direction of rotation and rotational speed data.

Recorded data can then be transferred via a gateway to the cloud, where engineers will be able to access the information in real-time. Take, for example, smart bearings used in the railway industry. Measuring radial shift displacement allows the radial force on the sensor bearing to be calculated. This is mixed with innovative software, to give accurate calculations of the displacement and torque of other bearings and elements.

This means that information on overloading can be easily recorded and used to limit torques, or even switch off the drive if needed. By monitoring these critical assets, there's a higher chance of avoiding unplanned stops for enhanced overall rail operations.

Smart bearings also address a host of industrial applications, including the monitoring of thermocouple (speed and temperature) and accelerometer (vibration) levels.

But, does this make them smart? It all depends on the key parameters that are to be monitored. After all, anything can be sensed — the hard part is knowing what to sense and what the output signals mean.

With smart bearings, engineers can adopt a proactive approach to maintenance by monitoring machine processes such as pressure, force and vibration — each of which provide critical data for predictive maintenance. Real-time updates on the condition of bearings and other components allow for advanced diagnostics to be performed. Early warnings about any deterioration in bearing condition can also be accessed.

Adopting a proactive maintenance approach has many benefits. When a piece of equipment or a system malfunctions, the entire process comes to a standstill while the problem is fixed. By accessing advanced data on the operating status of a machine, it's possible to drastically reduce downtime and prevent factors that cause breakdowns. Avoiding system or machine breaks also minimises the need for repairs during operating hours.

A proactive approach to maintenance also benefits the durability of a component or machine, specifically, by solving the root causes of a problem, rather than merely dealing with the signs of a pending error. The longer the machine or component lasts, the longer the replacement costs can be deferred.

What component could be better-equipped to gather this critical data than a smart bearing? Bearings are typically located in the heart of all rotating applications; with rotational speeds, forces and vibrations all impacting on them in some way.

As industries continue to grow and develop, additional smart bearing sensor data is needed to more closely monitor proper bearing functions and optimise operations. Advancements in bearing technology, including data sharing and maintenance tracking, will continue to be researched and developed across more applications.

In the railway industry, adding smart bearings will provide operators with real-time, on-board information on bearing health, and allow the detection of early bearing damage. Because train bearings are key elements in the integrity of railway wheel sets, the integration of condition monitoring will significantly impact railway operating costs, and train safety. Hopefully, in the future, with the integration of smart bearings, the rail commuters of the UK will finally arrive at work happy and — more importantly — on time.

For further information please visit www.smbbearings.com





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Free exchange format for gearbox data

REXS Version 1.3 Published

Together with leading companies from the industry, FVA (Forschungsvereinigung Antriebstechnik e.V.) has developed REXS, a free format for exchanging gearbox data between different CAE tools. REXS (Reusable Engineering EXchange Standard) minimizes maintenance and data transfer errors for communicating between different tools. The latest version of the manufacturer-neutral interface is now available.

REXS Version 1.3 offers a number of enhancements for various gearbox machine elements. A total of 19 feature and change requests from industrial companies and CAE tool developers have been implemented.

“

REXS makes it possible to take advantage of the strengths of different calculation tools. With the new features in the current release, and the possibility of referencing other interface formats, a multitude of new application possibilities in design and manufacturing arise.

Dr. Moritz Keuthen, Head of Modeling and Simulation at FVA GmbH

”

What's new in version 1.3:

- In the new version, shaft geometry and load capacity parameters have been extended to include description of notches according to DIN 743.
- The contact behavior between the rolling elements and the raceway or rib of rolling bearings can now be represented in detail.
- Modeling of the relationship between flank, tool, and manufacturing data has been extended and standardized for all gear types. In particular, machine settings for bevel gears can now be directly described in REXS models.

Referencing of GDE files for cylindrical gears

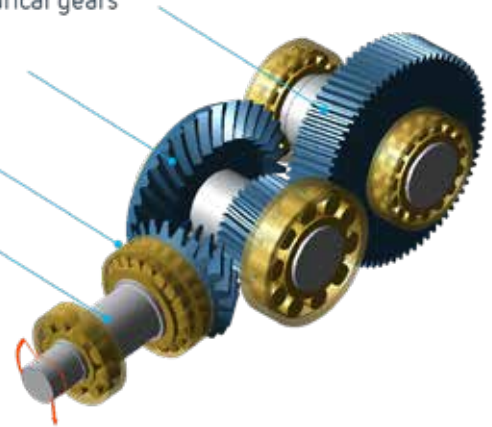
Machine settings for bevel gears

Modeling of rolling bearing contact conditions

Notch modeling acc. to DIN 743



REXS V1.3



- In addition to detailed description of cylindrical and bevel gear geometry in REXS, it is now possible to reference other interface files. The Gear Data Exchange format (GDE) is an established format for the manufacturing and measurement of cylindrical gears (see VDI/VDE 2610). With REXS 1.3, the description of cylindrical gears in REXS models can be supplemented by specifying an associated GDE file. It is also possible to reference Klingelnberg neutral data to supplement the description of bevel gears in REXS.

This is only an excerpt of the enhancements in REXS 1.3. A complete list of new features is available at www.rexs.info.

REXS in the FVA-Workbench 6.0

The FVA-Workbench 6.0 drive technology simulation platform supports the current version of the REXS interface, making

a significant contribution to the efficient exchange of data. Learn more at www.fva-service.de

About FVA

FVA (Forschungsvereinigung Antriebstechnik e. V.) is the world's leading and largest drive technology research and innovation network, overseeing approximately 220 ongoing research projects at leading German institutions. This type of cooperative industrial research forms the basis for product innovations by FVA's more than 200 members. FVA brings thousands of industry experts from the entire value creation chain together with the best research institutes and scientific institutions in the drive technology industry. In so doing, FVA has created a globally unique expert network that adds value for all participants. www.fva-net.de

“

The REXS interface has been significantly improved with regard to both content and usability since it was first published in 2017. The way it continues to be embraced by the industry shows that we are on the right track. The latest version has benefitted from a wide range of input from industry, research, and software companies.

Stephan Evert, Head of R&D Analysis Tools and Methods Development at Schaeffler and Head of the FVA REXS Project Committee

”

Making the world run more smoothly

“Clean Metal” for a sustainable future

"Clean Metal" takes lubrication-free plain bearings to the next level. Copper alloy is sintered onto a steel back and impregnated with fluorine-based polymer to achieve a low coefficient of friction. Despite its simple structure, various materials with focus on low friction, high load or fast rotation are available and can be selected according to desired application. Clean Metal is compliant with recent environmental regulations and contributes to a sustainable future.



RoHS

RoHS2

ELV



Inside The Steel Industry:

How Bearings Survive under very Harsh Conditions



— Figure 1: Steel foundry

Introduction

The steel industry is characterized by processes operating under very harsh environmental conditions. After the

initial foundry process, during which the molten metal is poured into steel blocks, the next stage requires the steel plates to be extruded and flattened into long extended strips in rolling mills.

These strips may be still hot from earlier stages of the process (in a hot strip mill) or reduced to room temperature in the later stages of the process (as in a cold strip mill). In either case, the equipment

— Figure 2: Rolls of steel plates finally coming out of a Roll Mill facility



involved needs to withstand various extreme conditions like severe temperature fluctuations and the intrusion of dust, steam, water and several other pollutants.

The bearings are suffering

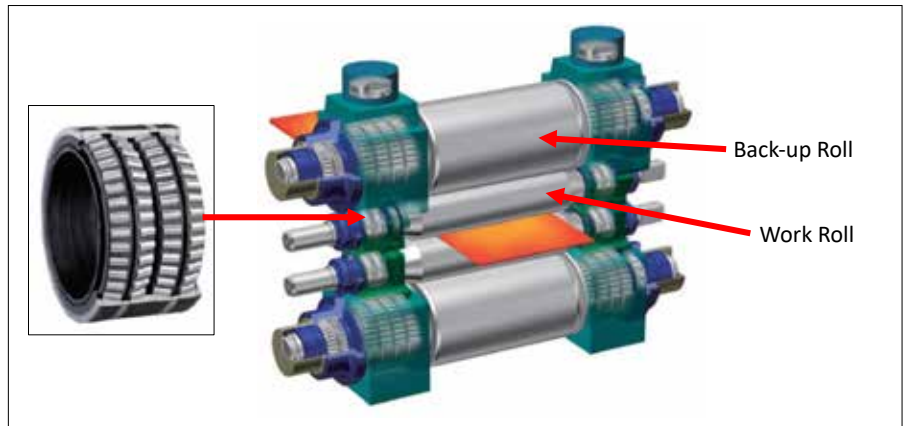
Roller bearings operating under severe conditions like high speed rotation under heavy load are still expected to offer high precision and reliability despite such harsh production environments. JTEKT's Koyo Bearing division has many decades of experience in designing, developing, testing and homologating roller bearings for the metal processing industries. Koyo is currently one of the major global suppliers of these types of bearings for steel mills. Typical applications are the support of the work rolls (4-row tapered roller bearing) as well as the back-up rolls (4-row cylindrical roller bearings and 2-row tapered roller bearings).

JTEKT/Koyo - a major manufacturer of bearings for the steel processing industry

As a major supplier in this field, Koyo has the right expertise to diagnose and tackle specific problems that arise during daily operation. In the Koyo Large Size Bearing Technology Development Center in Kokubu, Japan, engineers use dedicated testing machines for bearings for steel production equipment to provide input for simulations of the most common steel production methods. With this experience



— Figure 4: Bearing testing machine for steel production equipment

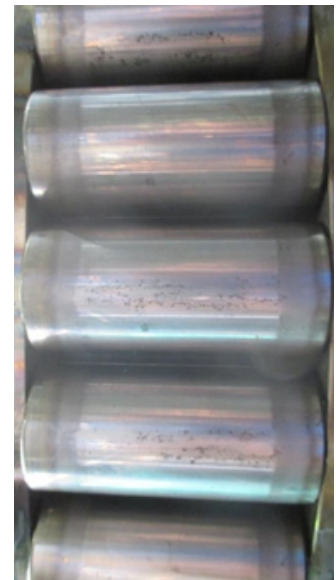


— Figure 3: 4-High Roll Mill with work rolls supported by 4-row TRBs

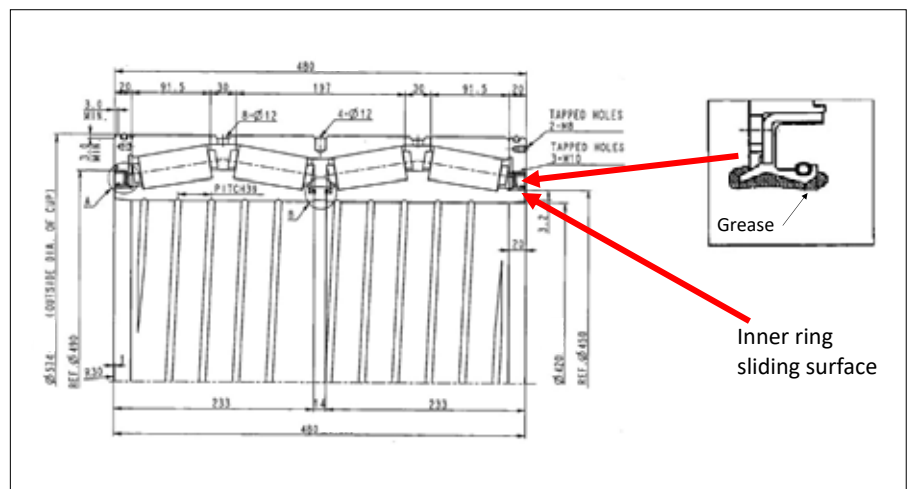
potential problems can be anticipated in new steel production lines or quickly solved in existing steel mills. In some cases a complete redesign of the bearing, or one of its components is required. One such specific case is described below.

Case study: Preventing the curious water ingress into a 4-row TRB in a steel strip rolling mill

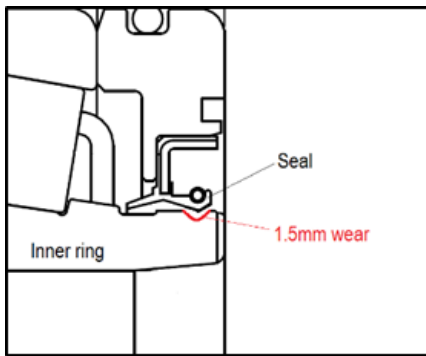
A steel mill customer was experiencing water ingress in roll neck bearings (see figure 6). During inspection, a 1.5 mm deep groove was observed on the inner ring of the bearing along the seal lip contact surface. The customer requested a root cause analysis of the water ingress and groove followed by a countermeasure against it, to support bi-directional axial loads (see figure 5).



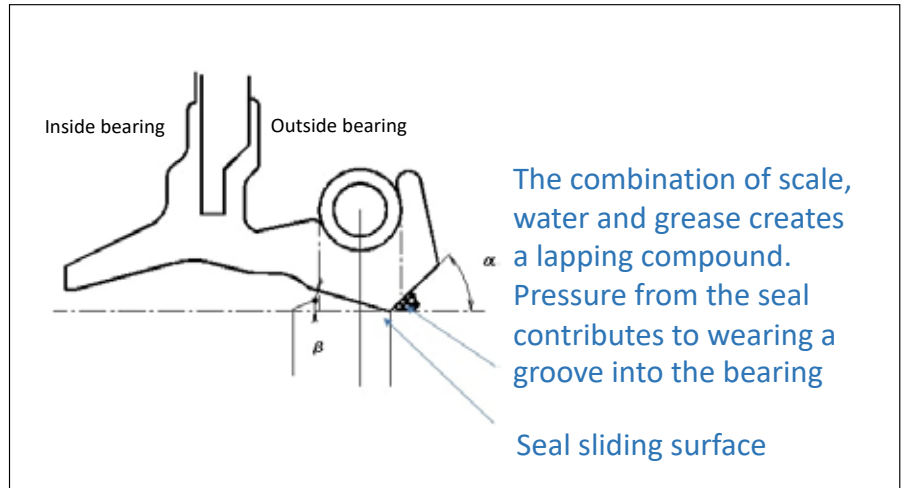
—Figure 5: Visible corrosion staining on the rollers



— Figure 6: 4-row TRB with oil seal



— Figure 7: Detail of oil seal and sliding surface



— Figure 8: The oil seal showing the accumulation of dirt

Analysis of the phenomenon

After investigation by a Koyo expert it was determined that the groove was caused by scale build-up between the seal lip and the inner ring of the bearing. The combination of scale, water and grease created an unwelcome ‘lapping compound’ which facilitated the abrasion of the sliding surface. Because of this wear the contact with the seal lip and the inner ring reduced, which resulted in a decreasing sealing performance. The consequence was water entering inside the bearing easily.

The solution? A complete redesign of the seal

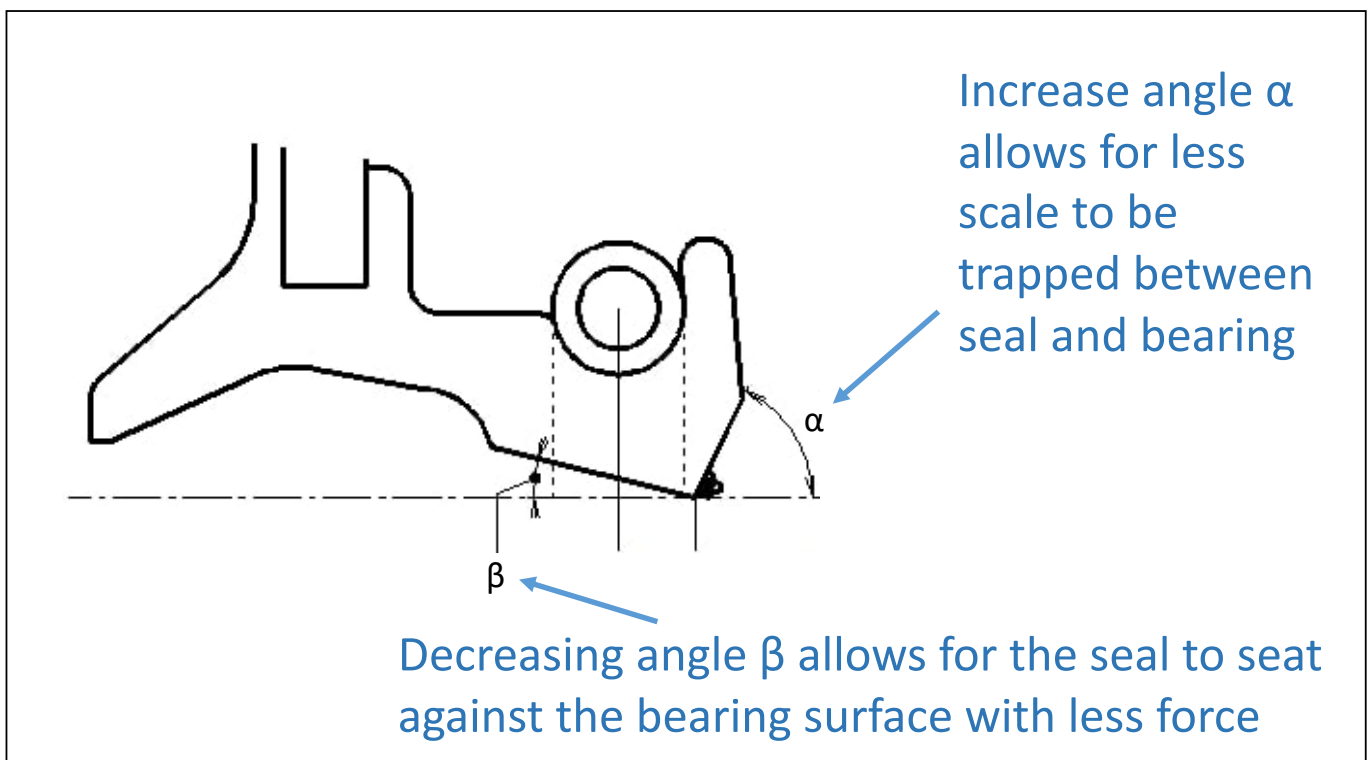
The countermeasure for the groove wear was a design change to the seal lip geometry to reduce the amount of scale being collected. The seal lip lower portion was also changed so that the contact area between the seal and inner ring became more stable, reducing vibration and allowing it to sit flush against the inner ring with reduced pressure, without losing sealing performance.

Conclusion

In retrospect the oil seal redesign looks simple and obvious as a solution, but to get there required a lot of engineering knowledge, design creativity, imagination and interaction with the end user. After testing and validation, the final improvements were successfully implemented.

For more technical details about bearings for steel mill application our engineers will be happy to support you. For technical or general information on Koyo’s products, please do not hesitate to contact your local Koyo office or Koyo distributor. You can also visit our European website: www.koyo.eu

— Figure 9: The redesigned oil seal showing the reduced amount of accumulated dirt



Experimental High Frequency Analysis of Electric Impedance of Rolling Bearings

When scientific research aims to break down the existing limits of machine elements, the associated equipment must meet the highest demands. Professor Kirchner and his team at the Technical University of Darmstadt (TUD) intend to use the electrical properties of rolling contact bearings for various purposes, including as sensors. This endeavor poses two particular challenges: measuring the bearing's impedance at high frequency and understanding how the associated high frequency electric currents might impact bearing life. For this purpose, Elgeti Engineering GmbH built a special test rig which is capable of applying and measuring high frequency electric currents and voltages on all four of its stations.

The first research results were announced at the BearingWorld International Conference in October 2020.

Presenter:

Georg Martin, M.Sc.

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Additional Authors:

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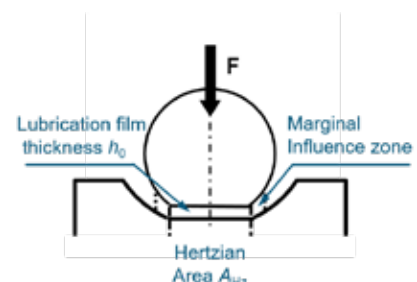


1. Introduction

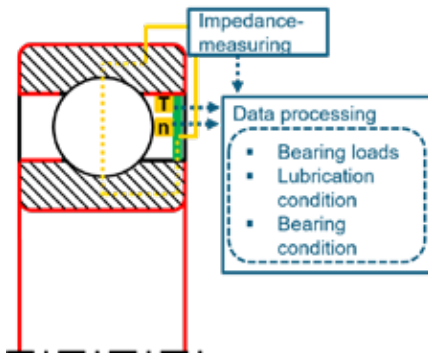
The current trend in process monitoring and predictive maintenance propels the development of sensor-rich systems. Against this background, the authors investigate using bearings' electric properties as a sensor. This approach is based on electric impedance of bearings under an EHD regime, which depends on bearing load, speed and temperature. In an EHD regime, a non-conductive lubricant separates the surfaces of the rolling elements and the bearing rings. The electric model for every rolling contact is a plate capacitor, with the plates formed

by the Hertzian area and the lubrication film thickness being the plate distance, as shown in Figure 1. In addition, the marginal area around the Hertzian area influences the electric impedance. Figure 2 shows a schematic design of such a sensor bearing. The lubrication film thickness depends on the temperature and rotational speed of the bearing [1]. Therefore, speed and temperature sensors are integrated into the sensory bearing. The electric measurement circuit needs to be isolated from the metal structure of the machine; the necessary isolating layers are shown by red lines in Figure 2. Finally, the electric impedance, temperature and rotation

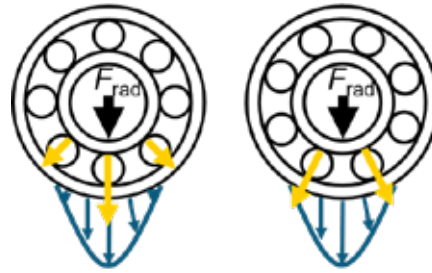
speed data are processed into information about bearing loads, lubrication condition and possibly bearing condition.



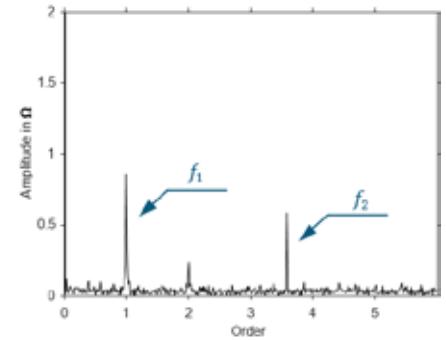
— Figure 1: The rolling contact modelled as a capacitor depending on lubrication film thickness and Hertzian area



— Figure 2: Load sensing bearing with insulating layer (red), connector (green), current flow (yellow) temperature (T) and rotation speed (n) sensor



— Figure 3: The two extreme states of roller position in roller bearings



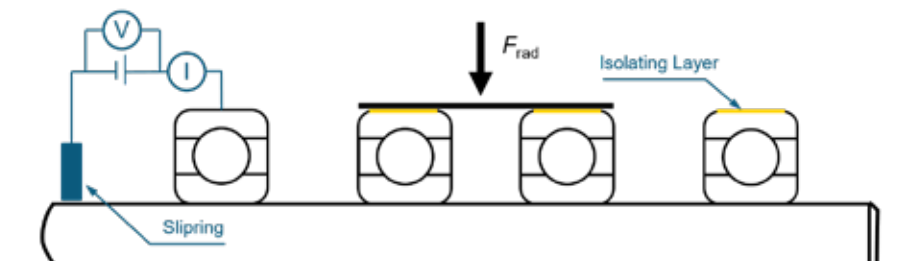
— Figure 6: FFT of the measurement in Figure 5

Jablonka et al. [2] examined the electric properties of a bearing under radial load, which consisted only all ceramic rolling elements except one steel rolling element. Thus, they measured how the electric impedance depends on the position of the rolling element relative to the loaded zone. The impedance depends strongly on the position of the rolling element. The maximum impedance value occurs when the rolling element is in the center of the load zone. In a bearing consisting only of steel rolling elements, the total impedance consists of the impedances of all rolling elements. Therefore, the position of the rollers in the bearing has to be taken into account. In Figure 3, the two extreme states of rolling element positions in the bearing are shown. In one state (left), three rolling elements are loaded. One has maximum load, the others have a lower load. In the other load state, only two rolling elements are loaded, but they both have the same load. These states are associated with different values of the total impedance, between which the impedance value fluctuates while rotating. With a rotating inner ring and an outer ring at rest, the cage and the rollers rotate with two rotations of the inner ring. Thus the frequency f_c of the change of the electric impedance depends on the number of rollers z and the rotation frequency of the shaft n , assuming pure rolling. This frequency f_c is also known as the ball passing frequency at the outer ring (BPFO).

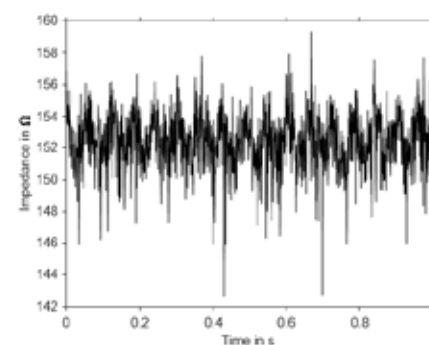
$$f_c = \frac{zn}{2} \left(1 - \frac{D_w}{d_m} \right) = 3.565 n$$

2. Materials and Methods

The experiments for this study are done on the bearing test bench shown in Figure 4. Lubricant temperature, rotation speed and radial load are held constant for each measurement. An electric voltage U with frequency of 5 MHz and amplitude 1 V is applied between the inner and the outer bearing ring. The voltage U and current I are measured and the electric impedance is calculated with $Z=U/I$.



—Figure 4: Bearing test bench



— Figure 5: Measurement of the electric bearing impedance

In Figure 5 an exemplary measurement result is shown. A periodic fluctuation between two impedance values is

visible. The results are analyzed in the frequency domain. Figure 6 shows the FFT diagram of the measurement in Figure 5. Two significant amplitudes appear in the first and 3,6th order with reference to the speed of 1000 rpm.

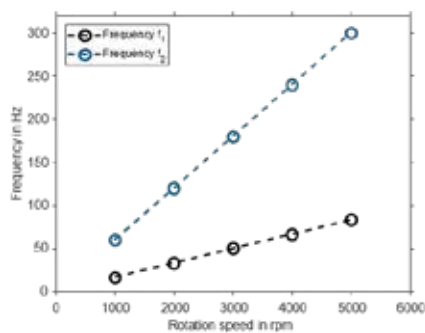
3. Results

In this study, the influence of the parameters temperature, internal clearance, rotation speed and radial

load on the frequencies f_1 and f_2 are investigated. The radial load varies from 750 N to 7000 N, the lubricant temperature varies from 30°C to 60°C and two types of internal clearance were tested (6205 C2 and 6205 C3). Temperature and internal clearance have no significant influence on the frequencies. On the other hand, the speed has a significant influence. Figure 4 shows the measured values for the two frequencies of the impedance signal at different values of rotation speed. The observation is a linear connection between the frequencies and rotation speed, with f_1 being equal to the rotational speed n and $f_2 \approx 3.6 \cdot f_1$.



In contrast to the expected single frequency f_c (see section 1), two different frequencies are observed. A possible explanation for the value of f_1 is an unbalanced shaft. The imbalance causes a load variation at the frequency of the rotational speed. The second frequency is f_c caused by the effect shown in Figure 3.



— Figure 7: Measured frequencies f_1 and f_2 for different rotation speeds

4. Discussion

The experiments in this study about the frequency spectrum of impedance signals of rolling bearings have shown

that there is a connection between the frequency components and the rotation speed, and thus dynamics and kinematics of rolling bearings. The presented explanatory approach suggests that the rotational speed can be extracted from the impedance signal if the shaft is significantly unbalanced. The benefit for the sensory use of the electric effects in rolling bearings is that there is no need for an additional speed measurement anymore because the information is already contained in the measured signal. Further investigations could deal with a different number of rolling elements to validate the connection BPFO and the observed frequency f_2 .

5. Acknowledgement

These experiments were performed using an EELPRAAX-80-4E test rig custom-built by Elgeti Engineering GmbH for this research. It is based on their standard bearing test rigs and allows time-dependent control of the axial load, radial load, speed, oil temperature and oil volume. A special feature of this particular rig is the ability to apply high-frequency

AC currents in a targeted manner and to measure high-frequency voltages and currents. In order to accelerate the research process, the rig has four identical and independent testing stations. The adaptation and setup of the test bench was supported by Deutsche Forschungs-gemeinschaft under project number 401671541. The financial support is gratefully acknowledged.

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- [1] Schirra, T., Martin, G., Vogel, S. a. Kirchner, E.: *Ball bearings as Sensors for systematical combination of load and failure monitoring*. Proc. DESIGN 2018, University of Zagreb, Croatia; The Design Society, Glasgow, pp. 3011–3022, 2018.
- [2] Jablonka, K., Glovnea, R. u. Bongaerts, J.: *“Quantitative measurements of film thickness in a radially loaded deep-groove ball bearing”*. Tribology International 119 (2018) S. 239-249.





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Condition monitoring in logistics

Online condition monitoring using SmartCheck prevents unplanned machine downtime at Schaeffler's European Distribution Centre



By installing SmartCheck condition monitoring devices on 58 critical drives, Schaeffler's European Distribution Centre has seen a range of benefits, including the prevention of unplanned downtime, reduced maintenance costs and increased machine availability.

Schaeffler's European Distribution Centre (EDC Central) in Kitzingen, Germany, is one of Europe's most modern logistics centres with several thousand shipping units rolling off the lines every day. Standard

products can be delivered to customers within 24 to 48 hours after receipt of order.

Opened in June 2018, EDC Central covers a total area of 148,000 square metres and employs around 200 people. The site has two storage racks with a height of 38.5 metres, which provides space for 28,000 Euro pallets and 95,000 containers. Equipped with an in-floor, 2km long conveyor system and state-of-the-art conveying technology, the centre also provides 20 ramps for up to 85 trucks per day.

can affect the entire supply chain. In the worst case scenario, this may result in delayed deliveries of customer orders. The logistics centre was therefore looking for a Predictive Maintenance solution.



— One of the seven automated storage and retrieval systems that are monitored using Schaeffler SmartChecks.

Challenge for Schaeffler

Inside the EDC Central are seven automated storage and retrieval systems, which continuously handle loads in various directions from storage racks with a height of around 38.5 metres. The bearings in the drives of these storage and retrieval systems are subjected to severe loads during operation. Any unplanned downtime of the storage and retrieval systems due to bearing damage

Schaeffler Solution

The EDC Central relies on intelligent maintenance solutions developed in-house for monitoring the automated storage and retrieval systems. Of the approximately



— Schaeffler's European Distribution Centre in Kitzingen, Germany.



3,000 drives at Kitzingen, 58 of the most critical are monitored using the Schaeffler SmartCheck condition monitoring solution.

51 of the SmartChecks are installed on spiral conveyors and lifting stations, where they monitor vibration, temperature and speed of the bearings. The SmartChecks are connected to the Schaeffler network, allowing local visualisation in the control room at Kitzingen. Seven SmartChecks are installed on the drives of the storage and retrieval systems. After an operating period of around 18 months, one of the SmartChecks detected an irregular upward trend. The subsequent visual inspection carried out by local maintenance staff confirmed that grease had escaped from the track roller bearing. Due to the early detection



— Grease has escaped from a bearing in the drive of a storage and retrieval system.

of this irregularity, the site was able to schedule and perform the bearing replacement in good time and therefore prevent any unplanned downtime.

Customer Benefits

The online monitoring solution is an important tool for Kitzingen in eliminating unplanned downtime and malfunctions during operation. Other advantages include:

- Prevention of costs resulting from production downtime.
- Prevention of subsequent damage to the drive.
- Low purchasing costs for the monitoring system.
- Reduced maintenance costs.
- Increased machine availability.
- Enhanced reliability through a self-reporting system.

Oliver Massa, Intralogistics Portfolio Manager at Schaeffler summarises the benefits of the monitoring solution: “Bearing damage was detected at an early stage thanks to the SmartCheck. The team was able to carry out the four-hour maintenance work outside of our regular operating hours. Production was therefore safeguarded and subsequent damage to the drive was prevented. With

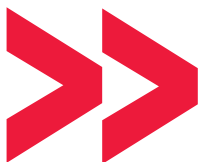
predictive maintenance, we can save costs of up to 70,000 euros every year.”

This holistic solution can also be applied and extended to other machines and equipment in almost every plant. In order to ensure optimum lubrication of the chain and roller conveyors, the EDC Central also uses the centrally controlled CONCEPT8 automatic lubrication system from Schaeffler with specially developed lubricating pinions for continuous and precise relubrication during operation.



— Schaeffler SmartCheck installed on the drive of a storage and retrieval system.

For more information, please contact Schaeffler UK's Communications & Branding Department on info.uk@schaeffler.com



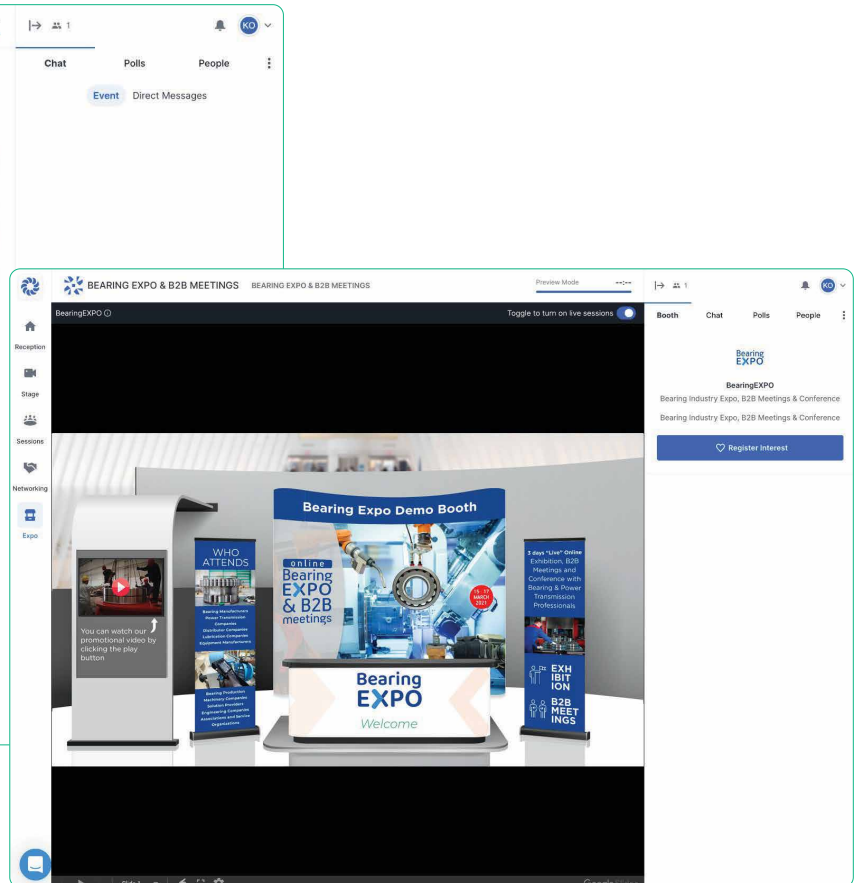
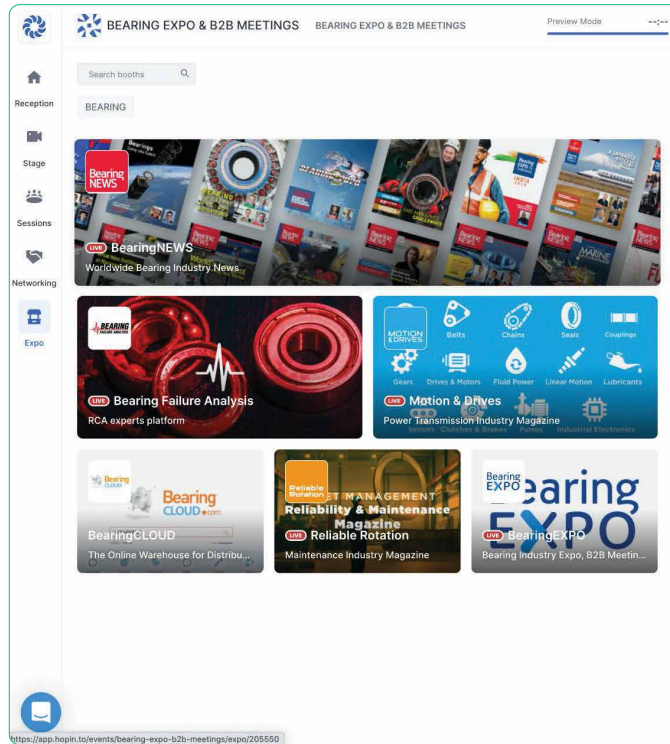
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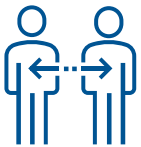
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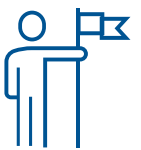


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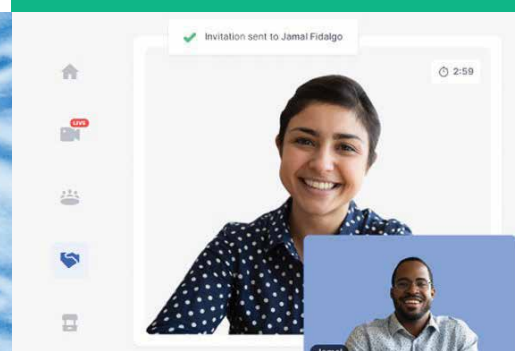
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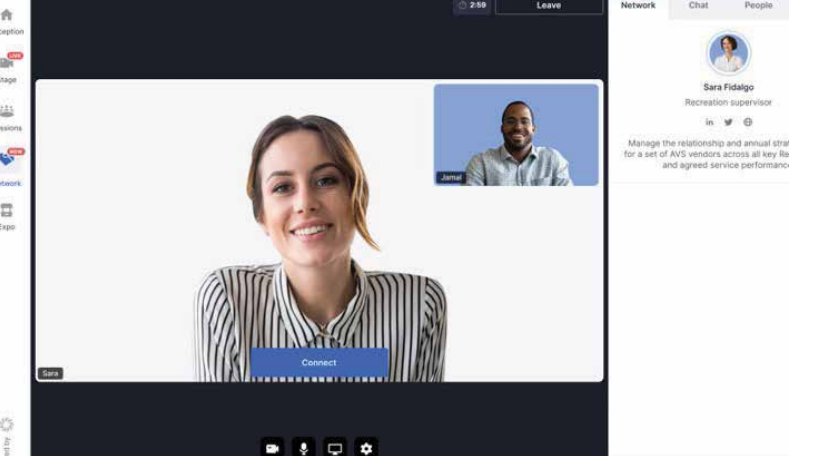


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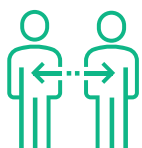
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Elgeti Engineering unveils its 4th generation bearing test rigs



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to achieve all three? At KG International, we think it is.

We have never stopped supporting customers and their objectives, and have developed a complete range of industrial bearings for heavy machinery and industrial equipment. Providing a viable alternative to premium brand components, helping preserve production and operational efficiency with the perfect combination of quality, performance and economy. Manufactured to international standards, our products play their part in supporting your business goals. With an excellent reputation in serving customers in the most challenging industries across the region and

further afield, our KG-U series bearings have helped provide customer solutions in the following industries; Quarrying & Mining, Mineral Processing, Construction Equipment, Cement & Concrete Manufacturing, Food & Sugar Processing, Conveying & Material Handling, Agricultural Equipment, Industrial Automation, Water Processing & Utilities, Ports & Marine, to name a few!

Our application engineers stand ready to support your sales team to install the correct product - whether premium or KG brand - according to your customers' specifications and the application requirements, within a predefined budget.

**Company details
and exhibit information**

www.bearing-expo.com/c/kg



Roller Bearing Analysis "Done-in-One"

All Klingelberg Precision Measuring Centers have the capability to accurately analyze and measure roller bearings and roller bearing elements to an extremely high degree of precision. Based on the manufacturer data and specifications, measuring runs and clear, conclusive protocols are created automatically in compliance with current standards and regulations. The series variations and quality grades of the bearings are supported by the innovative Klingelberg software.

Additional measurement tasks based on specific requirements of the bearing manufacturer are also easily implemented. The specifications of these highly accurate precision measuring centers make them ideal for in-process inspection of rolling bearings and rolling bearing elements in the immediate production environment. Thanks to standard interfaces, the results feed directly into the process and ensure appropriate responses and actions in the upstream and downstream processes.



**Company details
and exhibit information**

www.bearing-expo.com/c/klingelberg



Take a Virtual Tour at ABF

Whether you are looking for bearings or electric motors, or for a challenging job, you've come to the right place at ABF. With 9.485.207 bearings and electric motors in stock, ABF has one of the most extensive stocks in bearings, electric motors and related parts, worldwide.

ABF's friendly team is available the entire day to assist our customers worldwide with their requests for bearings or electric motors. They can help you in English, Dutch, German, French, Spanish, Italian, Polish and more. Check the link www.abf.store/i/en/tour for a virtual tour at ABF!



**Company details
and exhibit information**

www.bearing-expo.com/c/abf



RKB Bearing Industries presents a new AF2D Multiroll Cage Design for rolling mill stands



RKB Multi-row cylindrical roller bearings, also known as Multiroll, are mainly used in rolling mill stands, where they are subjected to very high radial loads and impacts, combined with medium-low speeds.

With its revision of the AF2D design, RKB

adopted a new generation of two double pronged machined steel cage featuring:

- Higher cage tenon stiffness compared with the classical design
- Cage pocket optimization, which reduces roller drop and highly improves piloting
- Enhanced cage manufacturing precision with narrow dimensional tolerances

Furthermore, to better suit in a wide range of

applications and environments in the harsh conditions of the steel and aluminum industry, the new RKB AF2D Multi-row presents superfinished rolling elements with a special roller profile and an advanced crowning technology for outer ring raceways. Combining these two technical solutions, the new RKB AF2D Multi-row gets a smooth pressure distribution among rolling elements and ring raceways, reducing stress edge effect and leading to longer bearing service life.

**Company details
and exhibit information**

www.bearing-expo.com/c/rkb



Lubrication and Condition Monitoring – a strong natural interconnection

Data collected by Lube team is exactly the data Condition Monitoring needs as a first line of defense, a kind of triage, because the data they collected and the way it was collected is the same trending data Ultrasound Condition Monitoring team needs as a trigger for deeper look and analysis.

UAS3 enables you to have easy access to your LUBExpert data and eliminate or accept

Lubrication condition as possible cause of anomaly. Equally, your LUBExpert will provide automatic indication for suspected bearing failures, all in one common UAS3 Strategy Center.

UAS3 is equipped with all needed tools to perform reliable analysis and deliver actionable conclusion.



**Company details
and exhibit information**

www.bearing-expo.com/c/sdt





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Steel Cages for Bearings

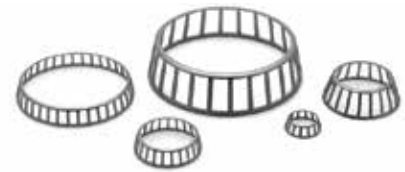
Our fully automated, deep-drawn transfer and die pressing technology allows us to manufacture a wide variety of precision sheet metal parts, including tapered and spherical roller cages as well as other products. This process delivers high precision and improves overall product performance. Most part of Tsubaki Nakashima's cages are used for roller bearings in the automotive industry, such as belt tensioners and suspension bearings, and in a wide variety of other industrial applications. All products can be surface treated for applications that require low friction or better wear protection.

Capabilities

- Precision up to 50 μ tolerances
- Width up to 400mm and 4mm thickness
- Low to high volumes
- Various treatments possible
- Various materials available
- Flexible laser welding production cell
- Samples available within 3 weeks

Benefits

- Increased bearing loads
- Enhanced roller running accuracy



- Higher RPM's
- Lower friction and heat generation
- Reduced energy consumption
- Improved automated bearing assembly
- High temperatures tolerated

Company details and exhibit information

www.bearing-expo.com/c/tsubakinakashima



Small Size Lubricator for Big Performance



In confined spaces, the 15 ml simalube offers the perfect solution. With its compact size, it is unique on the global market as the smallest automatic lubricator. It functions the same as the larger simalube lubricators and offers the same advantages.

- Space-saving thanks to compact size
- Only 15 ml of lubrication
- Robust aluminium enclosure
- Same refill, installation and function as other simalube lubricators
- Alternative to the simalube multipoint when less than 5 lubrication points are needed

Company details and exhibit information

www.bearing-expo.com/c/simatec



2nd and 3th generation Hub Units from PFI

PFI supply 2nd and 3rd generation hub assemblies, both of them identified with prefix PHU. Our hub assemblies (more than 700 different SKUs) are supplied with or without ABS sensors according to original equipment specifications. We are constantly adding new applications for a variety of new vehicles, including American, European, Japanese and Korean applications.

PFI 2nd generation bearings are compact double row units (double row angular contact ball bearings – 80% of the range or double row taper roller bearings – 20% of the

range). They have the same technical advantages of the 1st generation bearings (PW bearing family) and add a locking element (flange) that enables easier installation, reduces the number of assembly tools and the possibility of human errors. Flange ring material is different, PFI uses AISI – SAE 1055, which allows the forging of complex final forms, as required by the application.

PFI 3rd generation bearings are compact double row units (double row angular contact ball bearings – 80% of the range or double row taper roller bearings – 20% of the



the range) that share the same technical advantages of the 1st and 2nd generation and have an additional flange (2 flanges). This addition makes it even easier to mount and assemble the bearing to the car. Flange material is AISI – SAE 1055, as in the case of 2nd gen bearings.

Company details and exhibit information

www.bearing-expo.com/c/pfi



DUNLOP Motion Transfer Linkages

DUNLOP rod ends and spherical bearings also known as 'rose joints', along with ball joints and clevis, are available as individual components or can be supplied as part of a rod based motion transfer linkage. Proudly manufactured in the UK, we specialise in the supply of custom straight or bent formed rod-based linkages, ready to fit and quality guaranteed from end to end.

Cost savings

Besides the savings on your own in-house assembly costs, there are invisible savings to be made from reduction in part numbers, suppliers inventory variety, as well as stock imbalance elimination. Major manufacturers of agricultural, construction, industrial and automotive equipment, depend on our resources for complete linkages, cost reduction and improved efficiency.



Design Service

Take advantage of our design co-operation service from initial application appraisal, through costing and prototypes, to ISIR and PPAP approval and production supply.

**Company details
and exhibit information**

<https://www.bearing-expo.com/c/dunlop>



Customized Bearing Production & Components Modifications



Custom Bearing Manufacturing of complete bearings is our specialty at Napoleon Engineering Services. We take great pride in satisfying our customers' needs and providing them with high

quality bearings that will exceed both their expectations and those of their customers. Our savvy engineers extensively analyze application conditions to create a cost effective reliable product. With our comprehensive machining facility consisting of CNC turning, CNC milling, and CNC grinding machines capable of producing parts up to 18 in diameter, NES can manufacture a large range of products with specialty materials and processes to fit your needs.

Bearing Modification

Napoleon Engineering Services modification

program provides customers with flexible solutions to their bearing problems. Through the use of existing inventory NES can modify standard products to fit the most specific application requirements. Modifying existing products reduces lead time and increases savings while significantly enhancing the products performance in the application. NES is equipped to conduct precision and simple modifications, ensuring the bearing will operate efficiently. Bearing modification is part of the industrial bearing Condition Analysis Reclamation (CAR) program.

**Company details
and exhibit information**

www.bearing-expo.com/c/nep



Listen to the bearing, start lubricating and determine when to stop!

The Ultraprobe 201 Grease Caddy is uniquely designed to allow an operator to simultaneously lubricate and monitor ultrasound levels to prevent over-lubrication.

As lubrication levels fall, friction levels rise, producing ultrasonic waves, which are very directional and localized. Easily attached to most standard grease guns, or worn in an optional belt holster, the Ultraprobe 201 Grease Caddy translates high frequency sounds into the audible range, where

users will hear and recognize bearing sounds. The Ultraprobe 201 Grease Caddy focuses in on these sounds – even in the noisiest environment – and helps users identify when to stop lubricating.

The Ultraprobe 201 Grease Caddy will support your lubrication program resulting in:

- Prolong the life of your equipment
- Identify bearing issues by listening
- Prevent over lubrication



- Save on working hours & operational costs
- Improve maintenance efficiency

**Company details
and exhibit information**

www.bearing-expo.com/c/uesystems



New ZEN Cycle Bearing Catalogue is out

Zen Ball Bearings are manufactured to the highest quality for standard and non-standard applications. Our technical department can modify any non-standard bearings to your specific requirements, regardless of quantity.

Apart from our extensive miniature ball bearing range of more than 1000 different types, ranging from 1-10 mm bore (Including inch dimensions),

our range also includes Thin section, Three part thrust, Popular metric and any kind of non standard bearing. We are able to design bearings according to your requirements using new materials like ceramic or special steels for applications in Industry, Medicine, Chemistry and Food Processing. You can download the ZEN catalogues from the online booth below.



**Company details
and exhibit information**

www.bearing-expo.com/c/zen



Cost-effective, reliable, safe and ecological lubrication system



G-LUBE is an electronically controlled single-point lubrication system, driven by a chemical reaction. The dispenser excels through user-friendliness

and a good cost-performance ratio. This product is the right choice for most lubrication applications: cost-effective, reliable, safe and ecological!

G-LUBE combines all the advantages of gas-powered lubrication systems and is a cost-effective solution for users wishing to switch from manual to automatic lubrication and for those familiar with automatic lubrication systems.

The function is based on the proven technology of an

electrochemical reaction that produces non-reactive nitrogen (N₂) through the systematic use of an electrolyte. This type of pressure generation makes G-LUBE more temperature-independent than many conventional gas-powered lubrication systems.

With pressure generation not exceeding 5 bar and at ambient temperatures from -20 °C to +55 °C G-LUBE guarantees up to 12 months of reliable operation. The lubrication system is available in the sizes 60, 120 and 240 ml.

**Company details
and exhibit information**

www.bearing-expo.com/c/gruetzner



Super Precision Rings for Super Precision Bearings

PROSINO offers a wide range of ring products from 8 mm to 300 mm of OD for the bearing industry. The competence of the company goes from the sourcing of the best raw material (only from European Siurces) to turning (with different technologies), to heat treating, vibropolishing, grinding and hard turning. Every step is carefully checked and recorded in ERP IT system. Fully reliability and manufacturing consistency is granted in all steps.

Prosino's activity is not confined to the pure

implementation of customer's drawings, but thanks to its 60 years experience is also able to offer a co-engineering support to its customers. The collaboration involves the creation of new geometry aimed at the production optimization and cost reduction (for the client's benefit), and the selection of thermal and/or surface treatments.

The company presence in different industrial sectors created synergies that allowed to apply technical solutions from one field to every field. Two of the major



tools used by Prosino in order to offer customized products is a pre-manufacturing study of the item on the 3D CAD working stations and an absolute freedom in turning thanks to shaped tools profiled with EDMs.

**Company details
and exhibit information**

www.bearing-expo.com/c/prosino



ZWZ is looking for NEW distributors

China's well-known and largest bearing manufacturing company ZWZ Group (Wafangdian Bearing Group Corp. Ltd.) is expanding its global distributors network by announcing new distributors cooperation plan. The company is currently present in more than 100 countries and aims to increase this number in the coming period by appointing new distributors.

ZWZ Group has been the backbone of China's bearing

industry since 1938 and has always been leading the bearing industry trends in China. The Group has today 8 large production bases, and 22 branch plants in China, and 1 bases in Germany, branded KRW. With a production capacity of more than 20.000 different types of bearings for key technical equipment and applications, the company covers a full range of bearings for its distributor partners. The ZWZ bearings are mainly designed and produced for the steel, cement, mining, engineering machinery, transmission



equipment, oil, wind, automotives, railway, shipping and related general industrial machinery applications.

You can contact ZWZ from the link below for becoming a distributor.

**Company details
and exhibit information**

www.bearing-expo.com/c/zwz



Marine bearings that replace composite, plastic, bronze and oil filmed bearings



Lignum Vitae North America, LLC. offers a time-proven EPA / ABS compliant water-lubricated bearing technology. With over a 160 year service record in vessels from workboats to icebreakers and submarines, our bearings will not smear or seize onto the shaft as plastic or composite materials often do. Lignum vitae bearings effectively replace composite, plastic, bronze and oil filmed bearings. Contact us to determine the best bearing for your vessel.

Technical Advantages

- Zero clearance
- No filtering or external cooling systems required
- Zero wiping or smearing of material
- High resistance to shock, edge loading/vibration issues
- Oil/grease-free operation
- No hydrolysis degradation/perfect memory
- Sustainable supply chain
- Steel friendly

**Company details
and exhibit information**

www.bearing-expo.com/c/lignumvitae



The Supplier with a Broad Scope on Angular Contact Ball Bearings

Ritbearing supplies a broad scope of angular contact ball bearings specially designed to withstand the demands of high-speed applications. These bearings are non-separable and have a contact angle which can accept radial and thrust loads. Although the angular contact bearings can accept thrust loads in only one direction, there are different contact angles available to transfer the load acting upon the bearing.

Common models of angular contact ball

bearings available through Ritbearing include the 5200 Series, 5300 Series, 7000 Series, 7200 Series, 7300 Series, 7800 Series, 7900 Series, QJ200 Series, and the QJ300 Series.

If standard solutions aren't right for your application, we can help. Our experts can work with you to provide custom engineered angular contact ball bearings designed specifically for you design needs.



**Company details
and exhibit information**

www.bearing-expo.com/c/ritbearing



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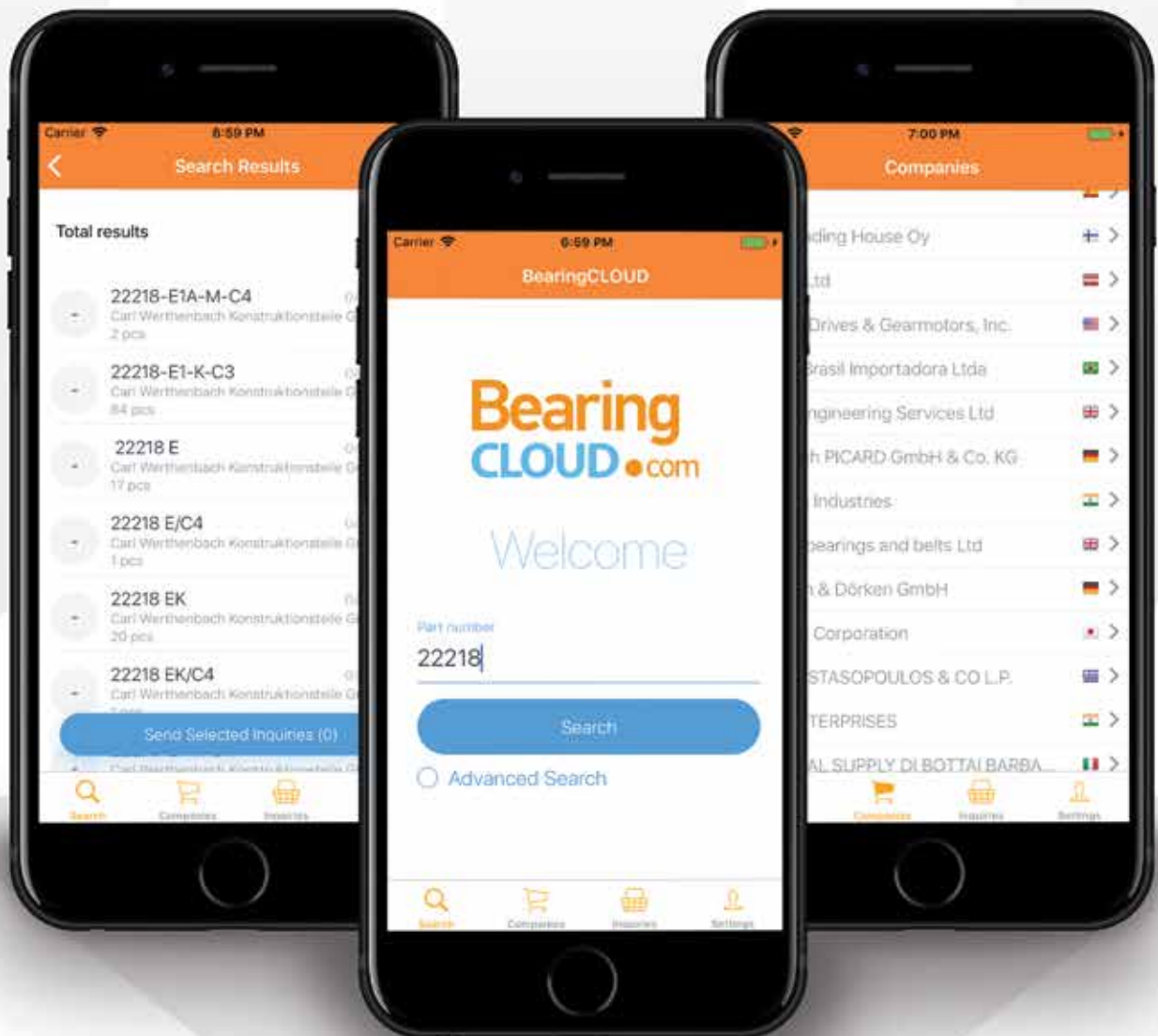
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