

Bearing NEWS

2020

SEPTEMBER
ISSUE 17

BEARING INDUSTRY MAGAZINE

The Bearing World's Road to Recovery

**"FOCUS ON
SUSTAINABLE TECHNOLOGIES"**

**A VIRTUAL FUTURE FOR
INDUSTRIAL EXHIBITIONS?**

**A DEEP ANALYSIS OF
CHINA BEARING MANUFACTURING INDUSTRY**



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2020 Antwerpen - BELGIUM

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The technological transformation will restart the Industry for a greater momentum

In this new edition of the BearingNews, we focus on the current dynamics of transformation within the bearing industry and tried to reveal the main trends which will lead the current period of change. The production, supply chain, distribution and even the way how we connect with potential leads are all in the middle of a period of major shift due to the global economic, pandemic, and political situation. All this results in further digitalization, change of consumer habits, a reshape of the supply chain and the conversion of machine systems and electrification of applications at high speed.

Is the technological transformation process taking a step back due to corona or just running up to a restart with even greater momentum? In an exclusive interview with Uwe Wagner, Chief Technology Officer of the Schaeffler Group, we tried to get the answers on this question from the perspective of a global automotive and industrial bearing manufacturer. The implementation of Industry 4.0 technologies in the bearing manufacturing processes are further discussed during an interview with Zhang Feng, Chief Executive Officer at XCC Group, China's Shanghai Stock Exchange registered, sixth largest bearing manufacturer.

More than ever before, small and medium size bearing companies are willing to move into strategic mergers and long-term partnerships. We tried to understand the main drive behind the merger and acquisitions during two exclusive interviews with Edmonda Monda, Chief Financial Officer of ICT srl and Head of ICT Advisory Division and with Kal Beidas, CFA and Executive Director at Worldwide Alliance Group.

What's Rolling..

What's rolling in the bearing industry? A brief summary of what happened during the last six months in the bearing industry; more details about key trends in the global bearing industry; new technologies for improving applications with ultrasound detection; automatic lubrication systems for bearings; Top 100 bearing reliability tips vol.07... and many case studies, insights, product and company highlights can be discovered in this September issue of the BearingNEWS magazine.

148 pages full of BearingNEWS.
hope that you will enjoy it!

Kenan M. Özcan
Editor in Chief



The BearingNEWS magazine is published **four times a year in March, June, September and December.**

The online editions are published in **8 languages** and can be followed on **www.bearing-news.com**

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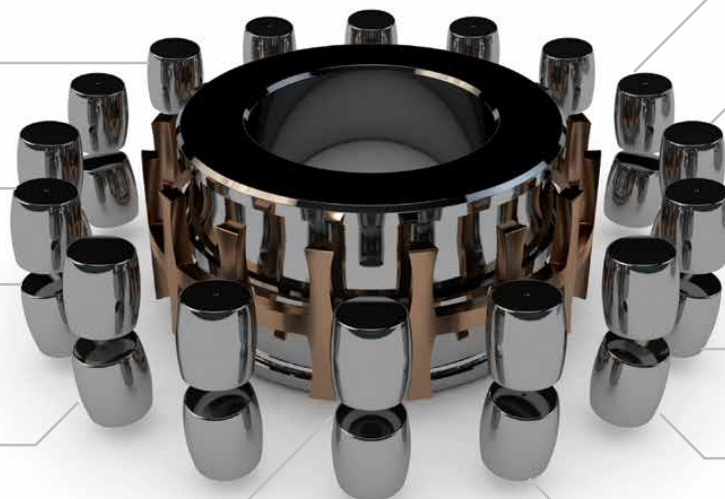
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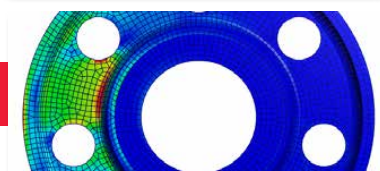
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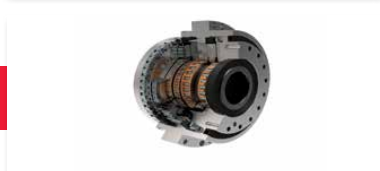
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SPINEA CONTINUES TO INNOVATE AND EXPAND
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February 25, 2020 // a bearing failure occurred with an Airbus A319-100. The plane which belonged to Air Canada and operated a flight from New York (USA) to Toronto (Canada) with 120 passengers and 5 crew members, made an emergency landing at the destination airport. When landing in Toronto, the crew reported a possible chassis problem. When the plane approached Toronto Airport, the crew asked to check the chassis from the ground. The plane was allowed to make a low approach at GDP 24, so that the control tower could inspect the wheel chassis and noticed the absence of the right main wheel. The aircraft was subsequently configured to land on Runway 23, where it landed without further incident. The Canadian Transportation Safety Council said on February 25 that, according to the photographs taken, the outer bearing appeared to be out of order, which allowed the wheel assembly to slip out of the axle. The severed wheel was found and handed over to the aircraft operator for further investigation.



March 01, 2020 // Hayley 247 Engineering Services adds Precision Linear Motion expertise through the acquisition of WMH Transmissions & Apex Transmissions. A majority share deal was completed on the 13th February 2020. WMH will now become the UK Groups specialist provider of Precision Linear Motion products and services.

March 03, 2020 // The popular and ever-expanding NSK academy www.nskacademy.com – has added a new training module to its portfolio



of courses. Aimed at increasing the knowledge of those involved in developing and specifying machinery for the food and beverage sector, the new module represents a comprehensive overview of all factors relating to bearing use in such applications. Like every training module available at NSK academy, those completing the course will be invited to answer a series of questions to test their knowledge. Participants attaining an 80% pass mark will receive a certificate in recognition of their achievement.

March 05, 2020 // Oxford, UK based Carter Bearings has been expanding again, taking on new staff, enlarging the sales offices and refurbishing the facility from top to bottom as sales reach a record high. New arrival Valentino Burattini obtained a First in Aerospace Engineering before joining Carter and has already established himself as a valuable team member. His colleague on the desk next door, Nathan Butterfield, is a fellow recent addition to the Carter engineering team too. He recently graduated with a 2:1 in Motorsport Engineering and has rapidly established himself as a knowledgeable

resource for customers seeking bearing solutions in his chosen arena.

March 08, 2020 // Axel Johnson International's business group Power Transmission Solutions, has signed an agreement through its subsidiary Jens S. Transmissioner A/S to acquire Hoyer Transmissions in Denmark. The acquisition is expected to close sometime in March, 2020. Hoyer Transmissions is a leading Danish distributor of mechanical transmission products. "The acquisition of Hoyer Transmissions is well in line with our business group strategy for expanded geographical presence as well as an excellent fit and add-on to Jens S current business" says Ola Sjölin, Managing Director, Power Transmission Solutions. Founded in 1974, Hoyer Transmissions is a well-established provider of mechanical transmission products with its main business and offices located in Hadsten, Jutland. The company mainly serves the Scandinavian and German markets. As a leading Danish distributor, Hoyer Transmissions has a well-known supplier base and offers a wide product portfolio. Hoyer Transmissions will be

divested from Hoyer Group and become part of Jens S Group.

March 18, 2020 // Regal Beloit Corporation, a leading manufacturer of electric motors, electrical motion controls, power generation and power transmission components, announced the introduction of new solutions for wireless vibration and temperature monitoring. The Perceptive Technologies® wireless monitoring system provides 24/7 services to help detect abnormalities in equipment before they become problematic. At a fraction of the cost of a wired system, this new Regal Perceptive Technologies wireless monitoring system eliminates the need to be near operating equipment and is adaptable to any industry. Monitoring can be performed on-site or from a cloud platform on equipment like fans, pumps, motors and blowers. Regal's wireless monitoring system allows users to take advantage of the extensive industrial experience of the Perceptive Technologies team to monitor and analyse machinery remotely, helping to improve reliability and maximize production.

March 22, 2020 // Counterfeit bearings were seized in Kursk – Russia. According to the Russian Central Customs Administration, the Swedish manufacturer SKF asked Russian customs to check the Kursk distribution network for bearings illegally marked with the SKF trademark. The manufacturer of bearings received a large number of complaints about the quality of products sold in the city.



— Regal's Perceptive Technologies® services includes now wireless monitoring system

During the inspection, about 1,000 different bearings marked with the SKF mark were found in two outlets. Individual entrepreneurs engaged in sales did not have documents confirming the origin of the goods and the legality of their import into the Eurasian Economic Union (EAEU), as well as permission from the copyright holder to use this trademark. Bearings were withdrawn from circulation and sent to research for the presence of intellectual property included in the Customs Register of intellectual property. SKF has verified product authenticity. The results of the study showed that all the products presented are counterfeit, i.e. These bearings were not manufactured at any of SKF's plants. The SKF mark was applied to products unlawfully – without the permission of the copyright holder. Neither the copyright holder nor the trademark license holder entered into any agreements with Kursk entrepreneurs on the use of this trademark. At the same time, counterfeit bearings had very low performance and did not meet SKF standards and specifications. Their use in units of equipment designed to work with original bearings could cause equipment breakdown and harm human health and the environment.

March 24, 2020 // Acorn Industrial Services Ltd is proud to announce its appointment by Flender as a stocking distributor to distribute its vast range of high-performance couplings, including the revolutionary N-EUPEX® pin coupling. A subsidiary of Siemens, Flender proudly manufactures robust and durable couplings which customers can depend on. With couplings available to suit applications across every industry, Flender's vast experience guarantees quality and reliability, even in the harshest environments. Following its commitment to minimise customer downtime and reduce lead times, ACORN has invested in large stocks of Flender N-EUPEX pin couplings. Short lead times are also available on the full range of Flender couplings, thanks to ACORN's close working relationship with the manufacturer.

April 02, 2020 // The leading executive association for Power Transmission and Motion Control (PTMC) industry across EMEA, is pleased to announce the addition of seven new member companies to its strong member portfolio:

1. ARKOV, Czech Republic
2. BELL D.O.O, Slovenia
3. JENS S. TRANSMISSIONER AB, Sweden
4. KYS KURKCUOGLU, Turkey

5. MAK AANDRIJVINGEN BV,
The Netherlands
6. PASSEROTTI SP. Z O. O., Poland
7. SVERULL ELEKTRODYNAMO AB,
Sweden

“EPTDA is honoured to welcome seven new companies – six distributors and a new manufacturer – to its solid portfolio. Spanning across key industrial markets of Czech Republic, The Netherlands, Poland, Slovenia, Sweden and Turkey – the newest additions are a great testament to our credibility and strength across EMEA region and beyond,” said Hans Hanegreefs, EPTDA’s Executive Vice President. “Despite the ongoing turbulence and uncertainties in the economy, we are pleased to continue our momentum. We are committed to continue adding value to our member companies by providing intelligence, best practices, market data and trends, and inspiration from other industries and leaders. We are leveraging new digital alternatives to bring our members together regularly to help them navigate this unknown slowdown” – adds Hanegreefs.

April 09, 2020 // Schaeffler plant in Vietnam has successfully started production for machined needle roller bearings in March 2020, in line with the localisation plan in Asia Pacific. With this addition to the production portfolio, Schaeffler is able to cater to the increasing demands in the region as well as globally, ensuring business continuity for our customers worldwide. It is also the first plant in South East Asia to apply the latest Industry 4.0 solutions developed by Schaeffler. Located at the Amata Industrial Zone in Bien Hoa City, about 50 km from Ho Chi Minh City, Vietnam plant produces industrial bearings and components for a wide range of applications, such as Tapered Roller Bearings (TRB), Radial Insert Ball Bearings (RIBB), including the extended range, Steering Column Bearings



(SCB) as well as the flagship product of Schaeffler Group – Needle Roller Bearings (NRB), in South East Asia.

April 11, 2020 // Mahr Inc., a global manufacturer of precision measurement equipment used for dimensional metrology, today announced a series of new Micromar Micrometers offering capabilities to perform specialized measuring tasks. Micromar 40EWR micrometers are a market-leading innovation, featuring a modern look and integrated wireless technology for data transmission. Following the recent introduction of its 40EWR-L Rapid Drive micrometers with high speed measuring spindle positioning, Mahr continues to expand its product family with new micrometers for specific measuring tasks.

April 17, 2020 // NKE Austria GmbH

reports record capacity utilisation at its Steyr plant: more than 1000 large bearings were in production in the first quarter of 2020. Based in the Austrian city of Steyr, the bearing specialist follows a flexible production strategy, allowing it to produce large bearings in batches of as little as 10 and up to 500 units. Deep groove ball bearings as well as cylindrical, tapered and spherical roller bearings with diameters ranging from 200 mm to 800 mm can be produced at these volumes. These bearings are used in a wide range of applications, including industrial and wind turbine gearboxes, generators and railway applications.

April 25, 2020 // SKF has reached a point where digitalization brings both challenges and opportunities. The key question is how to maintain growth when ball bearings can be bought in bulk via e-retailers such as Amazon or Alibaba and competition from China is growing. At the same time, demand for components for the mechanical industry as a whole – and thus also the need for ball bearings – is expected to fall. SKF’s vision is to be a knowledge-based company that leverages information, expertise and packaged solutions to achieve



– Production line at NKE in Steyr, Austria

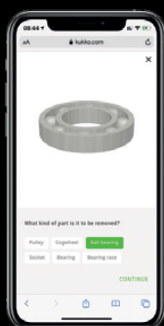
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competitive advantage. The strategy is to shift from being a supplier, manufacturer and seller of ball bearings to, ultimately, a supplier of efficiency, performance and availability to its customers. This impacts the entire chain, from design and production to sales channels and the customer offer.

May 01, 2020 // ABF, an international bearing and electric motor wholesaler from The Netherlands, now offers the option to add their customers own delivery note to the order in their online store. During checkout in the ABF online store, customers can now upload their own delivery note. This will be added to the order free of charge. A handy option, especially in these times.

May 12, 2020 // Ovako is the first producer in the world to heat steel using hydrogen. Together with Linde Gas AB, Ovako has conducted a full-scale trial using hydrogen to heat steel before rolling. The trial was performed with good results in one of the company's pit furnaces at the Hofors rolling mill in Sweden. This historic development for the steel industry proves that carbon dioxide emissions from rolling can be eliminated provided the right financial support and infrastructure are in place. As part of its sustainability efforts, Ovako has worked for a long time to modernize and improve the efficiency of its furnaces. Thanks to this prioritization and the investments made in recent years, including upgraded control and automation systems, Ovako is now ready to take the next step. The use of hydrogen in combustion would have a great positive effect on the environment since the only emission generated is water vapor. In collaboration with its partner Linde Gas AB, Ovako conducted a trial in which steel was heated using hydrogen instead of LPG (liquefied petroleum gas) before rolling at the mill in Hofors. The trial was successful and testing of the steel produced showed that heating with hydrogen does not affect

the quality. Given the right conditions, Ovako could therefore introduce hydrogen heating for furnaces at all its rolling mills and thereby drastically reduce its already world-leading low carbon footprint from cradle to gate.

May 24, 2020 // SKF is making further investments in strengthening its manufacturing footprint in China for ball bearings. The investment is in-line with the Group's region-for-region manufacturing strategy. The Group announced a 36 million Euro investment in a new factory in Xinchang in June 2019. With the factory now operational, a further 38 million Euro is being invested in expanding the site. Patrick Tong, President, Industrial Sales Asia, says: "We have made great progress in China, the world's largest market for deep groove ball bearings, over the last two years, thanks to our engineering competence and first investment phase in Xinchang. The next phase of the investment will allow us to serve our customers even better, across wider applications and with a wider product range." The second phase of the factory in Xinchang is expected to be operational during the end of 2021.

June 01, 2020 // The bearing industry has now its own radio station Bearing Sounds! A professional radio design team based in Spain, which built

Internet Stations including the Overseas Iceland in Europe, have enlisted the help of Steve Martin from R&M Bearings International Ltd in UK, to create an Internet Radio Station specifically for the bearing trade. The purpose is to enable companies in the trade to spread their news, offers and specialities over the airways with worldwide coverage 24/7 and 365 days aligned to great music. This new medium compliments other sources of information and advertising in the bearing industry such as that is offered by BearingNEWS magazine and can be played in the background of offices, warehouses, or at home and enables companies to create their own advertising packages that suits their budgets and requirements, and can even sponsor specific shows. Check www.bearingsounds.com to listen live and for more information regarding advertising opportunities.

June 08, 2020 // SKF factories to be carbon neutral by 2030. Since 2015, SKF has decreased its manufacturing carbon footprint by 36% and is already operating two carbon neutral factories. Today, SKF announced its aim to achieve a fully carbon neutral manufacturing footprint by 2030. The 2030 target will cover SKF's own manufacturing operations, i.e. SKF's scope 1 and 2 emissions. It will be achieved by a combination of process



— Bearing industry's radio station www.bearingsounds.com



— new SKF factory in Xinchang, China

improvements, energy efficient machinery, and procurement and generation of renewable energy. As a last resort, SKF may also purchase high quality carbon offsets. Alrik Danielson, President and CEO, says: “Reducing emissions is necessary to combat the climate crisis and as a global company it is important that we show leadership. We strive to reduce the climate impact in the full value chain, from the raw material we buy, to the customer’s use, and beyond. The responsibility to act starts in our own operations – we will act with speed and purpose to achieve this goal. Carbon neutrality will further improve our competitiveness and aligns the interests of SKF, our customers and the environment.”

July 03, 2020 // First trade fairs of German organizers successfully held in China. At the beginning of July 2020, the first trade fairs for German organizers took place in China after the Corona break. In Shanghai, these include BioFach China and Craft Beer China from NürnbergMesse and the China International Occupational Safety & Health Goods Expo (CIOSH) from Messe Düsseldorf. Four trade fairs of the Munich trade fairs were also held at the Shanghai location: Productronica China and Electronica China as well as Laser World of Photonics China and Vision China event in Shanghai. All events were carried out in compliance with strict hygiene

regulations, including the obligation to wear mouth and nose protection, and temperature measurements were carried out on the exhibition grounds.
July 05, 2020 // Schaeffler presented



its interim report for the first half of 2020. The Schaeffler Group’s revenue for the first six months amounts to 5,574 million euros (prior year: 7,226 million euros). As a result of lower demand due to the coronavirus pandemic, revenue for the period decreased considerably at constant currency, falling by 21.8 percent; the decline for the second quarter amounted to 34.5 percent. This decrease was driven by revenue declines at all three divisions, with the 26.8 percent constant-currency drop in Automotive OEM division revenue for the first half of 2020 by far the largest. The impact of the pandemic on the four regions varied. The Greater China region reported constant-currency revenue growth of 3.0 percent for the reporting period due to the recovery emerging there in the second quarter. The

remaining three regions experienced considerable revenue decreases for the first six months. Over the course of the month of June, business recovered noticeably across all divisions and regions. The Schaeffler Group earned 65 million euros (prior year: 556 million euros) in EBIT before special items in the first six months of 2020. This represents an EBIT margin before special items of 1.2 percent (prior year: 7.7 percent). The deterioration compared to the prior year was primarily attributable to the decrease in gross margin as a result of the volume-related revenue declines. EBIT for the reporting period was adversely affected by 288 million euros (prior year: 73 million euros) in special items. These included an impairment of goodwill allocated to the Automotive OEM division by EUR 249 million recognized in the first quarter. Special items additionally comprise 39 million euros in expenses incurred to expand the programs RACE (Automotive OEM division) and FIT (Industrial division), especially in connection with reducing headcount. Including these special items, EBIT amounted to 223 million euros (prior year: +483 million euros).

July 10, 2020 // The Timken Company, reported second-quarter 2020 sales of \$803.5 million, down 19.7 percent from the same period a year ago. The decline was driven by lower demand attributable to the broad economic slowdown caused by COVID-19, and unfavorable currency, partially offset by the favorable impact of acquisitions. In the second quarter, Timken posted net income of \$61.9 million or \$0.82 per diluted share, versus net income of \$92.5 million or \$1.20 per diluted share for the same period a year ago. The year-over-year decrease was driven primarily by the impact of lower volume and related manufacturing utilization, and unfavorable currency, partially offset by lower selling, general and administrative (SG&A) expenses, favorable price/mix, and lower material and logistics costs. In the quarter, the company implemented cost reduction

What Happened in the Bearing Industry? First Half of 2020

actions across the enterprise, including temporary compensation reductions and work furloughs, which meaningfully reduced operating expenses. Net special charges were higher versus the year-ago period, driven mainly by a pension remeasurement loss, higher restructuring charges and discrete tax expenses, partially offset by lower expenses related to acquisitions and a legal accrual. Excluding special items, adjusted net income in the second quarter was \$77.0 million or \$1.02 per diluted share versus adjusted net income of \$97.9 million or \$1.27 per diluted share for the same period in 2019. Net cash from operations for the second quarter was \$247.4 million, up from \$157.6 million in the same period a year ago, as favorable working capital and lower cash taxes more than offset the decline in net income. Free cash flow for the quarter was \$222.7 million. During the second quarter, Timken paid its 392nd consecutive quarterly dividend and reduced net debt by almost \$200

million compared to March 31, 2020.
August 01, 2020 // The global automotive and industrial supplier Schaeffler announced that the Supervisory Board of Schaeffler AG has appointed Dr. Klaus Patzak (55) as a member of the Board of Managing Directors of Schaeffler AG, effective from August 1, 2020. Dr. Patzak will assume the position of CFO, which includes responsibility for the Finance and IT functions, as the successor to Dietmar Heinrich (56), who will leave Schaeffler AG as agreed on July 31, 2020 in order to pursue new challenges in his career.

August 05, 2020 // The Customs Service of Lianyungang County (Jiangsu Province, China) has detained 40 bearing sets with the SKF logo printed on the outside of the packages. The bearings were planned to be exported. During the raid, the exporting company was unable to provide supporting documents for the legitimate use



of the rights of the SKF trademark. The customs service contacted the copyright holder and confirmed the doubts of the customs officials. The consignment has been blocked. Since the beginning of the year, the Chinese Customs Service has launched a special operation for the customs protection of intellectual property rights under the name Longteng (Dragon Fly) Action 2020. This is another project, repeated from year on year, aiming at eliminating the violation of intellectual property rights when exporting from China.

CSC BEARING worldwide

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appx. 100 Mio USD turnover

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Technical Support



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**“WHY AN EXECUTIVE LED ACQUISITION
MATTERS MORE THAN YOU THINK,”**



Straight Talk with
Kal Beidas



For nearly 20 years, I've truly valued the opportunity to work in a wide range of different sectors of the bearing industry on a global platform -from automotive to agricultural to almost everything in between. It has been a tremendous journey, yes- but it's also been an educational one, too. I've had the privilege of collaborating with some of the most exceptional technical and commercial minds in the industry and to say I've learned a lot during that time is probably a little bit of an understatement.

Today, I have the honor of running an Executive Led Acquisition at Worldwide Alliance Group, which itself launched just this year. It's a topic that is near and dear to my heart, and it's one that I'd like to go into a bit more detail about today.

What is an Executive Led Acquisition?

At its core, an Executive Led Acquisition is an initiative undertaken by an experienced CEO in an effort to acquire a family-owned company, all with the intention of leading it as its new CEO. You'd be forgiven for assuming that this is a cold and cynical process, as is so often true in the world of business. I'm happy to say that the reality of the situation, however, couldn't be farther from the truth.

In all the years of my career, I've learned one important truth: the greatest asset to an organization is its human and cultural DNA. This seemingly simple element is what binds an organization together, allowing it to collectively tackle obstacles as they arise and evolve to meet the demands of tomorrow.

The bearing industry in particular is in a constant state of flux - to the point where no two decades seem to be alike. During the past 20 years, I've witnessed a lot of these transformative changes up close and personal - from changes unfolding thanks to technologies that were introduced to meet the ever-demanding efficiency standards of the automotive industry, to an unprecedented level of globalization that shifted the industrial production landscape, to the brave new frontiers of Industry 4.0.

What does this have to do with an Executive Led Acquisition? It's simple - only the people within a business, and the processes they have built, will carry them forward and help them excel in this highly competitive industry.

Which is an issue, if the original beating heart of said company - the founder and/or CEO - wants to retire.

I see this happen all the time - someone poured their blood, sweat and tears into their company for more years than they can count and now they want to sit back and enjoy their retirement in peace and comfort. But so often, they still want to participate in the future success of their company in any way that they can - which is, in essence, what an Executive Led Acquisition is all about.

Executive Led Acquisitions fill a unique gap in the industrial sector in particular because they're not only front-facing, but are also open and highly transparent. In a general sense, they allow the seller to openly communicate not just with the buyer, but also with the future leader of their company. In my opinion, open communication and relationship-building are essential to privately held business owners since they hold their employees (and their legacy) in such high regard.

At the same time, large corporations

contemplating a divestiture obviously have a reputation to uphold - and they want a high degree of conviction from the buyer. They want to make sure that the future leader has a growth strategy that protects their employee's interests.

With the right hand by your side, an Executive Led Acquisition is a great opportunity to accomplish all of this and more at the exact same time.

Why an Executive Led Acquisition Matters More Than You Think

During my conversations with many founder CEOs who endured the great recession of 2008, many can vividly recall the uncertain and slow recovery that followed. But many of them persevered because their business was their identity - a legacy that they hoped to carry on.

Flash forward to today, and about 75% of founder CEOs plan to retire over the next five years. Despite that, absolutely nobody could have predicted the COVID-19 pandemic and the potential economic fallout over the coming years.

But by being flexible on the deal structure, people like myself can provide founder CEOs with an avenue to retire, cash out for a majority stake in their business AND maintain a minority stake to a level they are comfortable holding.

Such an arrangement will allow them to participate in the future growth of their company should they choose to do so. It also brings with it the most important benefit of all: the peace-of-mind that only comes with knowing their legacy is being taken care of.

At Worldwide Alliance Group in particular, we understand that the bearing universe is vast - which is why we're open to looking at not only manufacturers and distributors, but also service providers anywhere along the value chain spectrum headquartered in the United States or Canada. Companies in the polymer, lubrication, gearbox/powertrain, electric motor, server and harmonic drive industries, just to name a few, are of keen interest right now. But really, as long as the company is in the mechanical and electromechanical space, we are very open to exploring the opportunity further.

We fully recognize that these are unusual times we're living in right now, but that the future is filled with opportunities. This is also a big part of the reason why we're eager to construct a deal structure to accommodate the realities on the ground, all to create the best possible outcome for everyone involved.

So if you're a seller, founder CEO or business development executive at a publicly traded company who is considering a divestiture, I encourage you to reach out and connect with us. I'll be able to learn a lot during my conversation with you, and trust me - what may seem outside of the realm of possibility might just turn out to be a perfect fit.

But more importantly, I genuinely enjoy the relationships we form in the process, irrespective of whether or not a transaction transpires.

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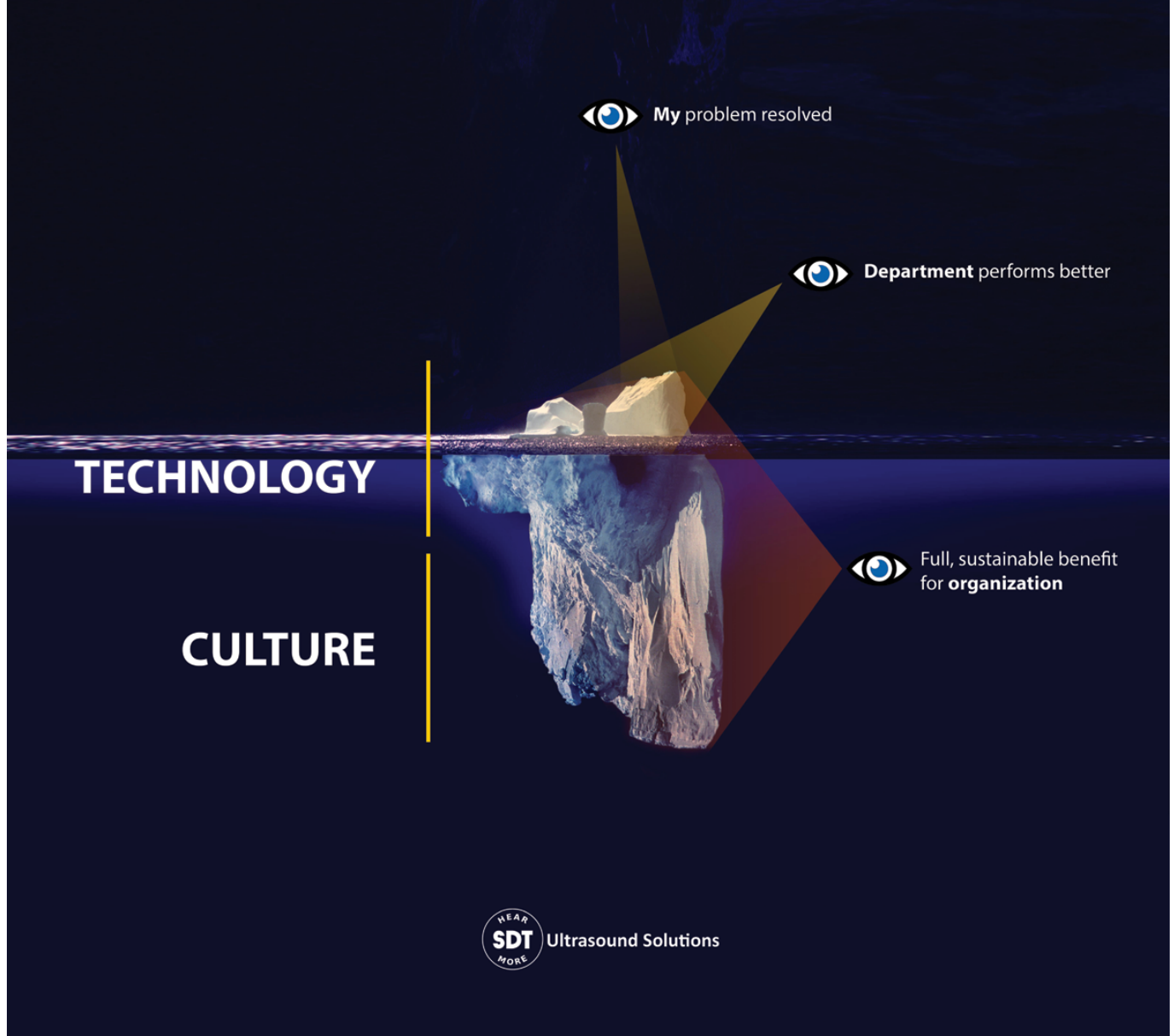


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LUBExpert - The Difference is in the Details

Compiled by Allan Rienstra and Haris Trobradovič

Anyone passionate about creating a world-class lubrication program realizes that ultrasound technology is the best tool for executing the replenishment task with precision. But which ultrasound instrument works best? Which features are truly game changers? What should a program leader look for when procuring an expert ultrasound lubrication solution?

Social media is alive with discussions about the virtues of scheduling lube intervals on the basis of asset condition rather than a set number of running hours. There is no shortage of webinars to watch on the subject either.

Program leaders now realize that

complicated formulae used in antiquated time-based systems, which rely on best-guess data inputs, do not provide the correct scheduling interval outcomes.

The days of adding a few extra “feel-good” pumps from the grease gun are over. Lubricators need discipline and

control in their work. Ultrasonic lube regimens use careful science to calculate both replenishment interval and grease quantity. Lube techs who do not follow the recipe prescribed must now explain their decision making to the lube log. SDT’s chief implementor and LUBExpert guru Haris Trobradovič says:

“

The lubrication chain fails when fine fibers around them are missing. Those include awareness, ownership, communication, discipline, control, responsibility, and recognition.

”

Before you purchase an ultrasound lubrication solution, be sure the instrument, software, and solution provider are fully capable and competent to overcome these important, human traits. You don't need another gadget; you need a strategy.

Lubrication Success Formula: Instrument + Strategy = Solution

To guide you, we overview the key features that differentiate SDT's LUBExpert solution from other devices offered in the market. You are encouraged to do your due diligence and, as always, we are here to help you Hear More if you have any questions.

Reasons to choose LUBExpert over the Grease Caddy

1. Guided Mode – When lube techs choose “Guided-Mode” operation they receive step-by-step advice from LUBExpert's onboard intelligence. This AI is the result of learning which stems from greasing thousands of bearings. Based on physical parameters of the asset, Guided-Mode advises you each step of the task while providing live feedback about the impact your efforts made on the bearing's greasing mechanism. Every instruction is provided based on real-time measurements. Guidance is based on LUBExpert's continuous assessment of the bearing's response to added grease.

2. Onboard Instructor – A virtual coach lives inside each LUBExpert system. Your first interaction with this mentor may be in a physical or virtual classroom but they follow with you forever. The algorithm inside LUBExpert is like having your trainer with you all the time, prompting and reassuring you what to do next. All

decision making is based on the real-time condition of the bearing and the effect adding grease made; positive or negative.

3. Grease Gun Database – LUBExpert and its supporting software UAS2 maintain a database of all your grease guns. It knows how many you have, the name you use to distinguish them from each other, as well as their capabilities. LUBExpert remembers the quantity of grease injected per stroke for every grease gun in your closet.

4. Lube Database – We all know that mixing incompatible greases is a big no-no; yet it happens all the time. UAS2 supporting software knows which grease to use with which bearing. LUBExpert reminds you at the start of every grease replenishment task to ensure the right grease is reaching the right bearing.

5. Sensor Control – On-condition lubrication is a precision task requiring precise procedures. It is critical that the same sensor type be used for repeating tasks such as bearing grease replenishment. With LUBExpert there is only one sensor type for this task, and it's called LUBESense. Lube technicians are prevented from accidentally using the wrong sensor, and LUBExpert even remembers the serial number of the sensor and stores it with every reading.

6. Location Tags – What are the chances of putting the right grease at the right time in the right quantity in the WRONG BEARING? Higher than you may wish to admit. LUBExpert makes

sure you are executing each task on the right asset by reminding you prior to pumping with a physical address location right on its generous display.

7. Conditional Reporting – Assessment of bearing and lubrication condition is continuous during the entire re-greasing task. In Guided Mode, each step is reported on board for you to see in the field, and for the final condition to be logged to UAS2 software. Each program's lube strategist may react to constant feedbacks and adjust the strategy as required. Outcomes include:

- a. Over-greased;
- b. Lubrication Success;
- c. Lubrication Failure;
- d. Suspected Bearing Failure;
- e. Shorten Interval
- f. Process aborted
- g. Safety risk (as an alarm)
- h. Defected fitting/line (as an alarm)

8. Shopping List – What's worse than returning home from the grocery store having forgotten to pick up a key ingredient? How about venturing 20 minutes into your plant only to discover you forgot to bring the right grease or the right grease gun for your planned tasks? No more! LUBExpert and UAS2 provide a list cleverly called “Things You Need”. The list is made by smartly calculating all the greases and guns pertinent to the planned lube routes you will do that day. Simply email the list to your storeroom and have all the grease guns, greases, and the correct quantities waiting for you as you head out to the plant.





size and running speed. UAS2 and LUBExpert will not allow the input of an acquisition time that is not well-suited to the parameters of that bearing.

c. Mandatory Messaging (stopped process) - During the grease replenishment task, you may choose to stop adding grease at any time. However, you cannot close the process without adding a comment to log your reason for stopping the job early. LUBExpert wants to know and so does your lube strategist. You must always add a comment to explain your actions.

Lubrication is a precision task that when done poorly does more damage to reliability than any other maintenance intervention. Without a strategy, without discipline, without control, and without training it would be better to not grease at all.

LUBExpert offers all of these. The solution is one that is missing from industry but promises to restore the role of lube technician to the high priority it once held and should always hold.

If you are shopping for an ultrasound instrument to assist you in your lubrication efforts, perhaps you should reconsider. An instrument alone will not improve your condition. You need a lubrication strategy, a trainer and a coach. You need LUBExpert to grease bearings right! Check out more details about LUBExpert at www.sdtultrasound.com/products-solutions/products/sdt-lubexpert

9. Discipline and Control – The lubrication task is arguably the most important one for supporting asset health and longevity. But it requires discipline and control and LUBExpert provides them in several ways. LUBExpert’s intelligence assigns automatic messages containing information critical for the strategist. This removes that burden of reporting from the lube technician’s shoulders.

- a. No lubrication task is completed without assigning a field message.
- b. No lubrication task is skipped without assigning a field message.
- c. Lube techs have the freedom to follow their own instincts only after considering the advice given by LUBExpert. In either case, it must be documented through messaging.
- d. Whatever happens in the field is easily read in UAS by the lube strategist, every single detail; what, how and why it was done.
- e. LUBExpert offers technicians to grease bearings in “Free Mode” with graphical and numeric on-screen representation. This “investigative mode” allows operator to feel the pulse of the assets before assigning alarms and guidance. This is NOT possible with listen-only ultrasound gadgets that force you to memorize values, outcomes and added quantity for each step.

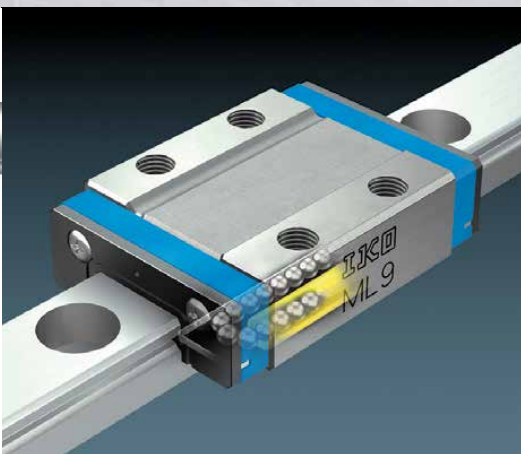
10. Amplification Control is a new feature added to LUBExpert that sets it apart from its competitors. Ensuring the acoustic settings are correct is a straightforward step but some inspectors have been known to skip it or miss it. LUBExpert blocks

the lube technician from collecting data unless the amplification is correctly set.

11. LUBExpert has many internal controls preset in UAS2 and LUBExpert. These controls add discipline and accuracy to the important precision task of grease replenishment.

- a. Acceptable Grease Gun** – During program setup each bearing is assigned a grease gun from the database of pre-validated grease guns. The recommended replenishment quantity is calculated based on the bearing dimensions and running speed. UAS2 will not allow the assignment of a grease gun that does not match the required output of the bearing.
- b. Acquisition Time** – As every action during grease replenishment is measured by LUBExpert, it needs to know how long to measure between grease injections. This is dependent again on bearing





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‘Fit and Forget’ Actuators

Provide a Low Maintenance Solution in a High Duty Bread Manufacturing Application

In recent months, due to the coronavirus pandemic, there has been a spike in demand for bread far in excess than previously seen. Whereas many people usually buy a ready-made lunch everyday, now they are buying bread and eating at home. The UK bakery market is one of the largest markets in the food industry, and not surprisingly, there is a high need for modern technology

to rise up to market demands. To keep up with today's demand, the food processing industry needs to be efficient; this means most of the tasks need to be automated. But in every automated system, there are a host of smaller components that perform simple yet essential processes. Without these components, the automation could not take place.

David Wood Foods – at the forefront of innovation

Based in Newport, South Wales, David Wood Food manufacture bread for the biggest retailers in the UK. Operating a fully automated production line, from the initial weighing and mixing of ingredients, to the proofing, baking and cooling, right through to the slicing and packaging, David Wood Foods currently produce in excess of 420k loaves a week. Operating 24/7, 364 days of the year (Christmas day being the only non-operating day), this is a high duty system requiring a low maintenance, reliable solution. In addition to this bread manufacturing site, there are a further seven David Wood sites throughout the UK manufacturing luxury meals, savoury pastries, pasties and crafted bread. A mature and fiercely competitive market, David Wood Foods operate highly efficient manufacturing sites to stay a step ahead of the competition.

Actuators are often essential elements of a production line in the food industry and for David Wood Foods this is no exception. In this high duty application, David Wood

Foods use HepcoMotion's DLS4 belt driven actuator system which comprises belt-driven linear modules, an AC motor/inverter package and a range of compact planetary gearboxes for use with servomotors. Corrosion resistant options are also available, very often a key requirement in the food and packaging industry where regular wash/wipe downs are frequently required. HepcoMotion specialises in high quality linear solutions and automation components and, celebrating its fifty-year anniversary this year, has gained a reputation for its high-end, low maintenance products.

A total of 10 x DLS4s are used in three key areas of the production line. Two are used to push the loaves into the oven, four are used as an infeed and outfeed in the cooler, and the final four are used in the packaging area to assist with packing the loaves into the delivery baskets. Ideally suited to this application, DLS4 is a reliable, low maintenance solution offering trouble-free operation from proven V guide technology and a long system life.

Actuators used in core processes

Arranged in parallel and operating with a single motor, the first set of DLS4s are connected to a pusher arm which moves the trays of loaves forward onto a conveyor, into the oven operating at a temperature of over 200°C. Working in close proximity to the oven, the double row bearings are suited to the high temperatures. HepcoMotion also offers Vacuum and Extreme Temperature bearings for either extreme high temperatures or extreme low temperature applications. 32 loaves are moved at a time and baked in the oven for over 20 minutes. The actuators are constantly repeating this process every 30 seconds, 24 hours a day, seven days a week. As a zero backlash system, the DLS4s are able to offer the greater repeatability and accuracy required for this application.

Another advantage with Hepco's DLS4s is that they can be specified to a bespoke length to the nearest mm, up to 8m as standard. This offers customers greater flexibility as they can specify the stroke length to suit the production line, rather than having to design around a



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Two DLS4 actuators push the loaves onto a conveyor

standard stroke length. This was an advantage for David Wood Foods as they could easily have variable stroke lengths to suit the different processes the DLS4s are used for. Hepco's DLS modules can also be supplied as joined sets to fulfil longer stroke requirements.

After the loaves have baked in the oven, they are transported to the cooler where they spend 2 hours rotating on a cooling rack. Cooling is a key part of the bread manufacturing process to prevent the bottom crust becoming moist and soggy. David Wood Foods have approximately 9kg of loaves in the cooler at one time. Working in parallel with a single motor and attached to a pusher arm, one set of DLS4s push 22 loaves onto the rack, while the other set of actuators push the loaves from the rack onto the conveyor to get transported to slicing and packaging.

Breadcrumbs are a recipe for disaster!

As with all food industry applications, the resulting breadcrumbs and dust at David Wood Foods creates a hostile, challenging environment. If particles of dirt and debris find their way beyond the seals of any

linear motion component, or if they become damaged, the system will become jammed and motion will be impeded. This can result in catastrophic failure – meaning excessive downtime, and a complete system change. DLS4, however, is ideally suited to this harsh environment thanks to its V guide system that functions on the basis of tight geometrical control over matching slide and bearing V's. In turn this provides a wiping action that expels debris, keeping machines running and reliable. This self-cleaning action eliminates contamination of the slide – a key benefit for David Wood Foods working with extensive breadcrumbs.

As small, but central parts of an enormous production system, low maintenance is a core requirement of these actuators. If one part of the system goes down, the entire production line is affected. With a high throughput of 420k loaves a week, any unplanned maintenance is going to have a big impact.

The challenge: low maintenance

A big advantage of Hepco's V guide systems is that they have long re-lubrication

intervals. Saving valuable downtime and cost, Hepco's cap seals need re-lubricating every 1000km, compared to every 100-150km with ball rails. These long re-lubrication intervals work well for David Wood Foods, dovetailing with their monthly planned maintenance schedule. In the last 12 months, re-lubrication is the only maintenance that David Wood Foods have had to carry out on the DLS4. Low maintenance cap seals are used to constantly lubricate the system and to provide effective sealing and protection.

David Wood Foods require minimal downtime and servicing to achieve continuous operation. When a DLS4 shows sign of wear, the process is simple and does not impinge too much on production time. The eccentric adjustment facility of the V bearings can be used to quickly and simply remove any play that has occurred. Moreover, when the V bearings reach the end of their calculated life, they can be replaced individually, and not as an entire set, saving both time and money. The DLS4s have been in operation for nearly 10 years and the bearings have never been changed.



The Superior Quality Bearing Manufacturer of China is Looking for New Distributors Worldwide

China's well-known and largest bearing manufacturing company ZWZ Group 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.



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Is all bearing surface damage troublesome? Combating Corrosion at the Design Phase

Up to 40 per cent of a vegetable crop can go to waste due to the aesthetic requirements of some supermarkets. While a wonky vegetable may not be the most visually pleasing, it possesses the same nutritional value as its perfectly proportioned counterpart. Here, Chris Johnson, managing director of **bearing specialist** SMB Bearings, explains why not all bearing surface damage should cause alarm and future headaches for offshore oil and gas plant managers.

Bearing surface damage can take many forms, from spalls in the raceways, wear from ineffective lubrication, corrosion due to harsh chemicals to false brinelling marks caused by static vibration. While surface distress can result in problematic symptoms such as excessive heat, increased noise levels, increased vibration or excessive shaft movement, not all external bearing flaws point to compromised internal machine performance.

Corrosion is a naturally occurring phenomenon and a common form of bearing surface damage that offshore oil and gas plant managers must contend with. There are ten primary forms of corrosion, but bearing corrosion usually falls into two broad categories — moisture corrosion

or frictional corrosion. The former is environment specific, but can appear on any component of the bearing, creating an alarming oxide layer as a result of a chemical reaction with a metal surface.

For example, in offshore mining, bearings are often exposed to moisture or mild alkalinity due to their contact with sea water. Mild corrosion may result in light surface stains, but in more serious cases, it can lead to etching on the surface of the bearing, resulting in flakes of rusted material entering the raceway. For this reason, corrosion is often known as the natural enemy of bearings.

Corrosion isn't just visually alarming; it can also significantly impact a business'



finances. According to the IMPACT study conducted by **NACE International**, the world's leading corrosion control organisation, it has been estimated that 15-35 per cent of annual corrosion could have been saved if optimum corrosion management practices were followed. This equates to savings between US\$375 and \$875 billion annually on a global basis.



The enemy?

It's impossible to ignore the significance of corrosion costs, however corrosion resistance must be considered alongside other operating requirements such as bearing longevity and load.

Consider this as an example. A drilling machine is required to operate with precision but must also operate in unforgiving conditions. Due to the extreme environment of oil and gas rigs, corrosion resistant bearings would be recommended. If a design engineer were to opt for a highly corrosion resistant bearing fabricated from polyether ether ketone (PEEK), this would stop the corrosion in its tracks, but the precision of the machine would be compromised. In this scenario opting for a high precision stainless steel bearing with superior roundness while allowing some superficial corrosion may be preferable.

When assessing the suitability and quality of bearings, it is important to look beyond the external aesthetic. Corrosion control is just one performance requirement, which doesn't necessarily equate to poor performance or affect the bearing's internal rollability.

Ensuring the right equipment is selected is the first step — and this is imperative for both large-scale machinery and small components, such as bearings. Luckily, offshore facility managers can weigh up their design requirements and can choose to combat corrosion at the design stage. Here are three corrosion control methods to consider:

A-Material choice

Stainless steel is the most obvious choice for corrosion resistance and is widely used in the offshore oil and gas industry. It also has other advantageous properties such as durability and heat resistance. 440 grade stainless steel bearings have good resistance in damp environments and are often used in applications such as the food and beverage industry. However, 440 grade stainless steel bearings have poor resistance to salt water and many stronger chemicals, so for harsh offshore environments 316 stainless steel may be considered. However, as 316 stainless steel cannot be thermally hardened, 316 bearings are only suitable for low load and low speed applications. Their corrosion resistance is best when there is an ample supply of

oxygen so these bearings are mainly used above the waterline, in flowing seawater or where the bearings can be washed down after submersion in seawater.

An alternative material option is ceramic. Full ceramic bearings made from zirconia or silicon nitride with PEEK cages can offer even higher levels of corrosion resistance and are often used fully submerged. Similarly, plastic bearings, with 316 stainless steel or glass balls, provide very good resistance to corrosion. These are often made from acetal resin (POM) but other materials are available for stronger acids and alkalis such as





PEEK, polytetrafluoroethylene (PTFE) and polyvinylidene fluoride PVDF. Like 316 grade bearings, these should only be used in low load and low precision applications.

Another level of armour against corrosion, is a protective coating. Chromium and nickel plating offer good corrosion resistance in highly corrosive environments. However, coatings will eventually separate from the bearing and need continual maintenance. This isn't the most practical option for offshore applications.

B-Lubricants

A lubricant provides a thin film between the contact areas in a bearing to reduce friction, dissipate heat and inhibit corrosion on the balls and raceways. Surface roughness and lubrication quality are extremely important influencing factors as to whether surface distress will occur or not.

Opting for the correct lubricant matters. In an environment where superficial corrosion may occur on the outside of the bearing, it should not be allowed to occur on the inside. SMB Bearings can supply sealed bearings with waterproof greases

that contain corrosion inhibitors. These lubricants protect the internal surfaces of the bearing and can be matched to the specific offshore application environment. Full ceramic bearings are mostly specified without lubrication but can be lubricated with waterproof grease for extended life.

C-Seals

In harsh environments, contamination protection is of utmost importance, so opting for a contact seal is favourable to ensure contaminants do not enter the bearing. For equipment that may be exposed to moisture, a contact seal will also offer increased water resistance. This will stop grease washing out of the bearing, allowing it to do its job in lubricating and protecting the internal surfaces of the bearing. An alternative option is a metal shield but this offers greatly reduced protection against moisture.

By assessing the operational environment, required longevity and loads that will be applied to the bearing, the best bearing may be the humble 'wonky vegetable' and not the one that remains looking aesthetically pleasing for the longest. By considering a bearing's full environmental

operating conditions, design engineers can weigh up whether opting for a corrosion control design feature will be the most cost effective, increase the bearing's lifespan and elevate a machine's performance.

For further information about SMB Bearing's range of bearings for corrosive environments, visit the website or contact a specialist today sales@smbbearings.com

About

SMB Bearings originally specialised in miniature bearings, thin-section bearings and stainless steel bearings. By natural progression, the company expanded the range to include other corrosion resistant bearings such as plastic bearings, 316 stainless bearings and ceramic bearings.

Remaining a specialist business, SMB Bearings provide a high level of product knowledge, providing bearing and lubrication solutions to existing or potential customers, whether individuals or large corporations. SMB Bearings does not just sell bearings, but helps to solve your problems.

For further information please visit www.smbbearings.com



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Edmonda Monda,
*Chief Financial Officer of ICT srl
& Head of ICT Advisory Division*



The Reference Advisor for
The Bearing Industry
in Europe, Asia and America



ICT Advisory Division, a company with a team of managers, engineers and technicians with more than 20 years experience – has become today the reference for merging technical and strategical know-how of the bearing industry with the financial and legal competences of M&A professionals.

The company is offering unique and rare capabilities for bearing industry companies, assisting them at 360°, both in the daily operational activities and in the extraordinary financial issues.

We tried to reveal the insight story of the ICT Advisory Division during an interview with Mr Edmonda Monda, who is a lawyer, tax advisor, auditor, currently operates as the Chief Financial Officer of ICT srl and the head of ICT Advisory Division.

Can you tell us the story behind ICT Advisory Division?

ICT Advisory Division was born at the end of 2019 by the union of competences of the ICT technical division (specialized since 2012 in technical, strategical and commercial consultancy to the worldwide bearings industry) and of Knight's Bridge Advisory Firm, company who has been engaged in M&A projects of automotive and high precision mechanics sectors since more than 12 years. The company has two sites, in Turin and in Pinerolo (North-West of Italy), and serves customers worldwide in more than 40 countries.



clients to structure the best financial strategy to maximise the sales value of the company (on the sell-side) or to minimize the transaction value and the potential liabilities (if we act on the buy-side). In doing so, we coordinate our actions with the team of engineers and technicians of the technical division who are able to better explain the strength and weakness points of each transaction, as well as the competitive advantages for all the actors of the deal.

In which countries are you active?

We do operate in the whole Europe, in Asia and in Oceania. Our team members are spread between Italy, Poland, Slovakia, United Arab Emirates, India, China and Australia. We are currently working to hire professionals also in Brazil and USA, despite these countries

are already now covered by ICT activities thanks to the rich network of connections developed in more than 26 years of work in the industry by the company founders.

What is the main activity of ICT Advisory Division?

We work on M&A projects, supporting our customers in the company acquisition process or on the sales process. In case we work on the sell-side, we screen the market looking at companies having potential interest to acquire business similar to the one of our clients. This may happen for several reasons. For example, the ambition to grow in a specific geographic area and/or within certain products segment; the willingness to avoid competition to grow; the wish to acquire the product brand rights and/or the technological know-how.

“ ICT Advisory Division focuses on the bearings industry only ”

What is your role in the company?

I am the Chief Financial Officer of the company and the head of ICT Advisory Division. I coordinate a team of lawyers and chartered accountants in the legal and financial due diligences of target companies, as well I help our

“ We guarantee extreme confidentiality and professionalism and our team can assist ... with no any risk for the clients. We always work on base of a success fee. ”

When acting on behalf of the buyer, we first work with the clients in order to better understand their strategy and the main characteristics of the target company, in terms of size range, geographical location, type of business (manufacturing, trading, R&D, etc.), status of the business (profitable or in the need of turnaround), type of transaction (acquisition of 100% of shares or of majority or minor stake for partnership/joint-venture).

ICT Advisory Division is also capable to support the company restructuring processes, identifying the best financial structure – for example - to get out from difficulties period. We can also support in finding commercial partners for business development: for example, to find partners who can commercially develop a specific brand in a certain geographical region of difficult reach for the client.

Which are your fields of expertise and industries served?

ICT Advisory Division focuses on the bearings industry only. Our typical clients are the bearings manufacturers, the bearing components (balls, rollers, cages, seals, rings) manufacturers and the bearing distributors and traders.

Which are the projects that you are currently working on?

We are regularly working on around a dozen of different projects, both on buy- and sell-side. For instance, we are currently actively looking on behalf of our clients for manufacturing plants in Europe and in America to be acquired. Similarly, we are looking for potential buyers of bearings distributors in Europe and in Brazil. In general, I do invite the companies that are looking for important steps of M&A to get in touch with us. We guarantee extreme confidentiality and professionalism and our team can assist ... at no risk for the clients.

What do you mean at “no risk for the clients”?

We do always work on the base of “success fee”. It means that the customers pay our services only if the transaction is positively closed.

Otherwise no fee is due other than the reimbursement of the exceptional costs that, in any case, are time by time pre-authorized by the client himself. We do believe this is an important way to show to the clients the seriousness of our approach and the fact that, if we accept a project, it is because we are convinced to succeed.

Can you explain the difference between ICT Consulting & Trading and ICT Advisory Division?

ICT Consulting & Trading is the technical division of the company. Indeed, ICT started initially as technical, commercial and strategic consulting company to the bearings industry. Through 10 different high quality long-term partners located between Europe, Asia and America, ICT Consulting & Trading is capable to sit in front of any bearings manufacturers and to offer almost all the needs in terms of components (balls, rollers, cages, seals, rings), process tooling

“ Many small and medium companies do not have any long-term strategy, few of them think even that there is no need of having a strategy. While a clear and written strategy is of great help to define the company’s direction. ”



(grinding abrasive, diamond tools, hard metal tools) and machinery (grinding, assembly, visual, dimensional and ECT control, demagnetizers, bearing noise control and statistical analysis).

As said, the Advisory Division was born as natural development and evolution of the experiences and know-how of the technical division, in order to offer an unique integrated service to such industry.

When should a company seek for strategic consultancy?

Especially many small and medium companies do not have any long-term strategy and they move at zig-zag without a clear direction, trying to grasp any opportunity that they randomly find in their path. Some few of them think even that there is no need of having a strategy. Indeed to own a clear defined written strategy is of great help for the company management to have a clear direction, to take decisions that are coherent with the strategy itself and to refuse those opportunities that are in contradiction with the long-term view. The benefits are also evident for the employees that

have clear vision of where and how the company wants to move towards.

Which activities do you conduct for the financial aspects of companies?

For distressed business, we do also analyse the financial opportunities of company restructuring in order – for

example – to make them more attractive for financing process and/or for a next partnership or sales step. This is of course done taking in account the laws of each country and the international connections that we can offer.

How is the impact of current economic situation for company mergers & acquisitions?

In these last few months, it is evident an acceleration trend of willness to sell for those companies that already had some profitability issues before Covid or that have unsolved succession issues. On the other side, the financially strongest companies have intensified their efforts to look for proper targets for the growth and for their competitiveness enforcement. We do believe that this trend will be even stronger in the next 6-12 months.

Which other services are you offering?

ICT Advisory Division can assist the clients also in Initial Public Offering (IPO). This is of interest for those companies who want to boost their growth process and to finance themselves by entering the Stock Market. A full detailed list of all our offerings can be consulted at our website www.ict-advisorydivision.com





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The Bearing World's Road to Recovery

Like many, the bearings industry has taken a significant hit in the wake of the coronavirus pandemic. Whilst the industry was initially set to grow over the next few years, the world has been put on pause — along with the growth of the bearing industry.



In 2018 the global bearing market was valued at 39.46bn USD, according to a report by Fortune Business Insights, and the outlook for the future was bright. Before COVID-19 put the world on hold in 2020, the market was estimated to grow by an average of 3.6% per year — reaching 52.44bn USD by 2026.



WHAT IS NEXT?

However, with a global recession looming, the recovery of the industry may be hindered by that of other industries, such as aerospace, automotive, mining, construction, and manufacturing. One thing that is for certain is that it will not be an easy recovery.

Research from Oxford Economics, showed the global GDP to have grown steadily following the recovery of the global financial crisis in 2008, a trend that was set to continue.

General Outlook

However, if COVID-19 is to trigger a deep recession (and in turn another financial crisis), the global GDP may not reach its pre-pandemic value until late 2023. On the other hand, if scientific advances in our understanding of the virus allow for the world to return to normal (and there's no second wave), the worldwide GDP could be back on track by Q2 2021.

A White Paper released by the World Economic Forum (WEF) stated that although

the world has seen similar disasters in the past, none have had the same effect as coronavirus, partly because COVID-19 is having an effect on all economies.

The report stated that "previous crises have typically been concentrated in one sector, or one region, but COVID-19 is a global crisis that has impacted over 75% of the world's global manufacturing outputs". This has undoubtedly had a knock-on effect on the bearing market.

According to Fortune Business Insights, global revenue from commercial aircraft in 2018 was estimated at \$191.1bn USD and was set to increase by about 2.93%. This would have led to an increase in industrial aircraft manufacturing — and the demand for power transmission and bearing products.

However, aviation giants Boeing and Airbus are facing considerable headwinds as international lockdowns put most of the world at a standstill, with an 87% reduction in daily international flights during Q2 2020.

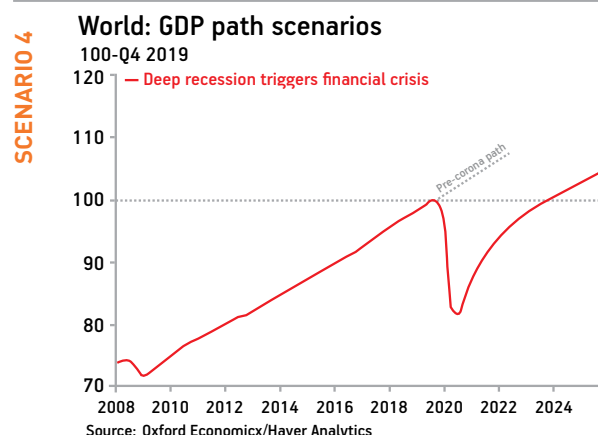
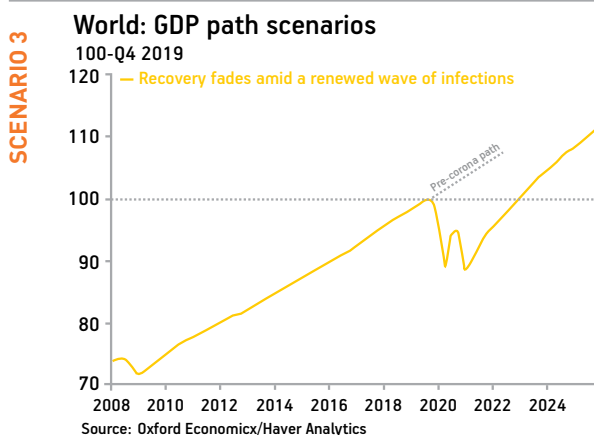
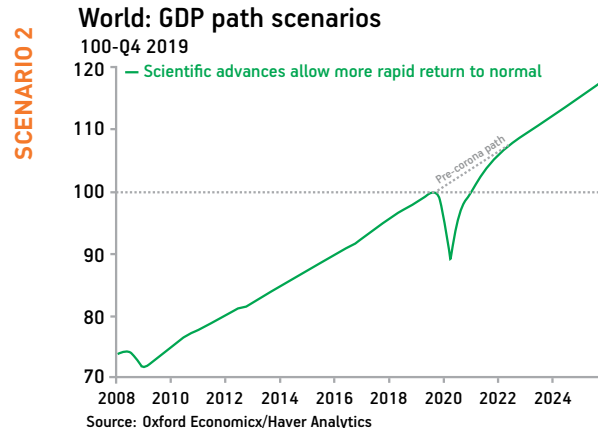
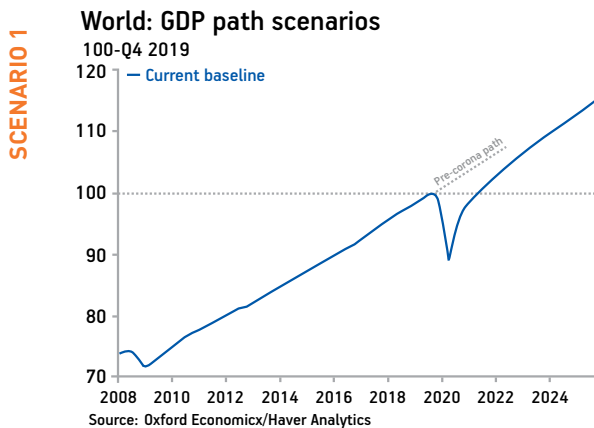
Having recently cut 15,000 jobs,

Airbus CEO, Guillaume Faury said the company is "facing the gravest crisis this industry has ever experienced."

As a result, there was reportedly a 25% drop in manufacturing output in the aerospace sector between Q4 2019 and Q2 2020, according to Oxford Economics. Meanwhile, manufacturing for the automotive sector, for which the bearing industry is also reliant on, has dropped by 37%.

There are other industries that provide big sources of demand & revenue to the bearings industry, which are also lagging in their output.

This includes the Electrical Equipment industry, which is down 13% in its output according to Oxford Economics. On the other hand, the output for the Industrial Machinery sector has dropped 12%. However, according to research by Arizton the global precision parts market size is projected to have a growth rate of 10% during 2021-2025. Then there's also the Metals & Metal Products sector, which saw its production



output drop 8%. However, “Global demand for January to May 2020 was 9.86 million tonnes compared with 9.61 million tonnes for the same months of 2019. Chinese apparent demand for the period January to May 2020 was 5320 kt which was 9.8% higher than the first five months of 2019,” according to a report from the World Bureau of Metal Statistics.

Meanwhile, of the key industries to be hit by the pandemic, the Food & Beverage industry seems to have been affected the least, with its output declining by just 4%.

The global decrease in demand is actually not only triggered by the pandemic and can therefore last for a while even during the post-covid19 period.

In addition, increasing local conflicts and other hostilities, as well as disturbances in worldwide financial markets, political and regulatory barriers such as increasing taxes, tariffs could continue the downturn in demand for the coming period.

Future Outlook

Whilst some of the niche industries have seen revenue declines of more than -40 up to -50%, figures from the bearing manufacturing & distribution market have declined by just -20% to -25% during the worst phase of the pandemic whilst the global lockdown. There is more good news as data suggests that demand for the bearing industry have almost returned to pre-lockdown levels, predominantly for the distributors segment. Whilst the coronavirus has significantly disrupted the industry and the market, new opportunities are presenting themselves in the wake of the pandemic. One positive sign is that of the new and small size bearing and power transmission companies which are being set up — a clear sign of confidence in the industry’s potential for a speedy recovery. Apart from the visible reactions from the distributors segment, the manufacturing of bearings will be impacted more by the initiatives and regulations taken by authorities. As a result of this significant level of uncertainty, it will not be feasible to provide a reliable growth for the manufacturers.

As well as the bearing industry as a whole, it’s also important to consider

What is the business outlook of the global bearing manufacturers considering the pandemic situation and what do you expect in the short term?

Bearing is the heart of rotating equipment and machinery. The width of its applications across industries and sectors makes it a generic product having a strong correlation with global industrial output. The pandemic situation has resulted in shrinking of industrial activities and degrowth of national and regional GDPs thereby reduction in demand and hence the production of bearings for the manufacturers. Speed of economic recovery (expected to start from next year) will define restoration of global volumes for the manufacturers.

To reduce the impact of the volatile situation, bearing manufacturers are likely to restart production cautiously in a phased manner, focus on aggressive cost reduction measures and bring flexibility in the system for capturing the demand in the market by bridging the gap between the demand and production.

The key to managing this situation efficiently depends on how the organizations are able to support their critical suppliers, distributors, employees and run their operations with safety amid pandemic.

How has Covid-19 impacted the industrial bearing distribution business globally?

Industrial distribution is a highly fragmented market generally struggling with high competition and depleting margins. COVID19 has added to the woes of the bearing distributors by truncating the demand thereby sudden spurt in increase in “Inventory Period” (or Days Sales of Inventory-DSI). Many small distributors are struggling with liquidity challenges and trying to utilize government grants and support to sustain in this uncertainty. While the bigger ones are concentrating on industries like medical equipment, food processing & hygiene products that have grown exceptionally in last few months due to the impact of COVID 19.

What planning is being done by the larger bearing distributors to sail through these uncertain times?

Industrial distributors may plan the following strategies to tackle the uncertain situation:

- Focus on cost cutting & liquidity management
- Capture high growth areas emerged in the backdrop of COVID
- Analyse and optimize ‘Customer Mix’ & ‘Product Mix’
- Build capability for “value added services” rather than “vanilla product sales” offerings
- Digital push & accelerate technology adoption



How does India compare with respect to the global scenario and what is the outlook for India's various industrial sectors?

India's fight against the Covid-19 outbreak has been unique. Clamphdowns were imposed much earlier than in many countries, but the last one months has witnessed significant spread of the virus. India stands at a higher risk as compared to most of the other countries of the world due to high population density, overburdened public health infrastructure, high prevalence of non-communicable diseases and the prospect of transmission from younger people to the elderly in joint families.

The economic fallout from the lockdown in India has been massive and unprecedented. Industrial production plunged by 16.7% in March (YoY), after only one week of lockdown. In manufacturing, the Purchasing Managers' Index (PMI), a predictor of near-term economic activity, contracted by a record amount in April and barely improved for May. There have been some signs of slow recovery in June but nowhere near the pre-COVID19 levels.

The situation has strained manufacturing industries in India, which contributes almost 20% of the GDP. Of this, 50% is contributed by the auto industry. Even prior to the lockdown, the auto industry was grappling with 15+% decrease in sales and production cuts of the order of 5 to 10%. The situation was challenging for Micro, Small and Medium size Industry as the uncertainty impacted these organisations with lesser retentive power, due to their weak financial muscle.

The economic future of the country will directly depend on how well the COVID situation is managed and how fast India is able to capture the opportunities arising out the global situation including

establishing itself as a reliable and cost effective global manufacturing hub.

What is the near future vision for industrial bearing distribution business in India?

The demand in traditional areas of growth is shrinking. Industrial Bearing distributors will be looking for new growth areas in sectors like pharma, medical equipment, and food processing to make up for weak demand in mobility sector (auto, aero & rail). Priority will move from "high volume-low margin" scenario to "low volume-high margin" scenario. Emergence of panic selling at very low prices can not be ruled out in short term.

Preference of distributorship of local manufactured bearings over import is likely to come in picture due to prominence of "Make In India" initiative. Distributors may also reconsider their "Brand portfolio" considering dynamic geopolitical situation that may impact businesses.

Economic stress may result into re-negotiation of distributorship & customer contracts. Distributors that sail through the unstable scenario will gain immensely in the recovery phase arising in post-COVID19 scenario.

Any other points, you deem to be relevant in the context of Bearing business?

Resilience is the most important leadership trait in this testing time. Leaders who drive their organization by taking right decisions considering inclusive management style by building a cohesive network of trusted suppliers, subcontractors, motivated employees and satisfied customers will build a sustainable organization and benefit from the hyper growth that will emerge after the crises.



*Questions answered by
Vikas Manral (1)
Director and CMO at SolutionBuggy*



the disruption and future outlook for specific sectors. For example, the considerable disruption to the automotive manufacturing industry (which already started before the pandemic) will likely have a significant effect on some specific bearing types as well. As more countries introduce carbon-free policies to fight climate change, a greater focus is being put on the manufacturing of electric vehicles, which require less anti-friction components. Less machined anti-friction components are expected to result in less demand for machine tools components.

There are, however, other industries with expected high demand increase that will keep the bearing industry afloat, such as food processing, agriculture, maintenance, medical equipment, electrical equipment, and robotics. Whilst the current market's prospect for growth is not as high as it was before the pandemic, the industrial situation is expected to change rapidly as the first signs of recovery mark the beginning of a new era. Moving forward, manufacturers will need to focus and develop more customized bearings and low volume – high margin products in accordance with the evolving landscape and consumer demand.

Growth is also expected to continue in the post-pandemic period as parts of Asia-Pacific, such as China, Indonesia, Vietnam, India and Thailand will show increased demand for construction, energy and industrial equipment in order to develop their respective infrastructures



— as well as the growing use of roller bearings being used in the renewable energy sector. The demand from the energy sector components event showed a slightly growth during the pandemic period in Asia-Pacific. Marine industry remained unchanged in comparison with 2019.

North America and Europe will remain to contribute to the further development, growth and increase of demand as they form the base of more established industries. Driven by the digitalization, these regions will see an increase in investments in customized solutions and related products used in high technological applications and equipment. The main expectation for companies in Europe and North America is that they will swing from the pre-pandemic efficiency system into resilience. The biggest outcome of turning to resilience will be bringing back the supply chains and being much more careful about how to Globalize in the future.

Authors

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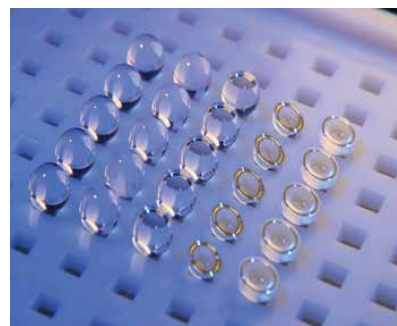
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The Most Common Causes of Bearing Failure And the Importance of Bearing Lubrication

Ciprian Radu

RKB Bearing Industries – Technical Team Unit

Abstract: Bearing failures have great impact on industry and economy. The aim of the present work is to study and spot the major causes that limit bearing efficiency, thus leading to bearing failure. This study shows that the main failure cause is the inappropriate lubrication of the bearing rolling elements (approximately 80% of the cases), followed by inadequate bearing selection (10%), improper mounting (5%), indirect failure (4%), and material defects and manufacturing errors (less than 1%).

1. Lubrication of rolling bearings

The rolling bearing is a machinery component that plays a very important role, since it dominates the machine performance. If one of the bearings fails, not only the machine, but also the assembly line stops, and the deriving costs may be extremely high. For this reason, every bearing manufacturer should make every effort to ensure the highest quality for each bearing and the most careful use and maintenance on behalf of the user [10].

Lubricants are used between contact surfaces to keep the parts in continuous motion. The main purpose of rolling bearing lubrication is to avoid or reduce the metal-to-metal friction between the rolling and sliding contact surfaces. This is not the only function of rolling bearing lubrication. The supplementary functions are: heat dissipation from the bearing, removal of solid wear particles and contaminants from the rolling contact surfaces, corrosion protection, increase of the sealing effect of the bearing seals [4].

Lubrication is crucial for bearing life. In heavy duty applications, such as rolling mill machines, furnaces, ovens or high temperature fans, rolling bearings may be exposed to higher-than-normal temperatures. For these applications, appropriate selection of the lubricant and lubrication method is very important [13]. In industrial applications there are two types of lubricants suitable for high temperature use: grease and oil. In special cases, bearings are lubricated with solid dry lubricants [4]. Grease lubricant is used for 90% of all rolling

bearings. The amount of grease to be used will depend on many factors relating to the dimensional and geometrical parameters of the housing, space limitations, bearing working speed and type of grease used. As a rule, rolling bearings and their housings should be filled from 30 to 60% of their total capacity. If working speed and temperature rise, then a reduced amount of grease should be used. If the amount of grease is excessive, temperature rises, which may cause the grease to soften and local leakage may appear. With the passage of time grease loses its properties and fresh grease must be resupplied at proper intervals. The relubrication interval depends on the bearing type, dimensional parameters, bearing working speed and temperature [10].

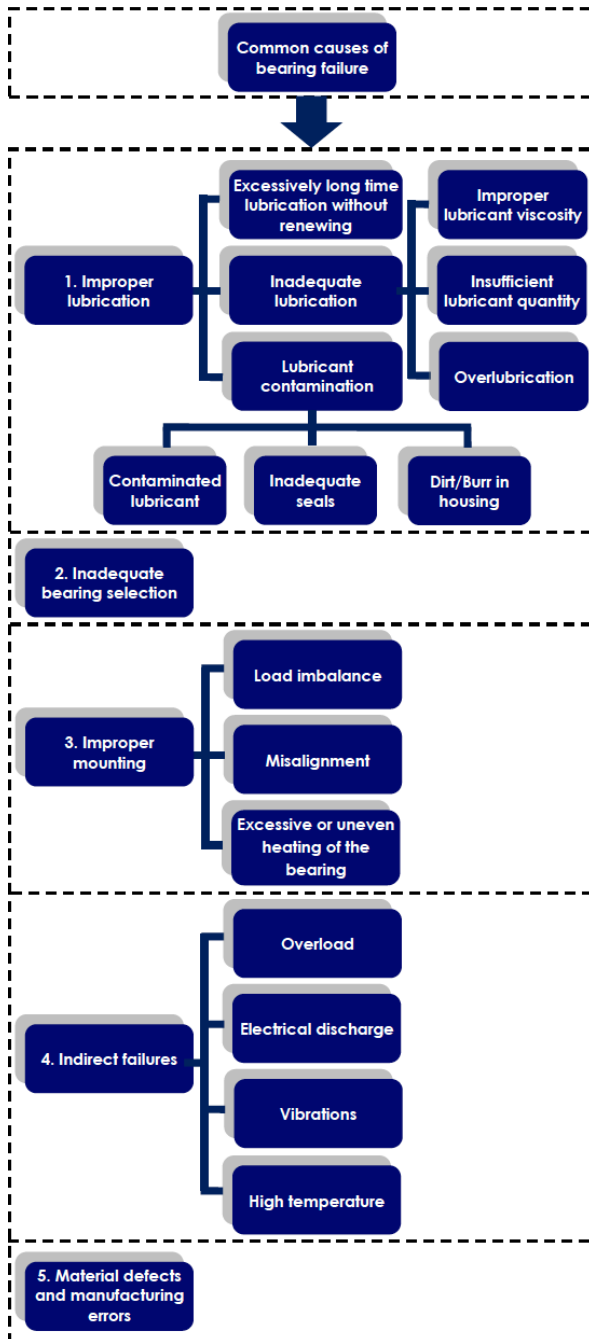
In industrial applications, oil lubrication is used if adjacent machine components are supplied with oil as well, or if generated heat must be dissipated by the lubricant. The heat dissipation is necessary if high rotating speeds and/or high loads are involved or if the bearing is exposed to high temperatures [4]. In this case, the relubrication interval depends on bearing operational conditions (temperature, speed, load etc.), oil quantity and type of oil used. If an oil bath lubrication method is used when operating temperatures are around 50 °C, then the relubrication interval should be one year. For operating conditions of 70 to 100 °C, the oil should be replaced every three months. Anyway, it is important that lubrication system and deterioration be verified regularly to determine oil replacement [10].

Another type of bearing lubrication is solid or dry lubrication. This method is used in industrial applications, where rolling bearings are subjected to heavy loads, slow relative movements and high working temperature. Solid lubrication is very effective and yields relatively long running times. The most used solid lubricants are graphite and molybdenum bisulphide. These solid lubricants are applied to the raceway surfaces in the form of powder loose, sliding lacquer or paste. Graphite and molybdenum bisulphide lubricants can be used for high operating temperatures of up to 450 °C [4].

2. The most common causes of bearing failure

In practice, damage or failure of a bearing are often the result of several mechanisms operating simultaneously. The failure can result from improper assembly or maintenance or from faulty manufacture of the bearing or of its adjacent parts [3].

In some instances, failure is due to a design compromise made in the interests of economy or from unforeseen operating conditions. It is the complex combination of design, manufacture, assembly, operation and maintenance that often causes difficulty in establishing the primary cause of failure. Consideration of each feature is required for reliable determination of the cause of bearing failure. Since more than one process may cause similar effects to these surfaces, a simple description of the appearance is usually inadequate to determine the reason for the failure [7]. In the event of extensive damage to or cata-



— Fig. 1 - Common bearing failure causes

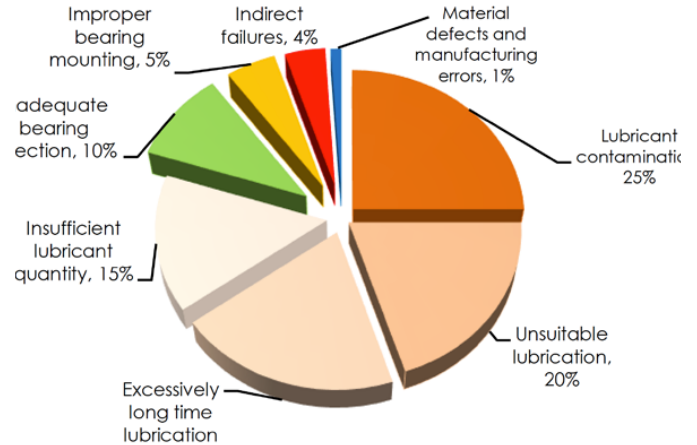
strophic failure of the bearing, the evidence is likely to be lost and then it will be impossible to identify the primary cause of failure. In all cases, knowledge of the actual operating conditions of the assembly and the maintenance history is of the utmost importance. Typically, the causes of bearing failure can be classified in five groups and various sub-groups as shown in figure 1.

The evolution of tribological research during recent decades has led to a remarkable increase of new knowledge describing failure mechanisms [7]. The data from this research field show that improper lubrication is the

most cited cause of bearing failure and accounts approximately 80% of breakdowns [12] (figure 2). Naturally, these percentages may vary from application to application depending on operating conditions and maintenance practices.

2.1. Improper lubrication

The selection of adequate bearing lubricants is based on decisions around whether to choose oil or grease and determining what kind of additive is required [1]. This decision depends on some factors, such as operating load, speed and temperature.



— Fig. 2 - Common bearing failure causes in %

Lubrication is a key factor that can make or break bearing service life. Some researches in the bearing industry have stated that improper lubrication can account around 80% of bearing failures [8]. Failure can be the result of excessively long-time lubrication without renewing, unsuitable lubrication and lubrication contamination [12].

The excessively long-time lubrication without renewing and unsuitable lubrication of rolling bearings represent a large percentage of premature bearing failures (approximately 20% each), and in most cases they can be prevented [9]. Unsuitable lubricant is a lubricant that does not contain the right additives, does not have the proper viscosity, or may not be designed for use in such an application or temperature range [9]. Abrasive wear can be the result of inadequate lubrication. The surfaces become dull to a degree that varies according to the coarseness and nature of the abrasive particles (figure 3). These particles gradually increase in number as material is worn away from the running surfaces and cage. Finally, the wear becomes an accelerating process that results in the failure of the bearing [7].



— Fig. 3 - Abrasive wear on the outer ring raceway surface of a spherical roller bearing

Improper lubricant viscosity is one the major causes of bearing failure. As for lubricating oils, viscosity is one of the most important properties and determines oil lubricating efficiency [8].

According to ISO 281:2007(E), the effectiveness of the lubricant is primarily determined by the degree of surface separation between the rolling contact surfaces. If an adequate lubricant separation film is to be formed, the lubricant must have a given minimum viscosity when the application has reached its operating temperature. The condition of the lubricant separation is described by the viscosity ratio, κ , as the ratio of the actual kinematic viscosity, ν , to the reference kinematic viscosity, ν_1 [6]:

$$\kappa = \frac{\nu}{\nu_1} \quad (1)$$

where:

κ : viscosity ratio,

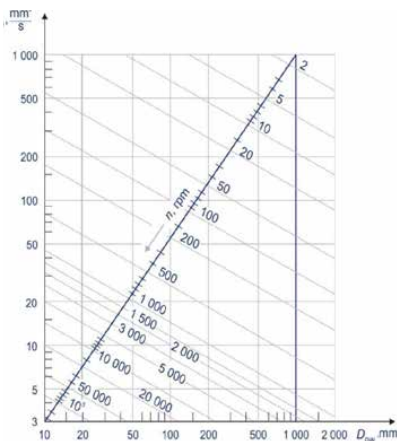
ν_1 : reference kinematic viscosity (mm/s²),

ν : actual kinematic viscosity at operating temperature (mm/s²).

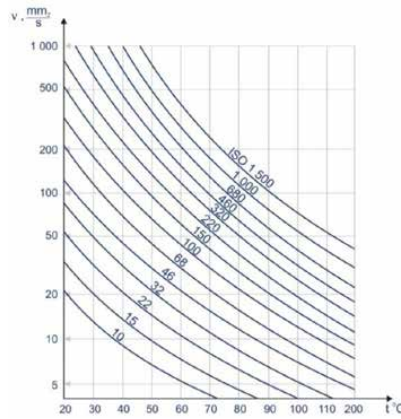
In order to form an adequate lubricant film between the rolling contact surfaces, the lubricant must retain a certain minimum viscosity while at operating temperature. The bearing life may be extended by increasing the operating viscosity, ν . The reference kinematic viscosity, ν_1 , can be estimated by means of the diagram in figure 4, depending on bearing speed and pitch diameter, D_{pw} , or calculated with the equations (2) and (3) [6]:

$$\nu_1 = 45000n^{-0.83} \cdot D_{pw}^{-0.5} \quad \text{for } n < 1000 \text{ r/min} \quad (2)$$

$$\nu_1 = 4500n^{-0.5} \cdot D_{pw}^{-0.5} \quad \text{for } n \geq 1000 \text{ r/min} \quad (3)$$



— Fig. 4 - Reference kinematic viscosity, ν_1 , at reference bearing speed and pitch diameter



— Fig. 5 - Required kinematic viscosity, ν , at reference temperature

where:

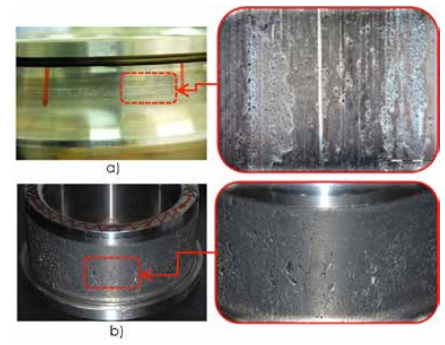
D_{pw} : pitch diameter (mm),

n : rotation speed (r/min).

The calculation of κ is based on mineral oils and on bearing raceway surfaces machined with good manufacturing quality. The diagram in figure 4 and equations (2) and (3) can also be approximately used for synthetic oils like Synthetic Hydrocarbon (SHC), for which the larger viscosity index (less change of viscosity with temperature) is compensated for by a larger pressure-viscosity coefficient for mineral oils, and by that about the same oil film is built up at different operating temperatures if both oil types have the same viscosity at 40 °C. The diagram in figure 4 and equations (2) and (3) apply equally to the base oil viscosity of greases. With grease lubrication, the contacts may operate in a severely starved condition because of the poor bleeding capability of the grease leading to poor lubrication and possible reduction of life [7].

Oil kinematic viscosity depends on bearing operating temperature. Figure 5 represents oil kinematic viscosity-operating temperature comparison chart for the purpose of selecting lubrication oil with viscosity characteristics appropriate to an application.

The faster the flow, the lower the viscosity, and vice versa. If viscosity is too low, the oil film will not form, and damage will occur to the bearing contact surfaces. On the contrary, when viscosity is too high, viscous resistance will also be great and temperature due to friction will be high. In either case, the asperities (microscopic machined high points) of the bearing component surfaces may contact each other, initially causing a



— Fig. 6 - a) The frosted appearance of spherical roller bearing inner ring illustrates what happens when the oil viscosity is too low and metal-to-metal contact occurs. b) Cylindrical roller bearing failure due to continual welding contact between asperities on the metal surfaces

frosted or smearing condition, followed by adhesion at the contact points [9]. Failure of the bearing will be inevitable (figure 6).

Contamination from water, chemicals, and particles is especially harmful to rolling bearings and represent 25% of premature failures [14].

When the lubricant is contaminated with wear solid particles, permanent microcracks on the bearing raceway can be generated when these particles are over rolled. The appearance of these microcracks can generate local stresses, which will lead to a reduced life of the rolling bearing [7].

The life reduction caused by solid particles in the lubricant film is dependent on [6]:

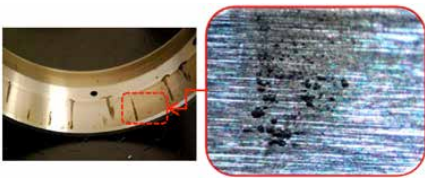
1. type, size, hardness and quantity of particles;
2. lubricant film thickness;
3. bearing size.

In case of a viscosity ratio $\kappa < 1$ and a contamination factor eC for this viscosity ratio, a value of $\kappa = 1$ can be used in the calculation of the contamination factor, eC . For values of $\kappa > 4$, the value $\kappa = 4$ shall be used. The motivation for increasing the κ value is that a favorable smoothening effect of the contacting surfaces can be expected when an effective EP additive (Extreme Pressure additive) is used. In case of severe contamination (contamination factor $eC < 0.2$), the efficiency of the EP additives shall be proven under actual lubricant contamination. The efficiency of the EP additives should be proven in the actual application or in an appropriate bearing test [6].

The contamination factor, eC , is function of viscosity ratio, κ , and pitch diameter, D_{pw} [6]:

$$e_c = f(k, D_{pw}). \quad (4)$$

When steel, used for rolling bearing components, is in contact with moisture, e.g. water or acid, oxidation of surfaces takes place. Subsequently the formation of corrosion pits occurs and finally flaking of the surface. A specific form of moisture corrosion can be observed in the contact areas between rolling elements and bearing rings, where the water content in the lubricant or the degraded lubricant reacts with the surfaces of the adjacent bearing elements [7] (figure 7). Bearing contamination problems can be easily avoided if proper design and adequate maintenance of sealing and lubrication system are used.



— Fig. 7 - Double row taper roller bearing failure due to water contamination

Inadequate maintenance practices associated with misalignment and shaft tilting influence contamination related failures, due to large shaft orbits that develop. A major tendency of the inspectors that conduct the analyses of bearing failure is to jump to the conclusion that there is a sealing problem, when the damaged mechanism appears to be contaminated. Upon detailed examination, it is likely possible that the real problem is due to an excessive misalignment between components, which created the secondary seal problem. Solving the sealing problem will not solve the misalignment between components; in fact, the seal replacement may have a superior sealing capability but an even lower tolerance misalignment [3; 14].

Many bearings are simply brought to failure receiving insufficient lubricant quantity or no lubrication throughout their short life. Among others, the most common causes are simple neglect, incorrect lubrication intervals and failed lubrication system. For proper application, bearings must be monitored to ensure that lubricant intervals are not too frequent, causing over-lubrication, and not too infrequent, causing under-lubrication [13].

Smearing can occur on the guiding flange faces and on the end faces of the rollers due to insufficient lubrication (figure 8). In full complement bearings (cageless), smearing can also occur in the contacts between rolling elements depending on lubrication and rotation conditions [7].



— Fig. 8 - Smearing of cylindrical roller end face

Over-lubrication occurs when a rolling bearing is greased excessively or when too much oil is added to the housing. Excessive grease or oil quantity may cause internal friction between rolling parts, which generates excessive temperature that can create stress and deformity of the bearing [9].

Increasing the quantities of oil and grease in rolling bearings is not a good solution, since this practice may cause a churning action between rolling elements, and the result will always be an increase in temperature. Oil with high viscosity or grease with high consistency will also increase the temperature [2].

2.2. Inadequate bearing selection

Usually, the selection of bearing made by the original equipment manufacturer is the correct selection for the application. Of course, there are some exceptions, and there is always the possibility that a wrong bearing is used for the application. This possibility should be considered after all other sources of failure have been investigated. If there are any changes in the working process, these may necessitate the possibility of using a new bearing, but not all the times this is a good solution [14].

Another common mistake is the use of a larger or stronger bearing, believing that this arrangement will increase radial load capacity. The larger or stronger bearing will not solve the true root cause problems. On the contrary, this new layout may create additional problems as, for instance, that the selected bearing may have a speed lower than the nominal one

and may not work properly in an environment with relatively high trust. In some cases, bearings require to be preloaded to facilitate rolling motion and to prevent roller skidding. Replacing the original bearing with a new one may lead to failures that are more rapid if it is not properly loaded. Generally, for an industrial application the replacement of a bearing must be done with the same type of bearing, selected by the original equipment manufacturer [5; 14].

Inadequate bearing selection represents about 10% of all premature bearing failures.

2.3. Improper mounting

Improper mounting accounts for about 5% of all premature bearing failures. Improper installation can lead to bearing failure through load imbalance, misalignment or improper load distributions.

A change of misalignment of 0,01/10 mm is enough to cause huge rise in vibration and temperature in the bearing. These sudden changes may introduce heavy wear in the ball or roller pockets where they run. These problems can be detected as a non-parallel running mark of the ball on the outer raceway and as means of extra wide ball or roller pathway on the inner raceway [11].

Improper mounting can also lead to failure due to excessive or uneven heating of the bearing, when this is mounted on a shaft or housing. When heat is required to expand an inner ring, the temperature must not exceed 120 °C. Besides, if for the mounting technique induction heaters are used, it is important to demagnetize the bearing before installation. In case of magnetization, the roller bearing may fail very quickly due to its attraction of ferrous metal particles (figure 9) [9].



— Fig. 9 - Bearing failure due to improper mounting. The bearing was installed while magnetized

2.4. Indirect failures

Indirect failures, such as unacceptable operating conditions, transport, storage and handling represent 4% of premature bearing failures.

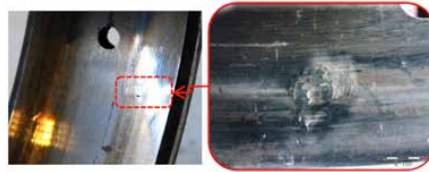
Among other indirect causes, the worst operating conditions are overloading, over-speeding, excessive vibrations, high temperature and electrical discharge [9].

"Overloading of a stationary bearing by static load or shock load leads to plastic deformation at the rolling element/raceway contacts, i.e. the formation of shallow depressions or flutes on the bearing raceways in positions corresponding to the pitch of the rolling elements" [7] (figure 10). Furthermore, overloading can occur by excessive preloading or incorrect handling during mounting [7].

If the typical bearing load and rated speed are doubled, then the bearing life may be reduced by up to respectively 90 and 50% [9].

Electrical discharge is becoming a serious problem for bearings. During equipment operations, V-belt drive systems may produce a high level of static electricity, that can be dissipated through the bearings to ground, causing pits or fluting to form on the bearing [9]. Initially the surface damage takes the shape of shallow craters, which are closely positioned to one another and small. This happens even if the intensity of the current is comparatively low. Flutes will develop from the craters in time, as shown in figure 11. They can be found on roller and ring raceway contact surfaces, but not on balls, which have dark coloration only [7].

Stray magnetic fields in electric motors, both AC and DC, can generate high electrical currents that will pass through bearing producing damages. To eliminate these problems, grounding brushes should be used [9]. Vibration represents a huge problem as for bearing failures. In fact, vibration in a bearing while stationary can cause damage, called false brinelling. The damages can be identified as bright polished depressions or reddish stain common to fretting. These marks left by false brinelling will be equal to the distance between the rolling elements, just as it is in the cases of true brinelling, so these two conditions are often



— Fig. 10 - Plastic deformation on the spherical roller bearing outer ring raceway by overloading



— Fig. 11 - Craters formed by current leakage resulting in fluting



— Fig. 12 - False brinelling at the roller pitch identified on the spherical roller bearing inner ring raceway

difficult to be distinguished [9] (figure 12). Higher temperatures than those recommended by the manufacturer represent a risk factor for bearing life, no matter what type, quality or amount of lubricant is used. To highlight the importance of this point, consider the fact that a good quality mineral oil begins to oxidize at 71 °C. The same result will occur in greases where such oils are used as the lubricating agent [9].

Handling starts when a rolling bearing leaves the factory to the point when it is installed on a machine and continues if the machine is to be transported after it is installed. Proper transportation and storage are essential to prevent damages from occurring before the machine is even placed in service [9].

2.5. Material defects and manufacturing errors

The ultimate failure causes for a bearing are material defects and manufacturing errors. Rolling bearing failures due to manufacturing defects make up less than one percent of overall bearing failures around the world. This percentage is being continuously reduced by improvements in

manufacturing process and material technology. Today bearing manufacturers use sophisticated instruments to detect surface and subsurface bearing material defects, eliminating in this way poor quality products during the manufacturing process [9].

3. Conclusions

Considering the facts mentioned above, the most common cause of bearing failure is lubrication, whether it is poor lubricant selection, poor application, lubricant contamination or lubricant degradation. Proper and accurate lubrication offers cost saving opportunities, by eliminating not only catastrophic but also functional failures which impact production and extends the life of many oil and grease wetted components.

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More information on p.122

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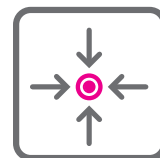


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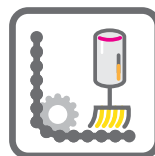
No under- or over-
lubrication of components



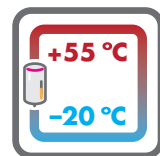
Compliance with
international standards



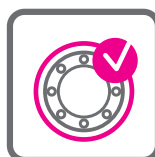
Environmental
sustainability



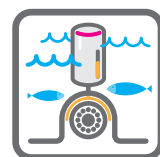
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for R&D and quality guidelines, logistics and customer support all over Europe.

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 enhancing logistics capabilities, offices and an enlarged Research & Development Center with its own measuring laboratory have been built there.

Design – made in Germany

In recent years, CSC has transferred the design and construction – especially of spindle bearings - to Germany. German engineers with decades of experience in bearing-design develop products for the world market. CSC products follow the DIN ISO guidelines in order to achieve fast testing and approval processes at the customer's site.

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Fast delivery times, low minimum quantities, and customized bearing designs are always possible at CSC. These include special seals, customer-specific materials, a variety of different greases as well as more complex adjustments such as individual ring shapes or special contact angles for angular contact ball bearings. Continuous development and optimizations are firmly established processes at CSC. Our target are bearings with low noise level, reduced friction and maximum efficiency to contribute to more energy-saving applications, for example.





Quality makes the difference

Besides the design feature “made in Germany”, good equipment is also very important. CSC buys production equipment from leading manufacturers such as G&N, Thielenhaus, Hembrück or AICHELIN, to name just a few. High performance equipment is essential for CSC to produce continuously high quality and meet international standards.



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as in the CSC Center in Germany. The success of the investment in quality is evident from the comprehensive certifications. In addition to DIN ISO 9001, DIN ISO 14001, CSC is also certified to IATF 16949, AS9100D and AS9104/1:2012.

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CSC supplies to well-known international companies and is worldwide known as a reliable partner in terms of quality and delivery reliability.

More information can be found on www.csc-bearings.com



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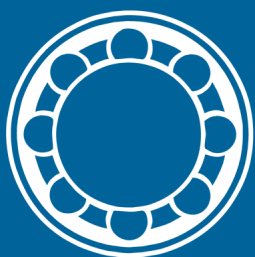


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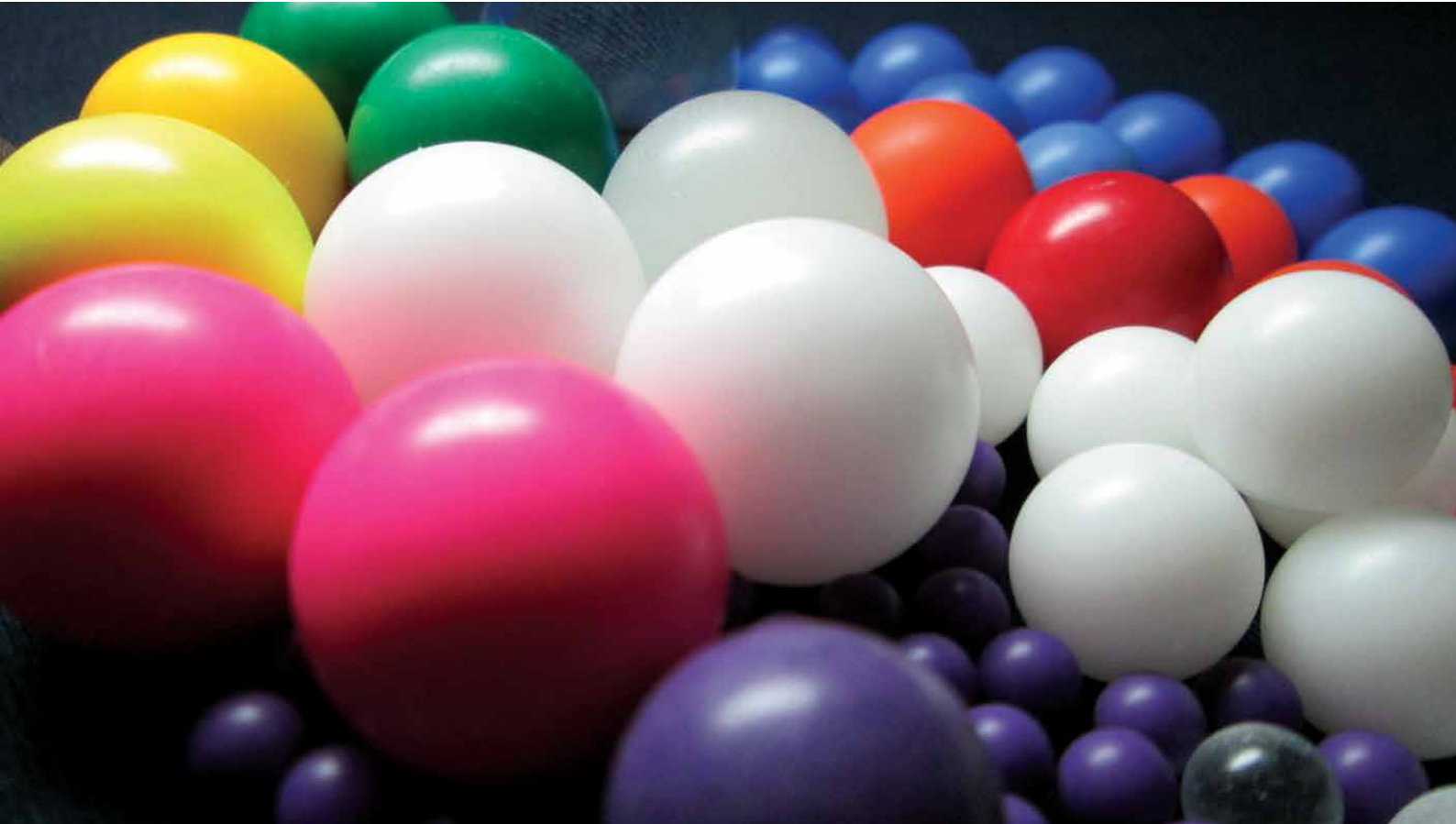


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Tsubaki Nakashima's Michigan production factory has recently received FDA Registration number 3014717638 for our Class 8 compliant cleanroom. "We are very excited for this achievement and the new opportunities it will mean for us and our customers" said Nancy Whitworth, Sales Manager. Achieving this result during a global pandemic has been especially challenging. Through it all the experienced staff at TN Michigan has stepped up and pressed on working as essential employees to support our customers' needs. We remain optimistic that all our precautions to protect our employees will continue to

enable us to meet the increased production demand to support our front-line medical workers against the pandemic fight.

Anyone who is working in a production environment is aware of the increased need for personal safety precautions ranging from increased use of PPE to extraordinary cleaning requirements on a factory-wide scale. Keeping our employees safe and production ready is an absolute necessity to help respond to the increased need for medical equipment and diagnostic devices.

At Tsubaki Nakashima our products

are used by our customers to produce critical medical equipment components such as CT Scanners, MRI machines, and diagnostic test products for COVID-19 and other conditions. This year has seen a marked increase in the demand for rolling elements produced from ceramics, plastics, and stainless steels not only due to the pandemic, but to the overall advancement in medical procedures.

Computer tomography (CT) scanners would not function properly without high precision bearings and linear systems to ensure the most precise images are



captured. Any vibrations or noise will reduce the quality of the CT scanner and could affect proper diagnosis. To minimize these detrimental conditions, high precision bearing balls and guides are used to guarantee quiet and smooth operation at all operational speeds. Tsubaki Nakashima FB ball screw linear system is ideally suited for this application with customized diameters and lengths. Magnetic resonance imaging (MRI) machines, like CT scanners, capture images thru rotation of the scanner body. Specifically, for MRI equipment, metal and magnetic content in the components must be minimized or

eliminated to avoid image distortion. Ceramic rolling elements are non-magnetic and insulate against metal contact and electrical conductivity. Ceramic rolling elements also aid in noise reduction which reduces stress for the patients. Plastics are another material widely used for ball manufacture which offer many advantages for use in bearings. Light weight, corrosion resistant, cost effective, low noise are just a few benefits. Plastic materials are available that are self-lubricating and offer excellent wear and chemical resistant properties as well. FDA, USDA, NSF and 3-A sanitary compliance plastics can be specified for

use in medical and food applications.

Tsubaki Nakashima produces a variety of plastic and stainless balls for use in the medical and industrial markets. We manufacture balls from over 80 specific types of materials including PA, POM, PAI, PC, PTFE, PP, PS, PE, and PMMA plastics in addition to 300/400 stainless steel series and tungsten carbides. These products often require specific tolerances and surface conditions (Ra) which are matched to the application specifications.

In keeping with environmental sustainability initiatives, plant based (Biomass) plastic materials are under increasing consideration to reduce dependence on fossil-based materials as well as for CO₂ reductions. These high-polymer alternative materials are made from plant cellulose. One example is a bio-polyurethane ball with a partial biomass content, when in a rigid form is suitable for load-bearing applications.

To learn more about the ongoing developments in plastics and other raw materials under development, please visit <http://www.tsubaki-nakashima.com/en/>



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“Focus on sustainable technologies”

Is the technological transformation process taking a step back due to corona or just running up to a restart with even greater momentum?

Uwe Wagner, Chief Technology Officer of the Schaeffler Group, provides answers.

Interview: Daniel Pokorny





Uwe Wagner,
*Chief Technology Officer
of the Schaeffler Group*

%30

of the EU's 1.8-trillion-euro corona relief package is supposed to be invested in the area of **climate protection**.

€7 billion

from the German federal governments' corona economic recovery program will be invested in future projects involving **green hydrogen** to be produced exclusively by means of renewable energies.

80

leading companies in the energy, transportation and industrial sectors have joined forces in the **Hydrogen Council**, a global initiative based in Belgium. Schaeffler is engaged there as a steering member providing decisive input to the advancement of this technology. In addition, Schaeffler is a founding member of the "Bavarian Hydrogen Alliance" established in 2019.

Would you have ever thought that a virus would keep the world on edge like corona has?

No, I wouldn't have. I don't think anyone was able to anticipate the impact we're seeing today.

What is your most impressive personal experience or realization in conjunction with the corona pandemic?

In retrospect, even I am amazed about how fast and effectively Schaeffler responded to the rapid developments with professional crisis management. In spite of all the circumstances, we managed to keep our operations running and, of course, kept pursuing our innovation projects, too. As a positive side effect, we intensively enhanced our skills in the area of digital applications, having worked on this at full

stretch out of necessity and with great personal commitment on the part of our employees. I'd like to use this opportunity to expressly thank all our colleagues who supported this effort. It seems to me that team cohesion has increased due to corona – in spite of physical distancing.

Talking about physical distancing: person-to-person contacts have been subjected to restrictions. What is the greatest challenge this entails?

Body language, facial expressions: all of this is often lost in purely virtual meetings, and along with it, the empathy that is a decisive element in communication. Video conferencing helps in this respect, but it does not completely replace real-life contact. That's why I really look forward to the time when physical meetings will increasingly be possible again. Direct

contact between people, both in private and professional life, is clearly more important than any video conference, no matter how technically perfect it may be.

In the wake of corona, has the world become more or less open-minded regarding the pursuit of diverse technological approaches?

According to my perception, the world in general tends to have become more open-minded concerning technological preferences. The available resources have no doubt been cut to some extent at the moment. However, the commitment to achieving goals like the reduction of CO₂ emissions using a wide range of approaches, including new technologies such as hydrogen as an alternative energy source, tends to have intensified. Important political decisions about funding support for hydrogen technology – both in Germany and on the European level – are relevant proof points. In addition, I find that the general focus on innovation has been sharpened: Which innovations deserve to be given a chance? Which areas do not merit any further development? Today, these questions are more important than ever, especially due to the tougher financial conditions. This leads to a new stimulation of competition focused on innovations.

The world has changed due to corona. What were the major effects in your area of responsibility?

As an automotive and industrial supplier, our global development network was a major issue for us. Due to the regional differences of the pandemic and diverse effects on various sectors, we had to show maximum flexibility here and act with speed and agility – which we managed to do really well. We kept the global development network running, which has also provided us with valuable experiences going forward. However, we miss aspects of our local presence like direct customer contact or even the direct exchange between our international teams. As briefly mentioned before, these aspects cannot be completely replaced by purely digital meetings in the long run. Especially the beginning of this phase was difficult also for our individual development engineers, who had to leave

their prototypes at the company and work from home. But our employees managed to adjust to this situation really well. After just a short time, the development processes were running like clockwork. In addition, we developed solutions for resuming on-site prototyping and testing in compliance with all hygienic aspects.

Digitalization has received a boost due to corona. What effects has this had at Schaeffler?

We're already in a very good position in terms of digitalization at Schaeffler, so we were well-prepared for coping with the crisis, of course not only in research and development. To name just one example: Maintenance employees were able to perform a large part of their tasks from home, even if this meant taking care of real-world machines and equipment, because we've already interlinked and virtualized a lot of our equipment. Project planning, programming, diagnoses and setup adjustments can largely be handled remotely. Obviously, the

pandemic has also clearly shown how important digitalization is in all areas of the organization. That's why we'll continue to drive our agenda here.

You're the chief technology officer: to what extent have forward-going strategies changed or areas of emphasis shifted?

The significance of focusing on the right technologies has sharply increased. Here, we're benefiting from our innovation program that we've consistently continued to implement also during corona. It enables us to compare innovative ideas with Schaeffler's market potential and fields of expertise and select the technologies we're going to pursue in greater depth accordingly. However, corona has not led to any fundamental changes regarding basic technological trends. Now being massively boosted, hydrogen and electric mobility are technological trends that we've been focused on for a long time: In the context of a carbon- neutral, sustainable future, our emphasis is placed on the

enormous potential of green hydrogen. As an automotive and industrial supplier, we keep our eye on the entire range of applications – from hydrogen production using electrolysis to mobile and stationary applications in fuel cells to the utilization of hydrogen-based direct-reduction steels. We're actively engaged in a large number of hydrogen initiatives in order to establish and help shape the hydrogen eco-system together with strong partners. As a supplier of systems and key components, we're going to play an important part in this context. Plus, we're also in a very good position in other areas such as electric mobility (see page 62) and robotics (see page 78), and have frequently demonstrated the expertise we've massively expanded in the area of systems in recent years.

What are the prospects for autonomous driving, going forward?

At Schaeffler, we still believe that this will become a hot topic, albeit the question of whether this will happen sooner or later due to corona is not so easy to answer.

“ In my view, the climate discussion has not lost any momentum, neither on the political level nor at Schaeffler: increasing energy efficiency, driving defossilization and decarbonization – these actions are being pursued worldwide and of course here at Schaeffler, too

Uwe Wagner

”





— The departure from fossil fuels and the transformation of mobility continue to have the same high priority as before and require a fundamental change in the entire energy sector. Schaeffler's activities in the "energy chain" focus field address exactly these market segments – from digital solutions to mammoth bearing solutions for wind turbines

Some players in this field have shifted this topic to a lower priority level due to the current constraints, while others are accelerating it for exactly the same reason in order to gain a competitive advantage in this way. Aside from these considerations, there are applications in which autonomous driving is going to gain traction for very rational reasons, such as in the heavy-duty field. The utilization of autonomous vehicles will really pay off here. With our drive-by-wire initiative based on Space Drive, we'll be able to offer a key technology in this area.

What does the situation look like in the industrial sector?

In the industrial sector, we're really well-prepared for the digitalization boost due to corona with proven- in use applications, too. In the area of Industry 4.0, for instance, with cloud-based services and condition monitoring solutions like OPTIME. By enabling seamless monitoring at low costs, this plug-and-play system eliminates an important hurdle. The general idea up to now has been that condition monitoring can be costly – that's why up to 95 percent of all units

in a production machine or plant are not being monitored at all or just sporadically, which entails high risks of unplanned stoppages and downtimes. We generally want to help our customers optimize their production processes, enhancing their efficiency and flexibility, and, as a result, making them more resilient against unexpected challenges such as corona.

Will it be necessary to place a greater focus on extreme situations like a pandemic in future technical developments?

I think that our well-balanced development portfolio and our global development team are crucial factors in this context. The more balanced one's position is in this respect, the better is one's ability to respond to exceptional situations. We're in a very good position with our innovation strategy here and are therefore going to retain it as it is.

The climate discussion has faded from the spotlight to some extent due to the corona crisis, but satellite pictures and air measurements show that the lockdown measures have been beneficial to the

environment. Obviously, no one would like to have an everlasting lockdown, but where have you identified corona-induced climate-friendly potential that might also be viable for the future?

In my view, the climate discussion has not lost any momentum, neither on the political level nor at Schaeffler: increasing energy efficiency, driving defossilization and decarbonization – these actions are being pursued worldwide and of course here at Schaeffler, too. The key objective driving all of these efforts is that the energy consumed has to become increasingly carbon-neutral. And this objective should mainly be achieved by focusing on the development of sustainable technologies. In this context, the renewal of car fleets is an equally important aspect as the efficiency enhancement of existing technologies. Both are going to soon lead to positive results. Of course, aside from this, it's important to develop an awareness of our personal carbon footprint: less travel, both privately and for business, intensified remote work, more conscious consumption, plus support for new mobility concepts are possible aspects that benefit our climate.

Around the world, a factional dispute has flared up: While one camp would like to restore the pre-corona status quo as soon as possible and pump money into existing systems, the other one views the pandemic as a turning point and advocates radical renewal, even though it may initially be painful. What is Schaeffler's position on this?

We do not see ourselves positioned in either of these camps. We stand for continuity and an unbiased view of technology. Our 30/40/30 scenario, which we continue to regard as being realistic and which in this form can make a major contribution to decarbonization, is a perfect example. For newly registered vehicles in 2030, it predicts 30 percent fully electric vehicles, 40 percent hybrid powertrains and 30 percent conventional IC engines. We include completely new fields in this, for instance in the context of hydrogen, where we've been focusing on the entire value chain from electrolysis to the fuel cell for quite some time.

In times of crisis, strengths and weaknesses are exposed. What areas proved to be strengths?

The fact that Schaeffler is an automotive

and industrial supplier and that both divisions are effectively coordinated once again proved to be beneficial. Our Skalica site in the Slovak Republic is a case in point. While automotive orders declined at the beginning of the pandemic, they remained relatively stable in the industrials market. At the Skalica plant, more than 4,000 employees produce needle bearings, cages and other products for industrial applications, plus components for transmissions, as well as belt and chain tensioners for automotive customers. Besides the differences in the automotive and industrial divisions' order situations, the plant was confronted with another challenge: Within a short period of time a large number of employees – sometimes as many as 20 percent – were unable to work for reasons of infection protection and corona virus control. In order to meet all industrial customer deadlines in spite of these manpower shortages, colleagues from the automotive division stood in on short notice and helped to sustain the manufacturing operations in that way. Due to this fast support, we delivered all orders on time. One of the crucial factors in this effort was the very high skill level of our employees, plus their flexibility and willingness to help out. This example impressively shows

how Schaeffler closes ranks worldwide in times of crisis and how cross-divisional teamwork has to function in order to jointly rise to the challenges. Corona has made us even stronger!

And how is the collaboration with customers and suppliers in times of crisis?

Here, the relationship with our customers and suppliers that has been growing for decades and is based on mutual trust has paid off. We have been engaged in constant exchange – in both directions: As a result, we're able to mutually assess our demand really well and respond with flexibility. This is also true for joint development projects.

Summing up our conversation in two sentences: what is the "new important?"

Flexibility, efficiency and strong judgment are more important in these days than ever. Due to our decades-long market experience and close interlinking with our stakeholders, we're able to systematically respond to all requirements and demands, and provide innovative solutions in response to global challenges.

Curriculum vitae

Uwe Wagner (b. 1964) studied mechanical engineering at the University of Stuttgart. In 1993, he started his career as a development engineer in the Control Hydraulics Automatic Transmissions unit at LuK. In the following years, Uwe Wagner held various management positions. In these roles, he implemented numerous new product developments and volume production launches together with his teams. In 2007, he assumed responsibility for the Transmission Technologies business unit. With numerous concept and product developments, such as the first Schaeffler hybrid clutch, he and his team paved the way for research and development activities in e-mobility. Uwe Wagner became a member of the management board of the Automotive division upon being appointed as Head of Research and Development Automotive in 2014. Two years later, he also assumed this role for the Industrial division. Since October 2019, Mr. Wagner has been Chief Technology Officer at the Schaeffler Group.





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Detection of Bearing Defects on Balanced Machine Bogies

Historically, condition monitoring of balanced machine bogie wheel bearings has been challenging, due to the very slow speed rotation and furthermore, in most cases, the variable speed adds even further complication.

We'll be explaining how these specific assets were successfully monitored at a mining company, using an ultrasound inspection instrument.

Background

Within this mining company, the coastal operations had many examples of failed bogie wheel bearings and, in each case, there was a great potential for subsequent damage to the shaft or the bearing bores in the bogie housing, which would add even more to the rebuild costs.

Thus, the maintenance team was working through multiple failures on the CLB Stacker long travel bogies. Led by the balanced machine specialist, the team built historical maps including rebuild vendors and the use of OEM spares.

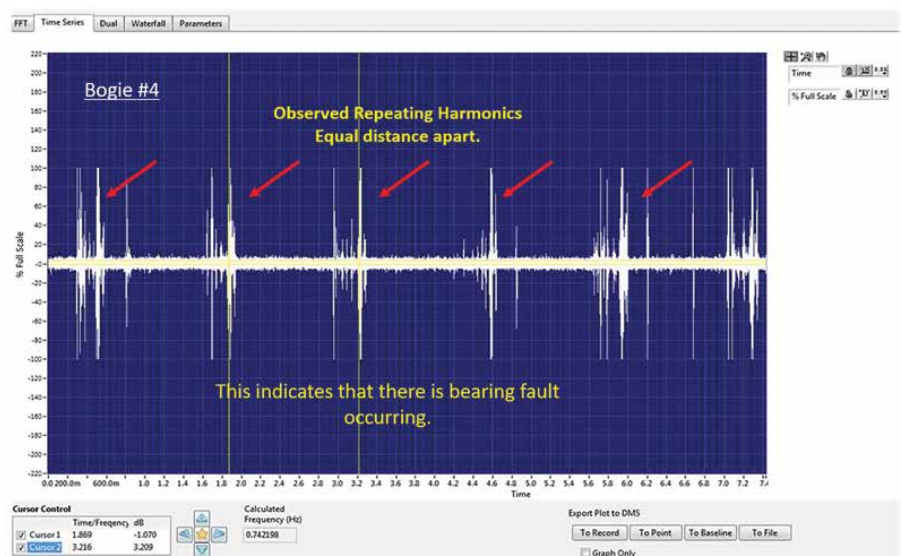
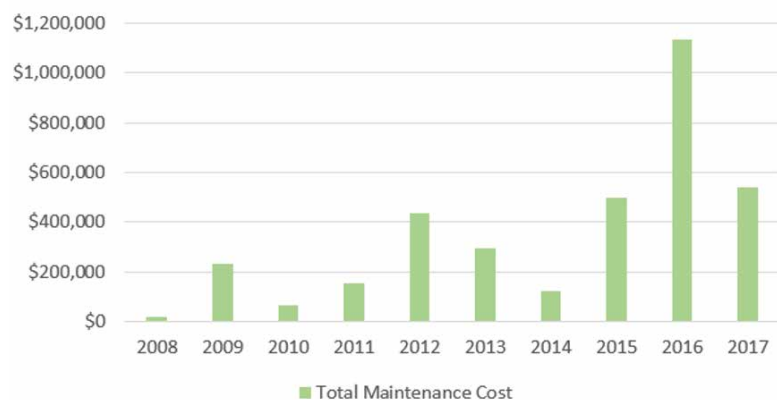
A study of SAP data for 16 of the 37 stackers in this company, across different sites, revealed an incredible \$3,491,146 in maintenance costs, directly related to bogie bearing failure, not to mention the additional unscheduled time loss, also important to consider.

Survey using Ultrasound technology

Next, a team of experts was asked to assist in this matter with identifying bearing defects using ultrasound technology, which is a proven technic to identify early bearing failures, especially when it comes to slow speed bearings.

A survey was conducted with an Ultraprobe 15.000 ultrasound inspection instrument, and an identified bogie set was removed and sent for strip and assessment, after the ultrasonic instrument

Bogie Bearing Failure Costs (2008-2017)



— Stacker 6P Bogie#4 – Sound Spectrum Prior to Removal

showed signs of bearing damage – which could be perceived by the sound quality heard & confirmed after a sound spectrum

analysis of the recorded ultrasounds. This is a screenshot taken from the Spectralyzer software (for sound analysis),

time series view. The peaks clearly point to a damaged bearing, since a healthy bearing will present a very uniform wave, without any peaks in amplitude. In this case, we can clearly see peaks in amplitude, representing harmonics equally distanced. This is an obvious sign of bearing damage.

As diagnosed using spectrum sound analysis, the raceway is displaying spalling damage.

Again, when performing sound analysis, we can find evidence of bearing damage. A bearing in good condition would be uniform on the time series view. But in this case we see again peaks in amplitude, corresponding to impact points or increased friction.

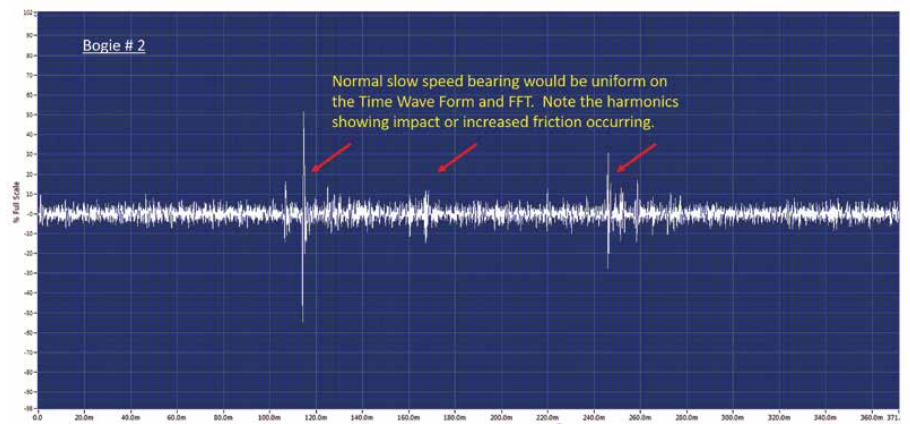


— Stacker 13 Bogie#2 – Post workshop strip

As we can see, during strip and assessment, in both cases, severe spalling was found on the raceways.



— Stacker 6P Bogie#4 – Post workshop strip.



— Stacker 13 Bogie#2 – Prior to removal

Conclusion

Whilst the detection of defects in these bearings is certainly possible through diligent inspections such as the daily rounds, categorising severity is extremely difficult, if not impossible.

This can be achieved by using an ultrasound inspection instrument with sound recording capabilities. This will allow maintenance teams to load the file on a sound spectrum analysis and identify issues in an early stage, quick and easily, even in very slow speed bearings.

It is important to note that, while bearings rolling at a medium/high speed can normally be monitored by relying on dB levels and verifying them against a dB baseline, this is not always the case with slow speed bearings. Since slow speed bearings, in many cases, will not produce enough energy to show a relevant dB increase, it is necessary to rely on the sound quality and posterior

sound spectrum analysis. That's how issues can be identified when using ultrasound for slow speed bearing monitoring.

And because ultrasound surveys are easy and quick to conduct, they can be performed in relatively short intervals of time.

Given the history of this particular case study, the point of failure detection was between 6 and 12 months from the scheduled change out. Therefore, an ultrasound survey frequency of 3 months could be considered appropriate for stackers, and of 6 months for reclaimers and ship loaders (given their lower duty cycle). The recommendation to extend the surveying of balanced machine bogie bearings across the coastal fleet at the above intervals would allow the company to potentially save millions in maintenance costs, as we seen before. A clear case where predictive maintenance, using a technology such as ultrasound, clearly pays off. More information can be read at www.uesystems.com



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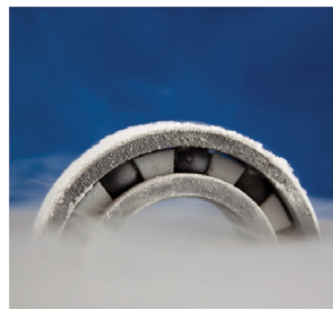
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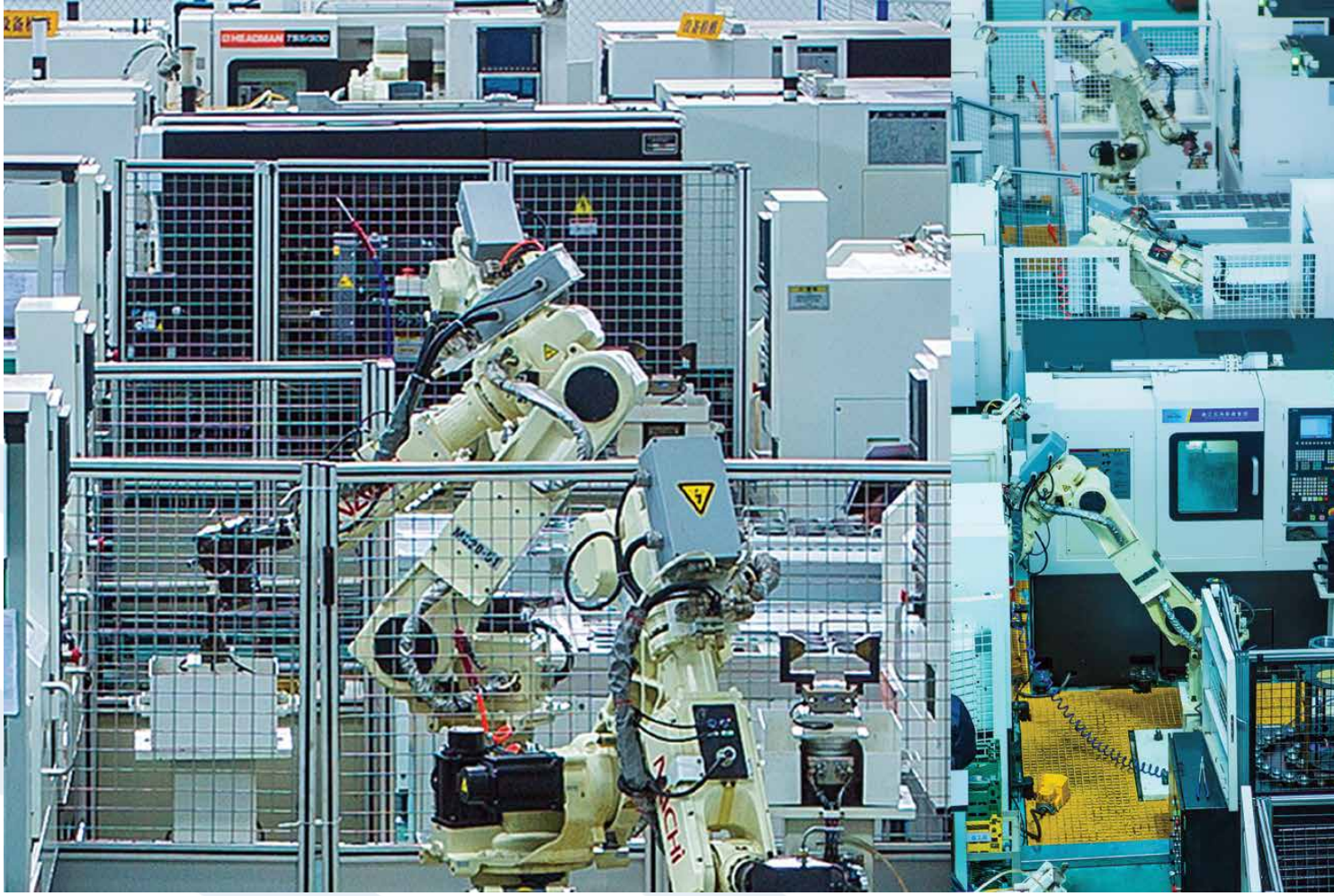
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The Bearing Manufacturer

-Ready for Industry 4.0-



XCC Group is the sixth largest bearing manufacturer in China, with sales revenue of 398 million USD in 2019. XCC Group began its journey of manufacturing automotive bearings and related components. As of today, the company is producing over 2,500 different types of bearings and has become one of the leading advanced manufacturers in China.

Thanks to the continuous investments in automation research and development, the company currently has 16 factories worldwide producing high precision bearings for agriculture, automotive, robotic, motor, and elevator related bearings. XCC is a company with advanced technology that is committed to the growth in research and development in every aspect of the production and aims to become one of the World's leading bearing manufacturers.



We tried to unveil the story behind this success story during an interview with Mr. Zhang Feng, CEO of the XCC Group.

Can you tell us more about the history and evolution of XCC Group?

I resigned from politics in 1998 and started a small bearing company. After decades of continuous development and growth, we acquired Zhejiang Xinchun Bearing Co., LTD which, set up in 1989, was one of the oldest bearing manufacturers in China. From then on, we created a complete industrial chain and streamlined the production of bearings. Now our group has been a reliable supplier of bearing rings to the world's largest bearing manufacturers such as SKF, Schaeffler, NSK etc. At the same time, our finished bearings are supplied to world-class OEM customers and are exported to the United States, Europe, Brazil, South Korea etc. In 2012, we completed our group's shareholder reformation and renamed ourselves as Zhejiang XCC Group Co., LTD. We then launched its IPO at the

Shanghai Stock Exchange in October 2016 under the stock code 603667. The launch of the IPO brought in an influx of capital which allowed our group to expand rapidly.

What are the types and scopes of bearings you produce?

We have five end-product bearing factories worldwide, each producing deep groove ball bearings, angular contact ball bearings, pillow block ball bearings, tapered roller bearings, cylindrical roller

bearings, spherical roller bearings, and CVJ roller ASSY bearings, both standard and non-standard. The production sizes range from ID 10 mm to OD 300 mm.

What industries and fields do you serve?

We are dedicated to provide the customized, green, intelligent, lightweight and maintenance-free products for our customers. They are widely used in automobile, elevator, alternator, agricultural machinery, construction machinery,

“

Our investments on digital and intelligent production equipment upgrades had exceeded 40 million USD.

”

Zhang Feng,
CEO at XCC Group





wind turbine, machine tools, industrial robots, and many other industries.

In which fields are your current R&D investments?

We possess a national level bearing Research and Development center. Our R&D areas include special raw materials, advanced processing technology and bearing performance research. Currently, we have completed the following projects: high-nitrogen bearing steel forgings, heat treatment with grinding processes, cold forming processing equipment and technology, third-generation hub bearing forging, turning and induction heat treatment technology, high-speed and long-life sealed bearing for electric vehicles, prolonging fatigue life of bearings by carbonitriding technology, and machining roller's special profile of working surface for wind turbine rolling bearing.

Which production processes are automated? How does this reflect in your overall production capacity?

Following our IPO in October 2016, the investments on digital and intelligent

production equipment upgrades had exceeded \$40 million. We have created a vertically integrated bearing production chain which consists of tubing, forging, turning, heat treating, grinding, and assembly. We accomplished real digital production systems consisting of automatic production, automatic detection, and on-line error prevention. We are actively upgrading to intelligent production management system. During the first half of this year, the production management MES project was completed to realize real-time monitoring of production data and quality data, as well as traceability of the entire manufacturing process of materials; which improved production efficiency and ensured the stability and reliability of the quality of our products.

To which countries are you mainly exporting? Do you have any overseas branches?

46% of our products are exported to more than 20 major countries. In order to provide better timely service to local customers, we have set up branches in the United States, Germany, Japan, Brazil and Singapore.

How large is your market within China?

China is the world's fastest growing market for bearings. According to the statistics of China Bearing Association, the annual demand for bearings in China is approximately more than 26 billion USD. XCC group's sales volume was 393 million USD in 2019. Because our sales to the Chinese market and our sales to the overseas market are relatively balanced at 50% each of our total sales, we regard the Chinese market as equally important as the overseas market. We focus on providing high-quality products and timely services to our worldwide customers. XCC group ranks No. 6 in China's bearing industry. We are the largest bearing ring production company in China, and we provide bearing rings to the top 7 largest brands bearing manufacturers worldwide. At present, we focus on the development and production of various applications of finished bearings.

What separates you from competing companies on the market?

Compared with other companies in the bearings industry, we have the following advantages:

“

46% of our products are exported to more than 20 countries.

”

- 1) We created a vertically integrated bearing production chain that combines forging, turning, heat treatment, grinding and assembly. Thanks to our world class manufacturing technology from raw material to heat treatment, we can provide the best process plan according to our customers' application requirements, which enables us to meet our standards of longer life and higher reliability.
- 2) We focus on providing customers with customized solutions. According to the customer's application characteristics, our R&D engineers will use Romax and other software for simulation analysis to find the best design scheme. All samples must be tested by XCC's R&D Center before they are submitted to the customer. We always provide the customers with the optimal design scheme to meet their unique working conditions.
- 3) The integrated production chain enables



us to respond quickly to our customers' requirements. Our application engineer can answer their questions within the same day and arrive at the customer's work site

within 24 hours; Essentially, from product design, mold development, sample production, to mass production, our new products can be completed within 90 days.





- XCC's full automated production lineEO



What level of quality can your products achieve?

Our group is committed to provide world-class OEM customers with high quality bearing products and services. Five years ago, we started supplying bearings to the world's top OEM customers in the automobile, elevator, agricultural machinery, engineering machinery industries. Because most of our customers are the world's leading manufacturers of high-quality bearings, we have great confidence that we will provide world leading quality service. Because we are a world leader in bearing ring technology, our quality and stability of the finished bearings are also trusted and approved by our OEM customers.

How do you see the current economic conjuncture and the impact of it on the bearing industry?

Every crisis is also a chance for industry reshuffle. Following the COVID-19 pan-

demic, our enterprise resumed production very quickly and ensured our OEM customers that their orders would be on time, which reflects our overall strength to cope with the change of supply chain and logistics, thus winning the trust of our customers. I believe that through this crisis, our customers will seek increased cooperation with competent companies, such as ourselves, and we will acquire additional opportunities for development.

What are your plans for 2021?

The economic impact of the COVID-19 pandemic in early 2020 was felt throughout the world. Unfortunately, this crisis is continuing in many parts of the world including North America, Europe and Asia with many companies still unable to resume normal work schedules. Our group is confident in our future growth and project development. We have 28 automobile bearing projects in progress and 3 wind turbine projects entering mass production.

Moreover, we will continue to make new investment on production capacity and R&D for the automobile, wind turbine and other major markets in 2021 and beyond.

How do you see the future of bearing industry?

With many years of investment in high-quality production equipment, management level improvements and continued R&D innovations, we will continue to be a market leader throughout China's bearing industry and the world. We will continue to be partners with our customers to be more involved in the design and development stage and to share our vast knowledge. With our great overall manufacturing capability, our production of high quality customized products, and our ability to rapidly respond to changing environments, we will continue to be a market leader.

SCHAEFFLER



Ball Bearings



- Angular contact ball bearings
- Deep groove ball bearings
- Self aligning ball bearings
- Spindle bearings
- Thin section bearings

Roller Bearings



- Barrel roller bearings
- Cylindrical roller bearings
- Needle roller bearings
- Spherical roller bearings
- TORB toroidal roller bearings
- Tapered roller bearings

Other Rolling Bearings



- Bearings for screw drives
- Crossed roller bearings
- Rotary table bearings
- Slewing rings
- Track rollers, back up rollers and cam rollers

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The 1,000th Rotor Bearing for Multi-Megawatt Wind Turbines

14 Tons of Concentrated Reliability

In March the colleagues at thyssenkrupp rothe erde reached a milestone in their production history: the manufacturing of the 1,000th multi-megawatt rotor bearing. We took a closer look at this component of wind turbines, which is so important for a successful energy transition.

Two years after the 500th rotor bearing was produced, our colleagues at thyssenkrupp rothe erde cracked the 1,000! Six years ago, series production started on the basis of a prototype developed and tested in cooperation with the leading producer of offshore wind turbines. Never before has a larger rotor bearing been built in higher volumes. The rotor bearings are part of an offshore direct-drive wind turbine with a rotor diameter of up to 170 meters. This corresponds to the length of two Airbus A380s.

Wind power plants in Germany: an integral part of the landscape

Especially in *Lower Saxony, Brandenburg and Schleswig-Holstein*, wind turbines are now part of the landscape. In 2019, wind power overtook lignite in Germany with a share of 24.4 percent of total energy, and today represents the most

important source of energy in Germany. With an installed capacity of around 61,405 megawatts, *Germany ranks third in the world in terms of wind energy* and is the number one in Europe. Rothe erde® rotor bearings generate energy for up to 7.5 million households every year.

Offshore parks: stronger winds, more power

And wind energy continues to hold great growth potential: Of the nearly 30,000 German wind turbines currently in operation, only about 1,200 are “offshore”, i.e. in the sea – the remaining turbines are distributed inland. But far out at sea, the wind is particularly constant and strong. Exactly the right place to use wind to generate electricity. Because the wind not only churns up the sea, but also drives the rotor blades of the wind turbines.

Rotor bearings for offshore wind turbines must be able to withstand this

Constant and strong winds, temperature fluctuations and strong wave movements place great demands on the bearings: For use in offshore plants, they must be able to withstand all forces of nature. In order to keep electricity generation costs low, it makes sense to install particularly large and powerful turbines – with blade lengths of over 100 meters and rotor diameters of almost 220 meters. The rotor bearings must be dimensioned accordingly to be able to absorb enormous forces.

In the open sea, all structural components of wind turbines must be highly resistant to corrosion.

Rotor bearings from thyssenkrupp rothe erde are known for their robust design and excellent performance. They are

— Offshore wind turbines are not only a breathtaking sight, they are full of high-quality and constantly evolving technology.



manufactured to the highest material purity, induction hardened and assembled in clean rooms. The high salt content of the marine environment also requires all components used in offshore wind turbines to have appropriate corrosion resistance. For this reason, rothe erde® rotor bearings are provided with an anti-corrosion coating.

Rotor bearings get better and better

Since the first delivery, thyssenkrupp rothe erde has continuously optimized the production process. State-of-the-art production methods allow us to meet customers' high demands on the efficiency and reliability of rotor bearings.

In addition, a significant increase in delivery volumes was achieved to meet the growing demand of the offshore market.

The rotor bearings, which are up to four meters in size and weigh over 14 tons, leave the factory closed, sealed and ready for installation. rothe erde® rotor bearings are among the key components for wind



— Superlative rotor bearings: weighing 14 tons and so large that people can walk around in them. — These are the dimensions of rotor bearings for wind turbines.

turbines and thus contribute to the expansion of renewable energies.

Where slewing bearings are used outside wind power

Large-diameter antifriction bearings ensure that everything runs smoothly, and not only in wind turbines. Whether

in the heart of the Gotthard mountain range on huge oil tankers or very special cruise ships – our developers are working on some of the most exciting engineering projects in the world.

Author

Güllü Beydilli from thyssenkrupp

— Highly complex production: Since 1998 thyssenkrupp rothe erde in Lippstadt has been developing and producing rotor bearings for various types of wind turbines.



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Regal® Introduces System Plast® iCOF® Condition Monitoring Device

Measures the coefficient of friction of a chain or belt while it is running to maintain optimal flow

Regal Beloit Corporation, a leading manufacturer of electric motors, electrical motion controls, power generation and power transmission components, announced the introduction of its new System Plast® iCOF® condition monitoring device.

For manufacturers running a manufacturing line, especially a dry running line, friction is a key factor for the proper handling and flow of containers. The iCOF condition monitoring device is designed to monitor the condition of a manufacturing line or a part of it by measuring the coefficient of friction (COF) of a chain or belt while it is running. It returns the average value and trend of the COF. The goal is to maintain line efficiency and an optimum cleaning regime.

“The iCOF device can be used in any conveyor, where a stable friction is the critical point. In dry lines, this value can more easily be affected by several factors, including the cleaning conditions of the conveyors,” said Brad Gossard vice president and general manager, PTS Conveying, Regal. “Inliners, feeders or the points where the containers change their speed quickly are the areas to watch. The iCOF condition monitoring device can also be used in mass conveyors to keep the back-line pressure under control.”

The iCOF device can be mounted on a conveyor and integrated in the line control system. Without any operator intervention, the system will independently measure

the friction at regular intervals. With these data, it is possible to calculate an average value and the related trend and set alerts to take corrective action.

The iCOF condition monitoring device is compatible with Profinet protocol and Ethernet. The iCOF design fits with standard 85 mm pitch conveyors. Its compact and firm structure, made in high strength steel (AISI 304), is completely closed and waterproof, offering the best resistance to cleaning agents. The easy and

quick replacing of wear parts, a low tension and current absorption (24 V, 400 mA, 10 W) ensure reliability and operability.

The iCOF system includes the iCOF device, one slider to imitate product type (PET, CAN or GLASS), one set of screws for the slider, one screwdriver, and one USB drive with graphical user interface (GUI).

For more information, visit www.regabeloit.com.



About the Company

Regal Beloit Corporation (NYSE: RBC) is a global leader in the engineering and manufacturing of electric motors and controls, power generation products and power transmission components, serving customers throughout the world. We create a better tomorrow by developing and responsibly producing energy-efficient products and systems. Regal is comprised of four operating segments: Commercial Systems, Industrial Systems, Climate Solutions and Power Transmission Solutions. Regal is headquartered in Beloit, Wisconsin, and has manufacturing, sales and service facilities worldwide. For more information, visit RegalBeloit.com.



— Carter visiting the team in early 2020 to discuss progress and deliver the S61818 thin-section bearings for the team's all-new electric challenger

World Class Oxford Brookes University Turns to Carter Bearings!

For the last 5 years, Oxford-based Carter Bearings has provided support to one of the UK's leading teams in the Formula Student motorsport series, a prestigious racing programme organised and overseen by the Institution of Mechanical Engineers (IMechE). One of the leading entrants in it, the Oxford Brookes Racing (OBR) team, sponsored by Oxford-based Carter Bearings, remains a competitive force in the series.

It is no coincidence that both entities are geographically located in Oxfordshire, at the heart of an area of the UK that includes so many leaders and innovators across science and technology, motorsports, medical and space engineering, to say nothing of its world famous Universities. Up until this year, all the cars on the Formula Student grid have used internal combustion engines as a power source, but in order to match the worldwide pursuit of greener, cleaner vehicles, from 2020 onward all cars in Formula Students must be powered by electricity. So the competitors are now operating real, live development electric vehicle test beds, and many of these engineers may well go on to become the vehicle designers of tomorrow. Carter is well experienced in providing bearings and the accompanying expertise in high performance electric vehicles – in 2013 it was the sole bearings technology partner (and supplied all the bearings used) in Drayson Racing's innovative vehicle which set a new Outright Land Speed Record for electric cars at over 200mph.

The switch to electric power has been warmly welcomed by OBR, who have been quick

to design an all-new drive system for their vehicle which is as energy efficient as possible yet powerful enough for them to aspire to first-place on the grid when race day eventually comes. As part of this drive for efficiency, Carter have supported OBR with both bearings expertise and a selection of lightweight, low-friction high performance bearings for uses in a variety of places throughout the OBR vehicle. For example, in the drivetrain, a Carter bearing sits inside an Electron Beam Melted 3D printed titanium upright and helps deal with lateral, vertical and longitudinal forces in excess of 3G on the track.

Elsewhere in the OBR drivetrain, Carter Type S 61818 high-performance bearings are coping with high static and dynamic loads to enable optimum gearbox rotation: they also assist in the transfer of axle loads. The all-new planetary gearbox features Carter thin section bearings that save space whilst delivering high precision smooth running. Further, Carter K10x14x10 TN and HK1015 high speed needle roller bearings are located within the planetary gears themselves to assure smooth and accurate running. OBR's Lead Engineer, Powertrain, 19 year old

Homan Ho says "In common with many sporting activities, the CV-19 pandemic has prevented us from racing so far this year, but we're filled with confidence for 2021 in this fantastic race series. Thanks to the expertise of the engineers at Carter, and the supply of some of their high-performance bearings in so many critical applications on our vehicle, we consider ourselves extremely fortunate and cannot wait for the forthcoming season".

Carter's Piotr Burda, (himself an Oxford Brookes Motorsport graduate and F1 engineer who is now a bearings specialist with Carter) has been working closely with the OBR team to help them maximise bearing performance and achieve their goals. He observes: "It is a pleasure to help the next generation of engineers and to see and be part of the advances they are making with new technology as it emerges".

The details can be checked on www.imeche.org/events/formula-student. For more information please visit: www.carterbearings.co.uk, email: sales@carterbearings.co.uk or call: +44 1865 821 720.



Revolutionary ideas in motion,
for high-performance **race**
cars of tomorrow.

Koyo's SAC bearings for precision screw drive shaft support

Introduction

Ball screw drive systems are used in a large variety of applications where rotational motion needs to be translated into linear motion, with low friction (high mechanical efficiency) and a high degree of preciseness. Typical applications are in aerospace (fly-by-wire), automotive (power steering), precision assembly systems, robots, semiconductor manufacturing (steppers) and machine tools (CNC machines). For high precision (micrometer level) applications where, besides radial loads, also axial forces come into play, special attention to the design of the ball screw drive as well as the ball screw shaft and its bearing support are essential.

JTEKT's experience in this field

After the integration of Toyoda Machine Works (machine tool manufacturing) and Koyo Seiko (manufacturing of roller bearings) into JTEKT Corporation, in 2006, engineers from both divisions have worked closely together to share their expertise and to optimize the bearings that are required for state-of-the-art machine tools with the high precision that is demanded by the market today.

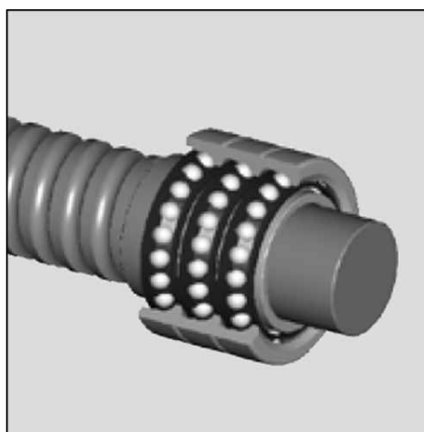
The critical role for the ball screw shaft support bearings

While during the development of a new ball screw system typically a lot of attention is paid to the proper design of the ball screw drive (with internal ball recirculating system) and the spindle/ball screw shaft (precision ground or rolled/cold formed), the importance of the *shaft supporting bearings* is often underestimated. For applications where ball screw positional accuracy and repeatability is essential (like in machine tools), the shaft bearings must absolutely immobilize the shaft axially



— Figure 1: Ball screw drive and screw drive shaft

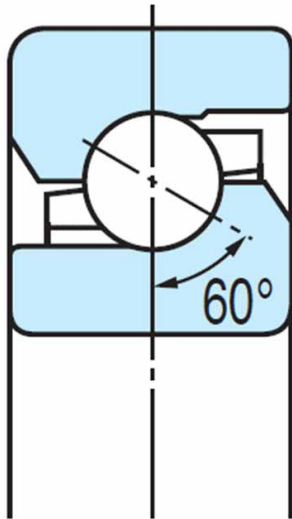
when subjected to varying degrees of axial loads from motor power- and inertia forces, to avoid backlash.



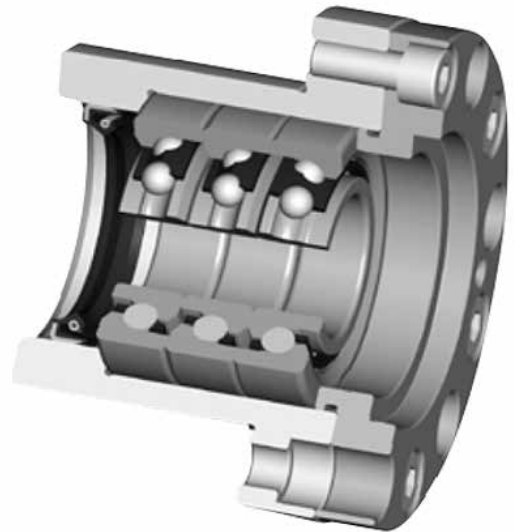
— Figure 2: Ball screw shaft support bearings

Single Angular Contact bearings for spindle shaft support

Koyo has developed a dedicated type of SAC bearing with special internal geometry (including a 60° contact angle) that provides maximum running accuracy and the radial/axial load support that is typically required for modern (high speed) machine tool applications, or for applications with similar operational requirements (see figure 3). The SACs can be mounted as a set into a housing (see figure 2) or offered as a bearing unit (see figure 4). Different configurations are available to accommodate for the specific application conditions, including two, three or four row matching types and optionally facing in opposite directions to support bi-directional axial loads (see figure 5). To maintain their inherent accuracy and ensure long life, great care is needed to avoid contamination with dirt



— Figure 3: Dedicated design SAC for Machine Tool application or similar



— Figure 4: Ball screw shaft support bearing unit

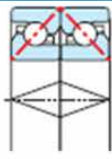
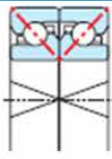
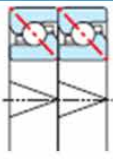
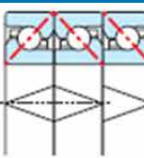
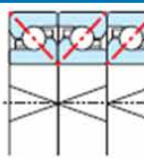
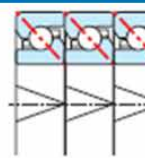
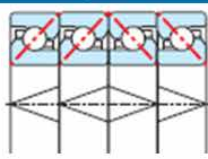
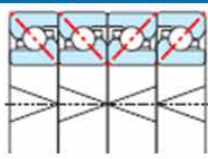

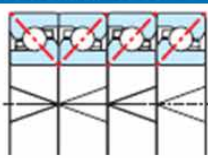
and abrasive particles. Precise pre-load setting is imperative to reduce slack (screw shaft axial free play), while optimizing bearing life (cost economy) and minimal internal friction (rotation efficiency – energy consumption). Koyo engineers

will advise on the proper configuration, sealing solution and pre-load setting depending on the specific application.

For more technical details about SAC ball bearings for spindle shaft application our

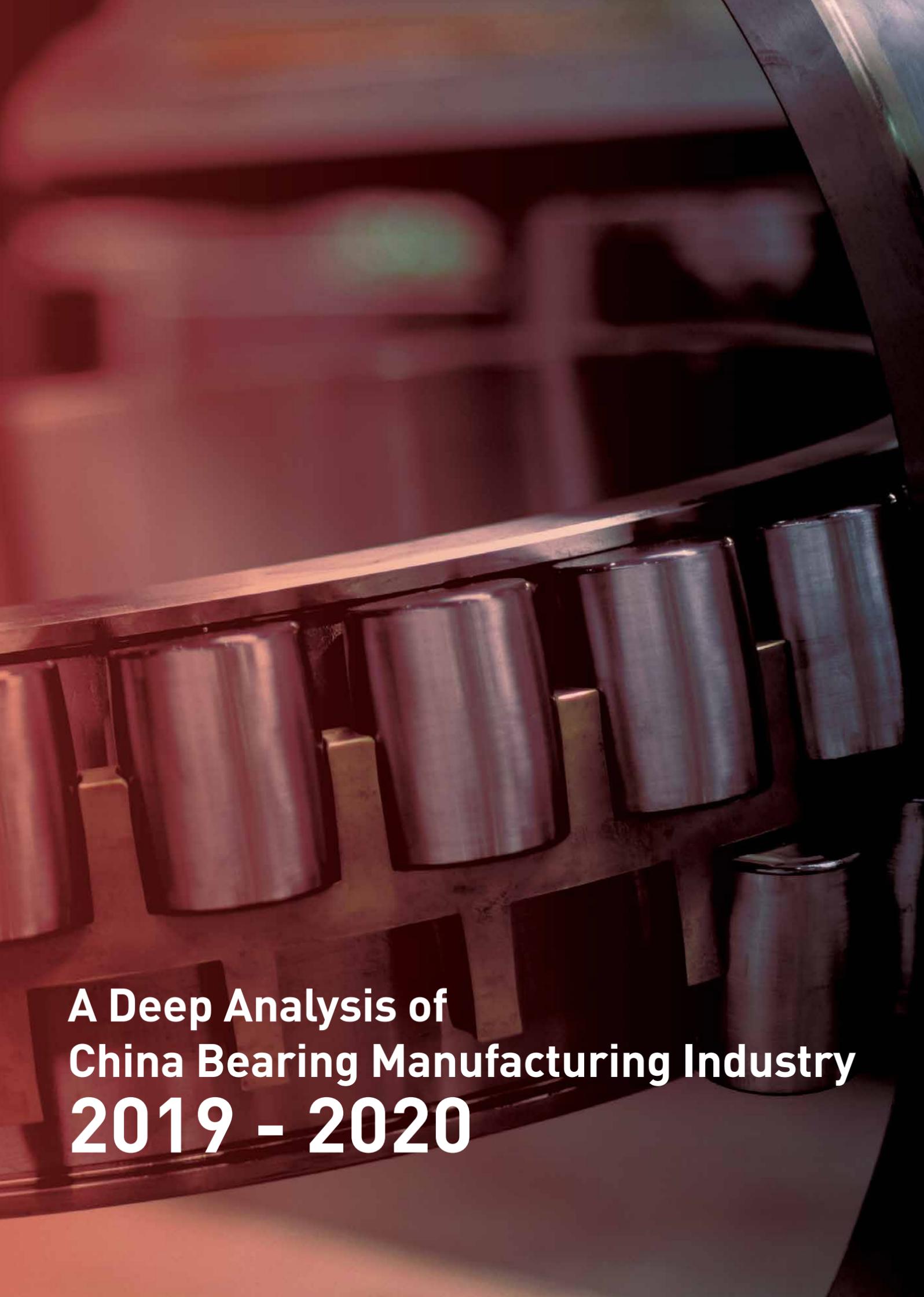
engineers will be happy to support you. For technical or general information on Koyo's products, please do not hesitate to contact your local Koyo office or Koyo distributor. You can also visit our European website: www.koyo.eu

Matching Types and Matching of Codes of SAC Ball Screw Support Bearings

Two Bearings	 Back-to-Back Matching Code: DB	 Face-to-Face Matching Code: DF	 Tandem Matching Code: DT
Three Bearings	 Matching Code: DBD	 Matching Code: DFD	 Matching Code: DTD
Four Bearings	 Matching Code: DBB	 Matching Code: DFF	
	 Matching Code: DBT	 Matching Code: DFD	

— Figure 5: Possible configurations of SACs depending on the specifics of the application





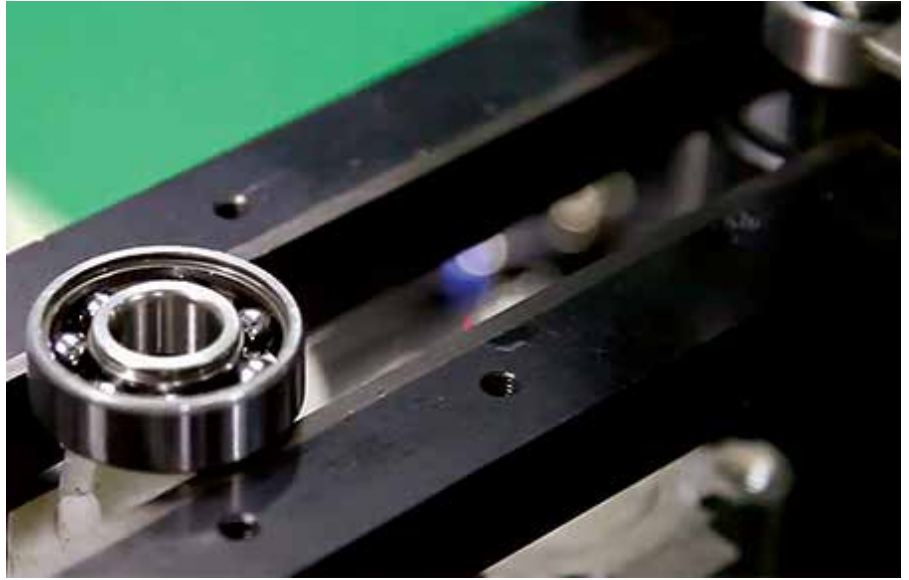
**A Deep Analysis of
China Bearing Manufacturing Industry
2019 - 2020**

2019 was an unusual time for the Chinese bearing industry. As the trade war between China and the US became more hostile, the industrial economy grew increasingly complex and volatile — with the bearings manufacturing business becoming deeply unpredictable as a result. In addition, the pandemic has continued to affect the economic activity of bearing companies since the initial outbreak in January 2020.

The growth rates of major drivers of China's industry, such as automobiles and machine tools, slowed down during the 12-month period of 2019 as demand decreased globally. This significantly affected the bearing industry and has continued to have an effect in 2020.

According to statistics presented by Chinese sources, the total operating revenue of enterprises in 2019 reached 177bn ¥ (\$25bn), a decrease of -4.22% year-on-year. Other figures include:

- Nearly 6 billion (5.887) sets of bearings were exported from China, -4.74% less than in the same period in 2018.
- Income from foreign exchange transactions amounted for \$5.3bn which represents a decline of -3.36%.
- Crucially, in 2019, China's exports to the United States counted for \$718 million, a decrease of -14.59% from 2018-19



— XCC Group was one of the first bearing manufacturer who implemented measures to ensure production continuity during the pandemic

A look back at the largest bearing enterprises in 2019 and first half of 2020

To identify the various changes and trends within the bearing industry in 2019, 127 of the largest enterprises were analysed. For the period from January to December 2019, the income of these enterprises amounted to 83.9 billion ¥ (nearly \$12 bn), or -2.8% YoY. The 50 largest industry companies accounted for 50.67 billion ¥ (\$7.22bn), but with a decline in revenue of -1.5% compared to last year.

These 127 enterprises made 65.43 billion ¥ (\$9.32bn), -5.08% in total (from the sales of bearings alone), while the top 10 accounted for 37.34 billion ¥ (\$5.23bn), a reduction of -2.27%. The total tax payments of these enterprises amounted to 3.16 billion ¥ (\$450 million), showing an annual decline of -12.44%.

The total industrial production (at current prices) of the 127 companies amounted to 69.2 billion ¥ with an annual change of -2.16%, while the production of bearings reached 5.32 billion sets, or -2.47% per year.

5.39 billion sets of bearings were sold, which is +2.07% more than in 2018. The sales ratio was 101.32%. From January to December 2019, stocks of bearings in 127 companies increased by +15.82% compared to 2018 and amounted to 8.57bn ¥ (\$1.2bn).

From January to December 2019, the number of unprofitable enterprises amounted to 15 companies (12.71% of the total). Since 2018, the number of unprofitable enterprises has not changed. However, compared with the same period in 2018, losses for these companies increased by +141.86% to 520 million ¥.

In this period, 118,000 people worked at these companies (-2.02% in comparison with 2018), and the total salary for this period amounted to 6.52 billion ¥ (\$930 million) up by +0.94%. The average monthly wage per person increased from 4,850 ¥ (in 2018) (\$700) to nearly five thousand ¥ (in 2019), or +2.78%.

These insights show that despite there being no surge in revenue in recent years, there have been minor decreases and changes in the market since 2018. With the ongoing global uncertainties and decreases expected to hit in later 2020, however, the revival of the industry is bound to be a slow one.

From January to June 2020, the main 127 bearing companies recorded -4.15% less operating income from the same period of 2019 and completed the first half of 2020 with -2.41% less production volume than for the same period of 2019. In physical terms, 2.47 billion sets of bearings were produced, or -5.5% less than last year. Bearing sales totalled at 2.39 billion sets of bearings, or -11.59% less than in the same period in 2019.

Only 50 companies saw their total profit increase during first half of 2020, while 72 companies, on the contrary, decreased their profits. The number of unprofitable enterprises is recorded as 27, which is +42.11% more than in the same period last year.

From the end of January to June, export sales of bearings from large enterprises decreased with -13.97% from the same period last year. In physical terms, exports amounted at 1.01 billion units of products, an increase of +4.85% compared to the same period in 2019.



— Bearing production and sales by Chinese national manufacturers in the first five months of this year showed a fall (Photo: Ningbo Chuangxian Bearing)



— Only some of Chinese national bearing enterprises have shown an increase in economic and financial indicators (Photo: C&U)

The road towards post-pandemic recovery

After the unprecedented decline in the China bearing production during the first-half of 2020 due to the pandemic, the question is now when the Chinese expect to rebound the production?

The best-case scenario: Most of the bearing enterprises expect to fully restore production and operation in the fourth quarter of 2020, if, of course, the pandemic can be controlled and stopped in China and in the main industrialized countries.

It is predicted that in the second half of 2020, there will be a significant recovery of production within most of the industries in China, which will lead to an increase in demand for bearings and provide opportunities for structural adjustment and long-term transformation of the bearing industry. Thus, the further development and recovery of the bearing industry can be more visible in 2021. The

Chinese professionals expect that 2021 will demonstrate a more obvious growth trend and gradual recovery in case the expected best-case scenario comes out.

But at the same time, it is noted that the current pandemic can cause several other recovery scenario's where the global markets can be imposed for a second or third wave of infections or the scenario where an efficient vaccine will not be available by 2021. In such scenario's the recovery seems to be postponed till 2022 or 2023 (see article "The Bearing World's Road to Recovery" on page 44).

However, there are already some positive factors to consider for the best-case scenario and important indicators that can help the bearing production to recover and maintain an economic performance at the same level achieved in 2019. Overall China is expected to remain the global bearing production hub in the near future. At least till the world returns to the "new normal".



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How to deal with... Persistent Bearing Currents

On rare occasions, operators in the process industry may note that their low voltage motors experience a current flowing through the motor bearings, especially when they are used with a variable speed drive (VSD).

Left unchecked, these bearing currents will inevitably result in premature failure. ABB has a well-established portfolio of first-action solutions. And now two new approaches can eliminate even the most persistent bearing currents. But making the right choice requires careful consideration of the specific application conditions, as Marcus Westerlund, ABB's Product Manager for Motors and Generators, and Matti Fyhr, Project Manager for Motors and Generators, explain.

What causes bearing currents?

When voltage is present on the motor shaft it can overcome the insulating effect of the bearing lubrication film. This causes a current flow that results effectively in electric discharge machining (EDM) of the bearing, causing premature wear and ultimately, early failure. This voltage can be generated in three different ways according to the size of the motor, how its frame and shaft are grounded, the electrical installation and the specific electronic characteristic of the AC drive.

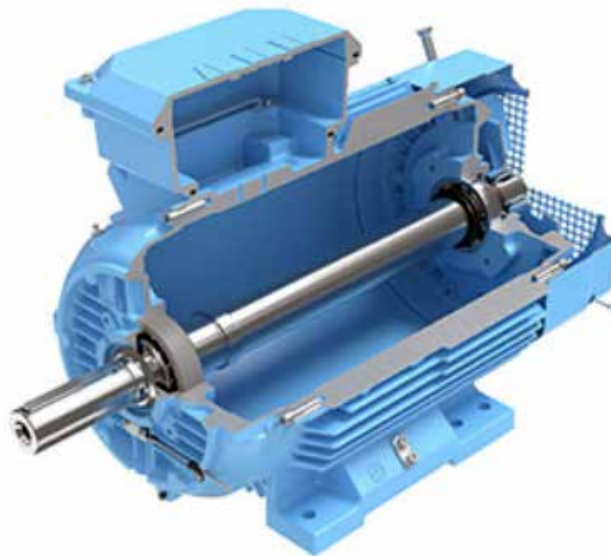
The first of the three types is circulating current in larger motors - above IEC 280 frame size - when a high frequency voltage is induced between the ends of the motor shaft by the high frequency flux circulating around the stator. When this voltage reaches a level high enough to overcome the impedance of the bearing oil film, a circulating current starts to flow in the loop formed by the shaft, the bearings and the stator frame.

Second, in larger motors, shaft grounding current leaking into the stator frame needs to flow back to the inverter, which is the source of this current. Any route back

contains impedance, and therefore the voltage of the motor frame is raised in comparison to the source ground level. If the motor shaft is earthed via the driven machinery, this increase of the motor frame voltage is seen over the bearings. If the voltage is high enough to overcome the impedance of the drive-end bearing oil film, a shaft ground current may flow

via the drive-end bearing, the shaft and the driven machine back to the inverter.

Third, capacitive discharge current happens in small motors - below IEC 280 frame size - when the internal voltage division of the common mode voltage over the internal stray capacitances of the motor causes shaft voltages high enough to create



— A motor shaft grounding brush

high frequency bearing current pulses. This can happen if the shaft is not earthed via the driven machinery while the motor frame is earthed in the standard way for protection.

An extended portfolio of bearing current solutions

There is not one single technical solution that can be applied to cover all installations where bearing currents are considered to be an issue. Instead, it is a question of helping customers to make the optimal choice from a range of potential solutions according to the details of their specific application, with motor size being the key consideration.

ABB has three effective first-action choice solutions for bearing currents already well established on the market. These include: an insulated bearing at the non-driven end; common mode filter and earthing and cabling. Now, for the most demanding situations where one or a combination of these solutions cannot provide a complete remedy, two new enhanced approaches have been developed in the form of shaft grounding brushes and insulated bearings at both ends. In detail, the three first-action solutions for bearing currents are:

1 - Incorporating an insulated bearing at the non-driven end

An effective solution for motors with an IEC frame size of 280 and upwards is to substitute the bearing at the non-driven end with an insulated bearing that prevents current flowing through this point. This can be applied as a retrofit or specified as an option on new motors. It must be noted that the current still has to go somewhere. So, while the motor will be protected, it is important to ensure that this approach will not create new issues in another part of the installation.

2 - Common mode filter used in conjunction with a VSD

For larger motors with a nominal power greater than 350 kW (IEC 400 or larger frame size), a common mode filter will reduce common mode currents and thus decrease the risk of bearing currents. The common mode filter might be installed

internally as part of the motor and drive package, or could be fitted on the cable between the VSD and motor. Common mode filters do not significantly affect the phase of main voltages on motor terminals.

3 - Earthing and cabling of transformer, VSD, motor and load-train

For all installations, and especially motors with a nominal motor power over 30 kW, we recommend the use of grounding and motor connection cables with symmetric PE (Protective Earth) shielding across the entire system as this strongly attenuates motor shaft and frame voltages. This represents best practice even when bearing currents are not regarded as an issue. It should also be the first action taken prior to installing a common mode filter on larger motors.

How to deal with persistent bearing current issues:

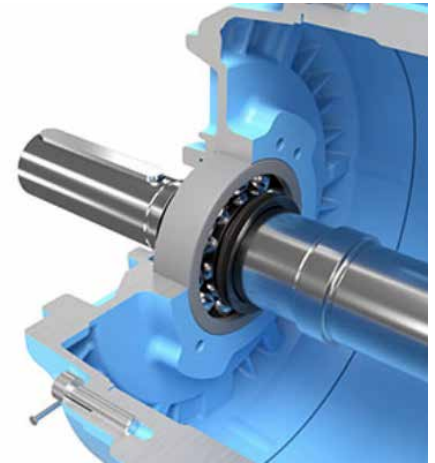
The two new enhanced approaches for installations where the first-action solutions do not provide a complete remedy are:

4 - Shaft grounding brush installed internally

An important new solution for motors in IEC frame sizes 132 to 250 is to install a motor shaft grounding brush that directs the current to the ground via the brush, rather than through the bearing. This protects the motor itself and the complete installation. The brush can be pre-installed on new motors by specifying a variant code. Or it can be retro-fitted on site.

5 - Insulated bearings at both the driven and non-driven ends

Another innovative approach, now being applied to motors in IEC frame sizes 71 to 250, is in the form of bearings installed at both ends of the motor with insulated outer races or rolling elements. This ensures that no current can flow to earth via the bearings. For smaller motors, as well as for special applications, hybrid bearings with non-conductive ceramic rolling elements can also be used. These hybrid bearings can offer other benefits such as longer re-lubrication intervals and a longer service life.



— Insulated bearings at both ends

How can you measure bearing currents?

In most cases it is difficult for operators to measure any bearing current that might be present on a standard motor. But if bearing currents are suspected they can be detected using special equipment operated by experienced personnel. ABB has developed vast experience in carrying out these measurements on motor and drive installations in a variety of different applications worldwide.

Summary – bearing currents can be avoided

While it is important to recognize that bearing currents can be an issue, they are responsible for a very small number of motor bearing failures. The most common causes for bearing failures are due simply to mechanical problems such as too high an axial or radial load, insufficient or wrong lubrication or foreign particles or moisture inside the bearing.

When a bearing current is present, there is no 'one size fits all solution'. It is vital for the customer and motor and drive supplier to work together to identify the most appropriate solution for the specific application. Ensuring the correct use of grounding and connection cables according to best practice will always be an important first step. New solutions in the form of shaft grounding brushes and hybrid bearings are now showing significant promise as a cost-effective way of eliminating the potentially harmful effects of bearing currents.



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A Virtual Future for Industrial Exhibitions?

As the coronavirus pandemic continues to keep much of the world in lockdown, countries have adopted strict travel regulations and people continue to socially distance. This has led to industrial and manufacturing exhibitions worldwide to either be cancelled or postponed for the foreseeable future.

Some may be relieved by the trade show hiatus, but despite how frantic they can be — they remain the best places for bringing industry professionals, experts and thought leaders together to learn, network, collaborate and work with each other.

This poses the question; how will companies continue to promote themselves, network and sell their products in such a way that only exhibitions allow? The answer is innovation, a natural bi-product of necessity.

As the events sector has had no choice but to adapt, many trade shows are planning to become virtual and in turn, companies within the bearings industry are looking to become more digital.

Will this emerging world of virtual events be a part of the 'new normal', or, when the threat of COVID-19 has dissipated, will we go back to the massive industry events that we've become accustomed to?



Leading the Change

Whilst almost all exhibitions being postponed, if not cancelled, the key industrial exhibitions have found innovative solutions to keep the sector connected.

As an example, The Global Manufacturing and Industrialisation Summit (GMIS), a joint initiative by the United Arab Emirates (UAE) Ministry of Energy and Industry and the United Nations Industrial Development Organization, announced in March that its third summit will be converted into a series of digital sessions.

It was originally planned that the GMIS (The Global Manufacturing and Industrialisation Summit) would take place in April, alongside the Hannover Messe 2020 as part of a wider initiative to connect Germany and induce trade with other geographic markets.

However, as the ‘real life’ Hannover Messe was replaced with a two-day digital event (14th-15th July), so too was the GMIS, which has been running a separate digital series since the 30th June and set to finish on 25th August. Moreover, the GMIS is hosting an additional virtual summit from the 4th-5th September.

In a statement released alongside the GMIS announcement, the Hannover Messe said: “The crisis surrounding the current pandemic is casting a new lens on the power of technology to assess how it can be utilised as a force for global restoration, allowing businesses to continue to operate, providing communities with tools to keep them connected, and restructuring supply chains to overcome the recent disruption to global markets.”

Badr Al Olama, Head of the Organising Committee for the GMIS also commented

saying that: “History demonstrates that innovation has proven to be an effective tool in solving the world’s toughest challenges time and again, while also being the driving force behind the advancement of humanity and global prosperity.”

“ 79% of engineers view webinars and are trying to improve their webinar skills ”

“ 94% of industrial professionals are filling the marketing gap, which is left by cancelled tradeshows by connecting to network portals and online marketplaces ”

How Are Exhibitor Companies Reacting?

Whilst taking events online is perhaps the most logical solution to bringing people together in this time of crisis, some maintain contingency strategies that suggest they’re sceptical about the overall value for the time and resources invested in attending or exhibiting.



© Messe München

— At the beginning of July 2020, German organizers in China once again held trade fairs after the Corona break - with success. All trade fairs were held in compliance with strict hygiene regulations. Photo: Laser World of Photonics China (3-5 July 2020)

A survey of more than 200 industrial marketers, which was held early 2020 by GlobalSpec found that 46% would not reinvest the budget set aside for physical industry expos in 2020. Of those that would look to reinvest, 28% said they will reallocate their funds to digital advertising, whilst 14% said it will focus on content creation. The remaining 13% said its budgets will be shifted to the sales travel budget.

A more recent survey indicates that companies are looking for ways to fill the marketing and lead generation gap which is left by cancelled tradeshows. “How to replace the high-touch, high-visibility benefits of tradeshows?” becomes the key questions that needs to be answered. 35% of industrial marketers indicated that they will not attend a tradeshow until a vaccine is available, while 24% indicated that they will not be ready to attend any exhibition for the upcoming 6 months. 94% of industrial professionals are looking for

information and suppliers via websites, network portals and online marketplaces. 79% of engineers view webinars and are trying to improve their webinar skills.

That being said, it would seem that the people who are open to attending digital events, are reaping the rewards. For example, the first session of the 137th China Import and Export (“Canton”) Fair, which took place 15th-24th June, attracted buyers from a “record-breaking” 217 countries and more than 25,000 exhibitors, according to a press release. An impressive feat considering it was the first time the event had been held virtually.

To contextualise the success, a separate statement from the Canton Fair, following the online introduction for its events, said: “More than 80 German business association representatives from more than 20 industries in 14 states joined the online event, which has also virtually connected buyers from European countries such as the United Kingdom, Italy, Spain, Switzerland, Denmark, the Czech Republic, Slovakia and Greece in attendance.”

With this in mind, perhaps now is the time for businesses to stay open minded when considering options to reach and engage existing and potentially new customers as digital events and exhibitions are proving to have plenty of their own perks.





© Messe Düsseldorf / CISOH

—CISOH (3.-5. Juli 2020)

The Future of the Events Industry

Although virtual events are unlikely to replace large exhibitions altogether, digital technology certainly has a place in the future of the events industry. This is more prevalent now than ever before, and as there's still no guarantee for when life will get back to 'normal', it's better to jump on the digital bandwagon than risk being left behind.

Moreover, if the pandemic has taught us anything, it's that getting on a plane for a single meeting really isn't necessary

when services like Zoom exist. However, it's important to remember that large-scale events cater to different needs, which can't simply be replaced with digital technology. As humans, we all understand the value of a real-life experience and the difference of meeting someone face-to-face compared to a Zoom call. But regardless of any new and emerging technology that helps us interact from afar, exhibitions are here to stay. The only difference being that in the future we may have to take more precautions to stay safe with digital tools.

There is, however, immense value in streaming, VR and digital collaboration. The uses of which are likely to bring even more value to exhibition programmes, whilst opening up a new dimension of the events sector — and provide a more than suitable solution for as long as real life exhibitions are on hold.

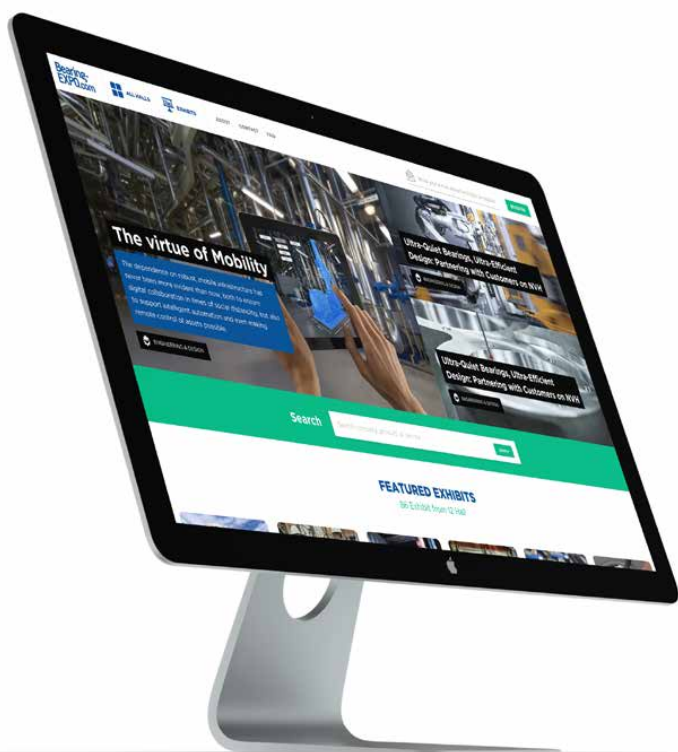
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Thomas Johnson,
editor at BearingNews magazine

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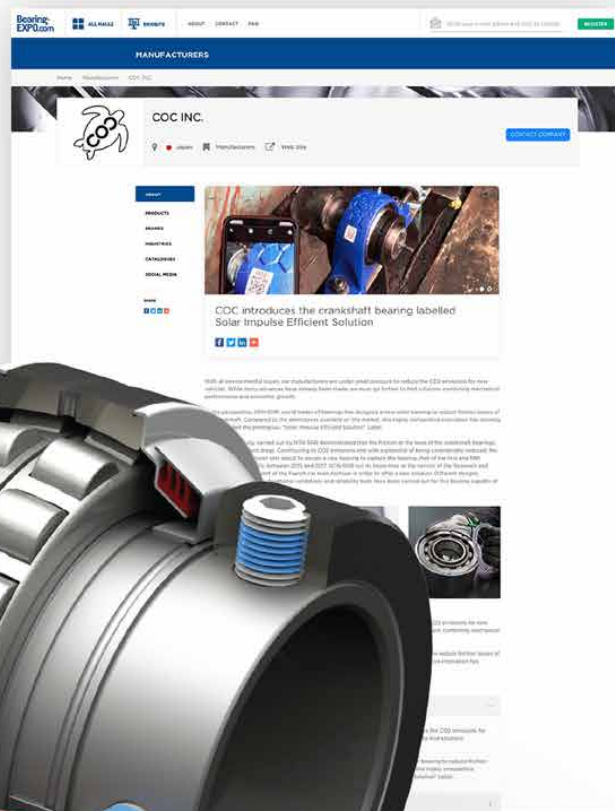
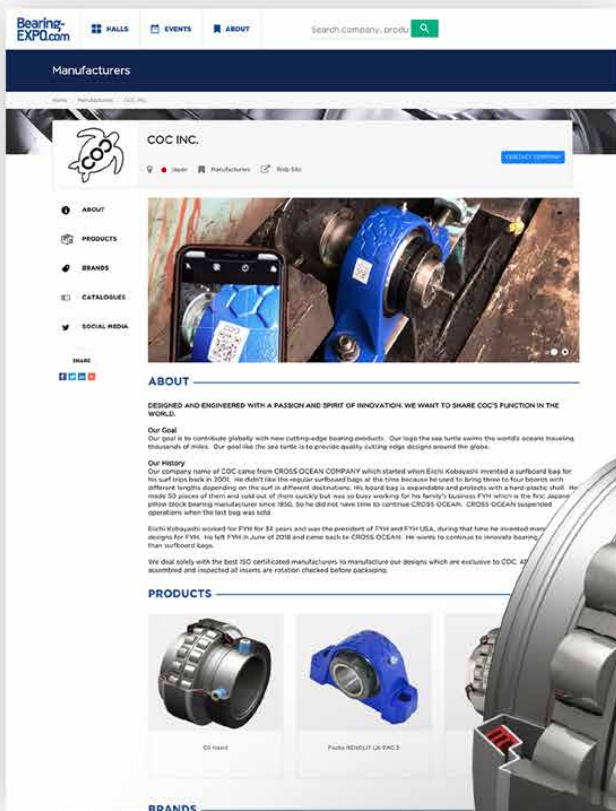




Acquire New Leads Solutions *and* Information *with* Virtual BEARING EXPO

Digitalization of Events Transforms
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BEARING EXPO, the online exhibition platform for the bearing industry has been serving the industry since 2018 and counts today over 700 registered exhibitors and 3.000 visitors on weekly base. Due to the current situation and rapidly changing user habits - new features are integrated to the online exhibition to transform it into a high-touch **“Virtual Exhibition”** and in-person **“Hybrid Networking Event”**^{***}. This to offer and to create more opportunities for the BEARING EXPO exhibitor companies by increasing their visibility and through providing the exact matchmaking for visitors who are looking for new solutions and products.



Build a Strong Online Presence with BEARING EXPO

It becomes more than ever before a must for companies to increase their organization's visibility at digital platforms and social media networks. Therefore, BEARING EXPO is transforming at a fast pace with the integration of new features to become the place-to-be for networking, connecting, finding solutions and products within the global bearing and power transmission industries. BEARING EXPO is a full year "Virtual Event" which is accessible 365 days and 24 hours a day.

Introduce Solutions and Products with "Featured Exhibits"

As next step towards the perfect "Virtual Exhibition" and "Hybrid Network", BEARING EXPO launched the "Featured Exhibit" option for its exhibitor companies.

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"Featured Exhibits" of exhibitor companies will be promoted and shared via the following channels:

- Visible on Home-, Category-, and Company pages at BEARING EXPO – www.bearing-expo.com
- Published within print BEARING NEWS and MOTION & DRIVES magazines
- Linked to +24 newsletters sent to 52.000
- Shared on related BEARING EXPO, BEARING NEWS and MOTION & DRIVES social media networks

More than Bearings only

With the accent on the bearings, which are considered as the heart component of the

machines, BEARING EXPO also provides information and insights regarding the power transmission, motion control, automation, and maintenance industries. There are currently 12 different halls and categories at the "Virtual Exhibition", including Manufacturers, Distributors, Components, Machine Tools, Maintenance, Tools & Equipment, Lubrication, Metrology, Engineering & Design, Mechanical Power Transmission and Organizations.

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Program Day 1

9:00 AM

OPENING

PROF. BERND SAUER

TUNIVERSITY OF KAISERSLAUTERN, INSTITUTE OF
MACHINE ELEMENTS, GEARS AND TRANSMISSIONS (MEGT)
GERMANY

CHRISTIAN KUNZE

RESEARCH ASSOCIATION FOR DRIVE TECHNOLOGY E.V.
(FVA)
GERMANY

9:30 AM

KEYNOTE

"BEYOND SIMULATIONS – USING AI ON PROCESS DATA TO
PREDICT PERFORMANCE"

PH.D. VICTORIA VAN CAMP

AB SKF
SWEDEN

10:00 AM

"THE LUBRICANT FORMULATION: ONE DRIVER FOR EARLY
DAMAGE ASSOCIATED TO WECS IN THRUST AND RADIAL
BEARINGS"

DR. ARNAUD RUELLAN

SKF
NETHERLANDS

10:30 AM

"THE INFLUENCE OF MECHANICAL STRESSES ON THE
DIFFUSION AND ACCUMULATION OF HYDROGEN IN A
CYLINDRICAL ROLLER THRUST BEARING"

DR. IYAS KHADER

FRAUNHOFER INSTITUT FOR MECHANICS OF MATERIALS
(IWM)
GERMANY

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TOPICS 2020

BEARING DURABILITY AND DIMENSIONING
BEARING MECHANICS
BEARING SELECTION AND DESIGN
CONDITION MONITORING AND SENSORS
ELECTRIC DRIVE TECHNOLOGY / CHALLENGES TO BEARINGS
NVH (NOISE, VIBRATION, HARSHNESS)
PREMATURE ROLLING ELEMENT BEARING FAILURES
ROLLING CONTACT FATIGUE AND MATERIALS
TRIBOLOGY AND FLUID DYNAMICS

11:00 AM

"INVESTIGATIONS OF ZDDP TRIBOFILM FORMATION
REGARDING TEMPERATURE INFLUENCES"

DENNIS MALLACH

UNIVERSITY OF MÜNSTER WWU, INSTITUTE OF
PHYSICSINSTITUTE OF PHYSICS.
GERMANY

11:30 PM

"CALCULATION METHOD TO EVALUATE THE RISK ON WEC
FAILURE OCCURRENCE IN INDUSTRIAL APPLICATIONS"

DIPL.-ING. DIRK-OLAF LEIMANN

BELGIUM

12:00 PM

LUNCH BREAK

2:00 PM

"INVESTIGATION OF THE DAMPING CHARACTERISTICS IN
THE DRY LUBRICATED ROLLING ELEMENT - CAGE
CONTACT OF DEEP GROOVE BALL BEARINGS"

M.SC. SEIEDARDESHIR SEBTEINI

TECHNICAL UNIVERSITY OF KAISERSLAUTERN INSTITUTE
OF MACHINE ELEMENTS, GEARS AND TRANSMISSIONS
GERMANY

2:30 PM

"BEARING RACEWAY WAVINESS INDUCED NOISE IN
APPLICATIONS"

MECHANICAL ENGINEER ANGELICO APPROSIO

SKF INDUSTRIE S.P.A.
ITALY

3:00 PM

"BALLS CHARACTERISTICS IMPACT ON BEARING NOISE
GENERATION"

SEBASTIANO RIZZO

TSUBAKI NAKASHIMA CO., LTD.
ITALY

www.bearingworld.org

Program Day 2

09:50 AM

WELCOME

10:00 AM

"SURFACE MUTATION OF THE BEARING RACEWAY DURING ELECTRICAL CURRENT PASSAGE IN MIXED FRICTION OPERATION"

M.ENG., SIMON GRAF

UNIVERSITY OF KAISERSLAUTERN,
INSTITUTE OF MACHINE ELEMENTS, GEARS, AND
TRANSMISSIONS (MEGT)
GERMANY

10:30 AM

"LOW TEMPERATURE TEST METHODS FOR ELECTRIC CAR BEARING GREASES"

THOMAS LITTERS

FUCHS SCHMIERSTOFFE GMBH
GERMANY

11:00 AM

"ENHANCEMENT OF THE INSULATION PROPERTIES OF THERMAL SPRAYED CERAMIC BEARING COATINGS"

M. SC. ELISA BURBAUM

RWTH AACHEN UNIVERSITY, SURFACE ENGINEERING
INSTITUTE (IOT)
GERMANY

11:30 AM

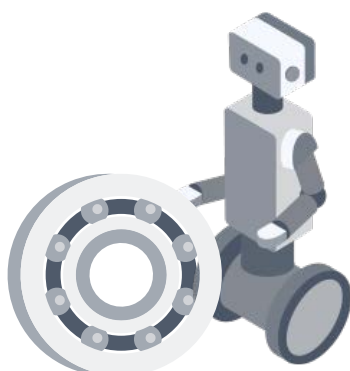
"EXPERIMENTAL HIGH FREQUENCY ANALYSIS OF THE ELECTRIC IMPEDANCE OF ROLLING BEARINGS"

M.SC. TOBIAS SCHIRRA

TECHNICAL UNIVERSITY OF DARMSTADT, INSTITUTE FOR
PRODUCT DEVELOPMENT AND MACHINE ELEMENTS (PMD)
GERMANY

12:00 PM

LUNCH BREAK



2:00 PM

"AN ANALYTICAL APPROACH FOR THE INFLUENCE OF THE REAL FILM THICKNESS DISTRIBUTION ON THE CAPACITANCE OF AN EHL CONTACT"

VOLKER SCHNEIDER

LEIBNIZ UNIVERSITY HANNOVER, INSTITUTE OF MACHINE
DESIGN AND TRIBOLOGY (IMKT)
GERMANY

2:30 PM

"AN INTELLIGENT HYBRID PLAIN BEARING AS A SMART MACHINE COMPONENT"

M.SC. ROBIN KURTH

FRAUNHOFER INSTITUTE FOR MACHINE TOOLS AND
FORMING TECHNOLOGY (IWU)
GERMANY

3:00 PM

"NOVEL ANALYTICAL AND NUMERICAL CALCULATIONS IN TRUNCATED CONTACT"

DR. LUC HOUPERT

BEARING AND TRIBOLOGY CONSULTANT
FRANCE

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MANUFACTURING AND ASSEMBLY OR
THE PRACTICAL OPERATION OR
MAINTENANCE OF BEARINGS.

www.bearingworld.org

Program Day 3

10:20 AM

WELCOME

10:30 AM

"EVALUATION OF THE INFLUENCE OF NON-METALLIC INCLUSIONS ON THE HIGH AND VERY HIGH CYCLE FATIGUE LIFE OF INDUCTIVE HARDENED BEARING STEEL IN MULTI-MEGAWATT WIND TURBINES"

FELIX STERN

TU DORTMUND UNIVERSITY DEPARTMENT OF MATERIALS
TEST ENGINEERING (WPT)
GERMANY

11:00 AM

"FATIGUE DAMAGE DEVELOPMENT IN BEARING STEEL: MODELLING AND MEASUREMENT"

DR. IR. ERIK VEGTER

SKF
NETHERLANDS

11:30 AM

"DEVELOPMENT OF OPTIMIZED NITRIDED BEARING AND TRANSMISSION COMPONENTS FOR A BETTER APPLICATION PERFORMANCE: FROM PROCESS PARAMETERS TO FUNCTIONAL PERFORMANCE PROPERTIES"

DR. CHRISTINE SIDOROFF-COICAUD

NTN-SNR ROULEMENTS
FRANCE

SIMON THIBAUT

NTN-SNR ROULEMENTS
FRANCE

12:00 PM

LUNCH BREAK

2:00 PM

"FINITE ELEMENT ANALYSIS OF TWO-STEP DEEP ROLLING OF BEARING STEEL FOR EXPANSION AND EQUALIZATION OF COMPRESSIVE RESIDUAL STRESS PROFILES"

JOSHUA SIMON

UNIVERSITY OF APPLIED SCIENCE WÜRZBURG-
SCHWEINFURT
GERMANY

2:30 PM

"PROGRESSION OF ROLLING CONTACT FATIGUE DAMAGE FROM ARTIFICIAL INDENTS IN HYBRID AND STEEL-TO-STEEL BEARING CONTACT"

DR YURI KADIN

SKF GMBH
NETHERLANDS

3:00 PM

"MICROSTRUCTURAL ANALYSIS OF BEARING STEELS BY A STATISTICAL NANOINDENTATION TECHNIQUE"

PROF. DR. ESTEBAN BROITMAN

SKF
NETHERLANDS

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EXPERTS."

PROF. DR.-ING. GERHARD POLL, LEIBNIZ UNIVERSITY
HANNOVER, BEARING WORLD
PROGRAM COMMITTEE SPEAKER



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Program Day 4

10:20 AM

WELCOME

10:30 AM

"VALIDATION OF A NOVEL CONICAL SLIDING BEARING FOR THE MAIN SHAFT OF WIND TURBINES"

M.SC. TIM SCHRÖDER

RWTH AACHEN, CHAIR FOR WIND POWER DRIVES
GERMANY

11:00 AM

"IF FORM DEVIATION THAN CORRECT - THE UTILIZATION OF PRODUCTION-RELATED DEFECTS FOR IMPROVING OPERATING PROPERTIES OF JOURNAL BEARINGS"

LARS FRIEDRICH

CHEMNITZ UNIVERSITY OF TECHNOLOGY, INSTITUTE OF DESIGN ENGINEERING AND DRIVE TECHNOLOGY (IKAT)
GERMANY

11:30 AM

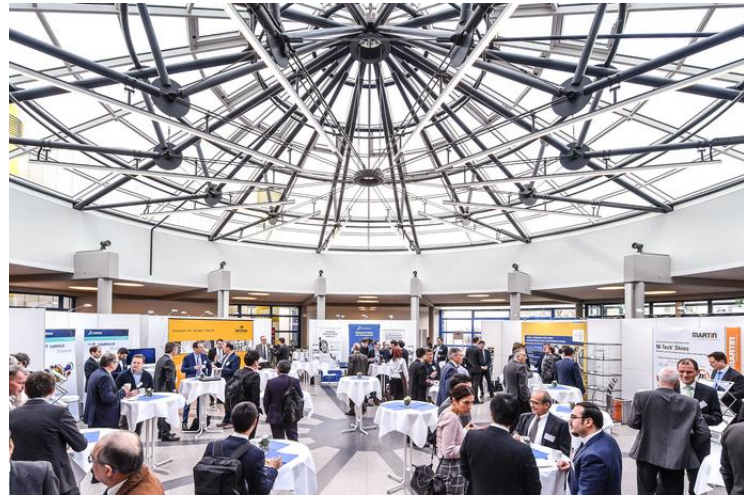
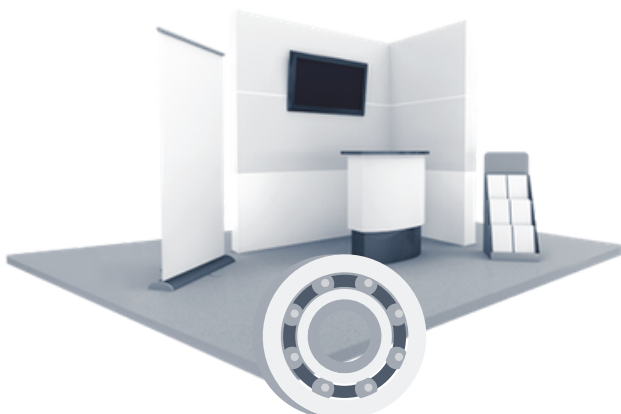
"BEARING SELECTION FOR HIGH EFFICIENCY WORM GEAR DRIVES"

JUN. PROF. DR.-ING. MANUEL OEHLER

UNIVERSITY OF KAISERSLAUTERN, INSTITUTE OF MACHINE ELEMENTS; GEARS AND TRANSMISSIONS (MEGT)
GERMANY

12:00 PM

LUNCH BREAK



2:00 PM

"3D CFD MODELLING OF TEXTURED HYDRODYNAMIC JOURNAL BEARINGS"

M.SC. PATRICK WIECKHORST

OTTO-VON-GUERICKE-UNIVERSITY MAGDEBURG, CHAIR OF MACHINE ELEMENTS AND TRIBOLOGY
GERMANY

2:30 PM

"SMEARING IN FULL COMPLEMENT ROLLER BEARINGS"

DR. NADINE NAGLER

BOSCH REXROTH AG
GERMANY

3:00 PM

"FRICTIONAL PROPERTIES OF GREASE ADDITIVATED BY GRAPHENE PLATELETS IN ANGULAR CONTACT BALL BEARINGS"

DR. FLORIAN PAPE

LEIBNIZ UNIVERSITY HANNOVER, INSTITUTE OF MACHINE DESIGN AND TRIBOLOGY (IMKT)
GERMANY

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Program Day 5

9:50 AM

WELCOME

10:00 AM

"INVESTIGATION OF WIND TURBINE PLANETARY BEARING OUTER RING CREEP ON A COMPONENT TEST BENCH"

M.SC. FELIX M. SCHLÜTER

RWTH AACHEN UNIVERSITY, CENTER FOR WIND POWER DRIVES
GERMANY

10:30 AM

"INVESTIGATION OF THE LOAD DISTRIBUTION ON A PLANETARY CARRIER BEARING OF A WIND TURBINE GEARBOX TO IDENTIFY TRIGGER FOR RING CREEP"

JONAS GNAUERT

RWTH AACHEN UNIVERSITY, CHAIR FOR WIND POWER DRIVES
GERMANY

11:00 AM

"A FATIGUE LIFE MODEL FOR ROLLER BEARINGS IN OSCILLATORY APPLICATIONS"

GEORG BRESLAU

TECHNICAL UNIVERSITY DRESDEN, INSTITUTE OF MACHINE ELEMENTS AND MACHINE (IMM)
GERMANY

11:30 AM

"APPLICATION-DEPENDENT BEARING PRELOAD IN PLANETARY GEAR UNITS – APPLICATION, DESIGN AND ASSEMBLY"

ERMAL T LAMAJ

SEW-EURODRIVE GMBH & CO KG
GERMANY

12:00 PM

LUNCH BREAK

2:00 PM

"MEASURING THE KINEMATIC BEHAVIOR OF SPINDLE BEARING ROLLING ELEMENTS UNDER RADIAL LOADS"

M. SC. HANS-MARTIN ECKEL

RWTH AACHEN UNIVERSITY, LABORATORY FOR MACHINE TOOLS AND PRODUCTION ENGINEERING (WZL)
GERMANY

2:30 PM

"DEVELOPMENT OF A METHODOLOGY FOR TOLERANCING RADIAL JOURNAL BEARING SYSTEMS"

MARKO EBERMANN

CHEMNITZ UNIVERSITY OF TECHNOLOGY, INSTITUTE OF DESIGN ENGINEERING AND DRIVE TECHNOLOGY (IKAT)
GERMANY

3:00 PM

"A NEW APPROACH FOR RAPID DETERMINATION OF ROLLER-FLANGE CONTACT IN ROLLER ELEMENT BEARINGS"

MARIUS WOLF

ROBERT BOSCH GMBH
GERMANY

3:30 PM

CLOSING

PROF. BERND SAUER

UNIVERSITY OF KAISERSLAUTERN, INSTITUTE OF MACHINE ELEMENTS, GEARS AND TRANSMISSIONS (MEGT)
GERMANY

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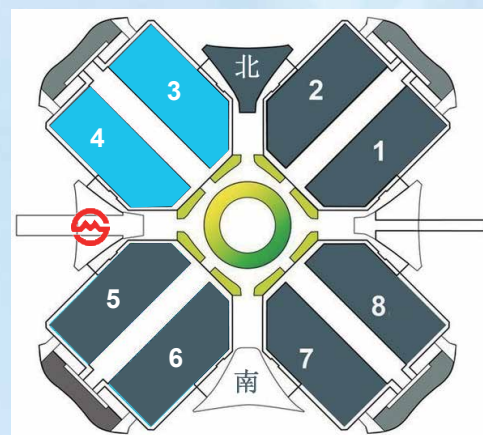
Covering an area of 53000 sqm with estimated 1000 exhibitors and 60000 visitors from all around the world will gather together during China International Bearing Fair between 09 - 12 December 2020.

Apart from previous year's the exhibition will be held this time in the new venue of National Exhibition and Convention Center in Shanghai. The exhibits include all types of bearings, and will cover special bearing industry equipment, precision measuring devices, transmission components, lubricant grease, solutions and accessories.

More opportunities for entering the Chinese bearing market, supplier development, and finding new business partners can be realized for International delegates during the B2B program sessions and at BearingEXPO International pavilion.

There will be simultaneously 5 different exhibitions in parallel halls at the same date and venue:

- ✓ The 20th China international Metallurgical Industry Expo
- ✓ The 18th China International Foundry Expo (METAL CHINA)
- ✓ The 18th China International Industrial Furnace Exhibition
- ✓ The 16th China International Refractory Material and Industrial Ceramic Exhibition
- ✓ The 14th China International Die Casting Industry Exhibition



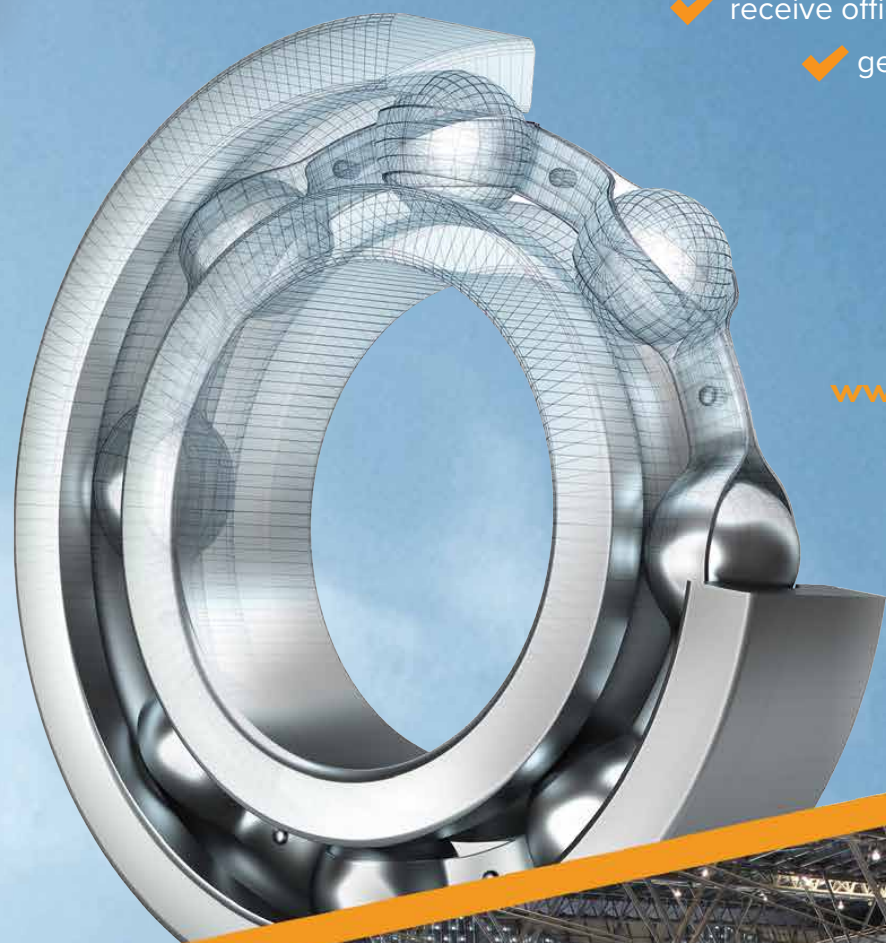
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Save Time Money Sleep Well



Done properly, manual lubrication is a time-consuming process. Grease guns have to be prepared with the correct lubricant(s) and in order to gain safe access to all of the lubrication points, production processes may have to be stopped, guards opened and/or specialist equipment such as man lifts may be needed.

This has to be done regularly, perhaps every week, every fortnight or every month.

It is little wonder that, in many plants, the most difficult-to-access lubrication points often receive fewer visits and therefore less lubricant than planned.

Even when a comprehensive lubrication plan is in place and rigidly followed, the nature of manual lubrication can lead to problems. A simple grease gun can generate 200 bar or more of pressure, without undue effort from the operator. There is a strong temptation to pump quickly and move on, which can lead to overpressure in the bearings and the displacement or rupturing of seals. In a fast running bearing, too much grease can be more dangerous than not enough; resulting in the rolling elements skidding instead of rolling and causing the bearing to overheat. Damaged seals allow contamination and moisture to enter and further accelerate wear. Contamination and water can also

be drawn into bearings that are under lubricated and be pumped in if the grease nipple or grease gun is not cleaned thoroughly before each application.





Can we quantify the results of these problems? Analysis by leading bearing manufacturers of bearings that failed earlier than anticipated are reasonably consistent. Around 15% fail due to damage caused by incorrect mounting. Around 34% of failures are due to either too much or too little lubricant and another 16% or so because of contamination. This means that fully 50% of early bearing failures are self-inflicted, attributable to the lubrication practices in use.

Imagine if a way could be found to ensure that all these manual lubrication points received a slow, continuous flow of the correct lubricant at a pressure that could not dislodge or damage a seal. Now imagine if this solution could do this for up to 12 months at a time without intervention. How many breakdowns would this save? How much more useful work could the maintenance crew do if they no longer had to go through the lubrication plan every week, every fortnight or every month?

You don't have to imagine: the Swiss company simatec AG have been delivering such solutions for 25 years. The simalube single point lubrication system consists of



a range of compact, self-contained oil and grease dispensers that can be mounted at each lubrication point. Construction and operation is similar to a syringe but with a patented electrochemical cell producing gas in place of a plunger.

The cell is activated and set by means of an Allen key and, once the pressure behind the piston increases beyond the back-pressure at the outlet, lubricant begins to flow in a slow even manner.

The setting disc is calibrated 1 to 12, representing months to empty the dispenser. The setting can be adjusted at any time to find the ideal supply rate for each lubrication point. A simple smartphone app provides a suggested starting point based upon the characteristics of the application or the current lubrication plan data. By eliminating the waste inherent in filling grease guns and overfilling bearings, the ideal delivery from a simalube will almost always mean that lubricant consumption significantly decreases.

This means less mess and a cleaner, safer workplace in addition to cost savings. The dispensers are available in a range of five sizes containing between 15 ml and 250 ml of lubricant. They are all sealed to IP68 and intrinsically safe for use in ATEX zone 1. They can be safely used on machines surrounded by explosive gas or dust and underground in mines. They require no special handling in such environments.

The patented gas producing cells are compact but extremely powerful and can overcome back pressure of up to 5 bar. This is enough for most applications and allows the unit to pump NLGI 2 grease up to 0.6m through a 6 mm ID tube. This provides mounting flexibility and decoupling from vibration and sources of heat. Clamps with powerful magnetic fixtures mean that in many cases remote tube mounting is quick and requires no modification of the machine. The units are normally supplied pre-filled with one of a range of standard greases and oils designed to cover a wide variety of applications from quarrying to food production. They are also supplied empty to allow customers to use their own special



lubricants for particular applications. A comprehensive range of accessories is also available including brushes designed to both clean and lubricate chains, gears and guides. Once empty the units are fully recyclable. The gas cell can be unscrewed and recycled with standard dry-cell batteries. The remaining housing goes into normal PET recycling like a drinks bottle.



So, in summary, by installing simalube single point lubrication there is a simple way to:

1. Optimise lubricant delivery
2. Prevent unexpected breakdowns
3. Reduce lubricant usage
4. Increase safety
5. Free up maintenance staff for other tasks
6. Reduce waste with a 100% recyclable product

All of these benefits ultimately lead to savings in both time and money and provide peace of mind.

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For more information.

Software for Gearbox Design

FVA-Workbench 6.0 Released: Precise Calculations, Simple Evaluation

FVA GmbH has released the latest version of its simulation platform for drive systems. The software combines innovative, research-based calculation methods with user-friendly presentation of results.



— Regardless of whether individual gearbox elements or entire systems are being simulated: The features of the FVA-Workbench 6.0 offer drive technology companies considerable time and cost savings.

With the FVA-Workbench 6.0, released on 28.07.2020, mechanical and hydraulic systems can be optimized, the precision of analyses increased, and development processes made more efficient.

Key features include: scientifically proven calculations – high precision thanks to validated methods based on the current state of research; scalable levels of detail – precise analysis of individual gearbox elements through to comprehensive system calculations; maximized efficiency – easy-to-understand graphical reports for fast and accurate interpretation of results.

The new FVA-Workbench calculation methods were developed and validated in the Forschungsvereinigung

Antriebstechnik e.V. (FVA, The Research Association for Drive Technology), the largest drive technology research and innovation network. Through member contributions and public funding, the FVA generates 17 million euros annually in research projects at leading research institutions. The FVA-Workbench serves as a platform for the practical and efficient application of knowledge gained in FVA research projects.

For more information on the benefits of the software or to contact the FVA, visit www.fva-service.de/en.

About FVA GmbH:

FVA GmbH is a joint venture between VDMA (Verband Deutscher Maschinen-

und Anlagenbau e.V., the Mechanical Engineering Industry Association) and FVA (Forschungsvereinigung Antriebstechnik e.V., the Research Association for Drive Technology).

Founded in 2010, FVA GmbH works hand-in-hand with top-level German research institutions and leading companies from the drive technology industry toward the active application of knowledge gained from FVA research projects in industrial practice. The company's core competencies are the development of calculation and simulation software for drive technology, preparation and transformation of established legacy code structures into modern software architectures, professional service and support, and technical seminars and conferences. www.fva-service.de #FVAWorkbench #FVADriveTechnology

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Counterfeit bearings – know the risks

Counterfeit bearings are a global issue, with all markets susceptible to the risks of buying these low-quality products. As a leading manufacturer of premium-quality bearings, NSK is focused on eradicating this issue, one that puts safety at risk and ultimately leads to users experiencing reduced reliability and higher lifecycle costs.

The relentless drive to remain competitive and profitable has created a culture where too many companies are forced into making purchase decisions based solely on unit price, ignoring other factors such as total cost of ownership (TCO) and performance. However, shopping around for irresistible bargains often comes at a far higher price, with many purchasing and engineering teams unaware of the risks and dangers involved from adopting such a strategy.

The end result is usually the inadvertent acquisition and arrival of counterfeit bearings. Although the price may have been cheaper, in reality the overall cost is likely to be considerably greater. For a start, these poor-quality fakes fail more frequently when put into service, increasing maintenance and downtime costs. It should also be noted that these costs invariably far exceed the amount saved on the initial purchase.

The origins of counterfeits

Counterfeit bearings tend to originate from uncontrolled sources in countries with low-cost economies, where disingenuous organisations use lower-grade materials that are usually processed on ageing machines operated by low-paid, unskilled operatives. The bearings, which are often poorly handled and stored, are then placed in boxes designed to resemble the packaging of the manufacturer being replicated, completely disguising the inauthenticity of the product to cheat both purchasers and users.

Inconsistent quality is assured when buying bogus bearings. Such bearings may last long enough to pass pre-production



— Fake NSK bearings in their packaging found at the production facility of a counterfeiter

trials, but their subsequent premature failure in the field will cast uncertainty over the performance of the machine, system or vehicle to which they are fitted. This eventuality can compromise brand reputation and damage sales.

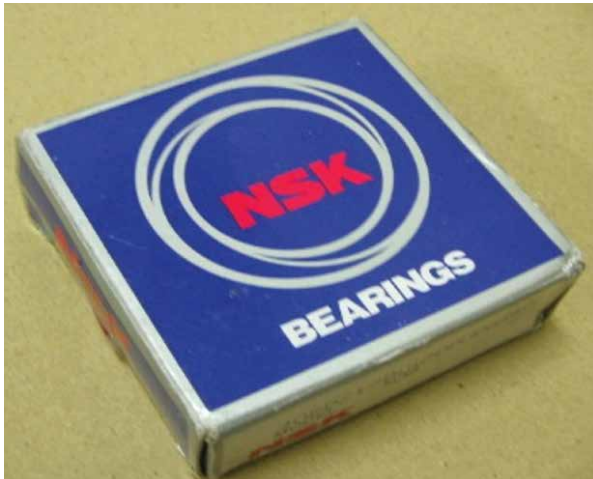
Many companies finding themselves in this situation will call for help, only to discover a complete absence of technical support or advice. Typically, counterfeiters will not have local application engineers available to help with questions, nor will there be any modern, well-equipped technology centres to provide test data, product defect assessments or failure analysis.

Material matters

The materials used to produce fake bearings are not of the quality provided

by OEM suppliers such as NSK, which leverages decades of experience in materials science to ensure its bearings exceed the demands of modern industrial applications. Steel quality is the major factor in bearing reliability, where a difference in operating life of up to 20 times (between genuine and counterfeit) is not uncommon.

The fatigue life of alloyed bearing steels such as 100 Cr6 (or SUJ2 in the Japanese standard) depends principally on the inclusion content. Oxide or non-metallic inclusions, in particular, promote negative effects under the raceway surface. As an example, it is known that aluminium oxide inclusions, which are formed via oxidation during the melt, can lead to a major reduction in bearing fatigue life. This effect is created because aluminium oxide inclusions are



— Highlighting the detail of a counterfeit NSK bearing box



— A counterfeit NSK bearing removed from its packaging

relatively hard and can break up when steel undergoes processes such as forging. During break-up, inclusions shrink and weaken the microstructure. Working with a leading steel manufacturer, NSK has developed materials like Z Steel, EP Steel and BNEQARTET to prevent this negative effect. The company also uses special melting processes that reduce non-metallic content and prolong fatigue life.

With counterfeits, heat treatment is another factor that is often absent or poorly applied, compromising the specific characteristics of steels and, consequently, bearings. Materials such as NSK's SHX steel are subjected to a specific heat treatment that is particularly resistant to wear at high operating temperatures. Bearings of this type are required not just when heat is present as an inherent part of the process, but in applications such as machine tools, where fast spindle speeds generate high temperatures in the drive components. During development, the characteristics of SHX steel were proven by means of comprehensive wear resistance and surface fatigue life tests. Counterfeit manufacturers do not offer this kind of product development and analysis.

The fight continues

Although NSK continues to invest extensively in efforts to identify and prosecute counterfeiters, the advice is clear: when purchasing NSK products, customers should exercise due caution. Only buy from trusted sources such as Authorised NSK Distributors.



— Close-up of a counterfeit bearing

Additional information about the fake bearings industry can be found at www.stopfakebearings.com

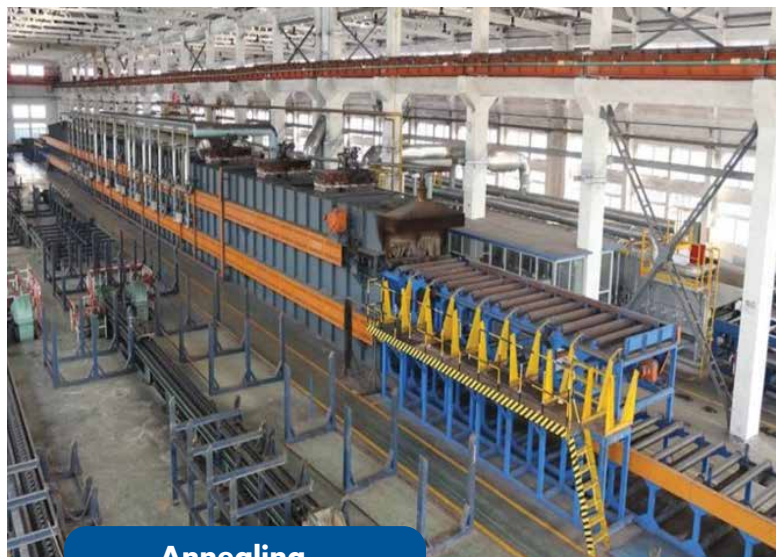


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NSK TL bearings double service life in papermaking machinery

NSK spherical roller bearings with TL technology are being increasingly adopted in the papermaking industry as more machinery manufacturers and paper mills seek to maximise operating life and uptime. The unique attributes of NSK's TL (tough and long life) specification is proven to provide greater resistance to hoop stress, subsequently reducing inner ring fractures and delivering service life more than twice that of conventional bearings with standard heat treatment.



TL series spherical roller bearings are specifically designed for sections of papermaking machinery where elevated temperatures prevail, including dryer rolls, calender rolls, canvas rolls and PV rolls. The bearings were developed as a solution to a specific problem: inner ring fractures. This problem is common on dryer cylinders (including Yankee dryer rolls) and calender rolls, where steam is passed through the hollow axis of the

roll to heat it. Here, the journal expands faster than the bearing, making the fit tighter. As the hoop stress (force exerted circumferentially) of the inner ring increases, cracks can begin to appear.

High temperatures in papermaking machinery also present further challenges to bearings. For instance, the presence of heat lowers the viscosity of lubricant, reducing bearing life, while

unwanted creep can have a negative impact on dimensional stability.

Although adopting a slow start-up procedure can prevent such problems – by introducing temperature gradually – it can take several hours and paper mills cannot afford the lost production and revenue. Instead, the solution lies in astute bearing selection.



— Example of a dryer cylinder roll structure showing the typical temperatures present. 1 Steam, 2 Lubrication oil, 3 Oil return

To counter the effects of temperature, NSK analysed the mechanism of inner ring fracture and established a strength evaluation method that subsequently led to the development of the proprietary TL specification. The type of steel used in these bearings is case-carburised using a special method of heat treatment that attains both high raceway surface hardness and dimensional stability under high temperatures. Importantly, the strength of the inner ring is increased sufficiently to better resist hoop stress, even at temperatures up to 200°C. The resistance of inner rings that meet

the TL specification is higher than the resistance of inner rings made from bainitic steel or bearing steel, while the surface hardness of the rolling surface is greater than the hardness of rolling surfaces made from bainitic steel or case-hardened steel. These factors underpin the ability of TL bearings to provide longer service life when used on calenders, guide rolls and smoothing rolls, for example.

A case in point involves a major paper mill that was experiencing problems with its calender rolls, where multiple cracks were developing on the inner rings of the roll



— Fracture evident on the through-hardened inner ring of a spherical roller bearing due to hoop stress

bearings. Frustrated by up to 12 failures annually, which led to excessive downtime and maintenance, the mill invited NSK's team of expert engineers to investigate and resolve the issue. As part of NSK's Added Value Programme AIP, a comprehensive application review was commenced.



— NSK spherical roller bearings with TL technology deliver twice the service life of conventional counterparts

The NSK specialists soon discovered that the standard spherical bearings being used in the calender roll did not feature carburised inner rings, leaving them susceptible to the high heat of the application, and cracking of the inner rings. It was therefore recommended that the paper mill switch to NSK spherical roller bearings with TL technology. The innovative chemical steel composition and greater resistance to hoop stress and cracks, doubled operating life and reduced the cost of replacement bearings and downtime. Over a five-year period since the change was made, the paper mill has saved around €430,000.

NSK spherical roller bearings with TL technology have been in operation on dryer cylinders and other papermaking machinery rolls since 1994, with no problems reported. Today, over 100 different TL bearing sizes/types are produced, helping a wide range of customers achieve better and more cost-effective performance. In addition, to accommodate bearings for Yankee dryer rolls, NSK can offer large TL series self-aligning roller bearings with diameters up to 1,360 mm.



Software **Version 07/2020** is available

A new version of the MESYS shaft and rolling bearing analysis software including new functionality is available. The bearing analysis software allows the calculation of the load distribution within the bearing and bearing life according ISO/TS 16281 and it is integrated in a shaft system calculation with additional possibilities like modal analysis, strength calculation for shafts and interfaces to gear calculations. Currently the software is used by customers in 26 countries on 4 continents.

General Extensions

The COM-Interface allows easier usage with Python as additional methods were added. Several new methods were added allowing easier access to elements in the shaft calculation.

As CHM-files for help cannot be used over network connections a new help viewer was added, which can be activated using helpFormat=EXE in 'mesys.ini'.

Calculations with large load spectra or 3D-elastic parts, which take long time, can now be cancelled using a button in the status bar.

As additional language Turkish was already added in an update for version 07/2019.

Extensions in the Bearing Calculation

The bearing databases containing catalog data from Schaeffler (FAG, INA) and SKF are updated. The inner bearing geometry is approximated by the software for these databases.

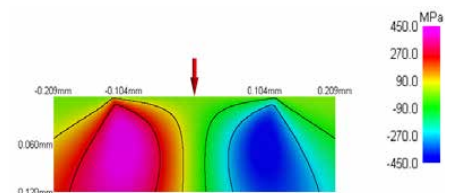
The database including inner geometry by HQW was updated and now also includes bearings from Barden (UK). The database now contains spindle

bearings with diameter 3 to 80mm and several double row axial angular contact bearings. In addition a database for spindle bearings from CSC was added which contains internal geometry too and diameters from 10 to 160mm. Further databases from GMN and IBC are available on request from the manufacturer.

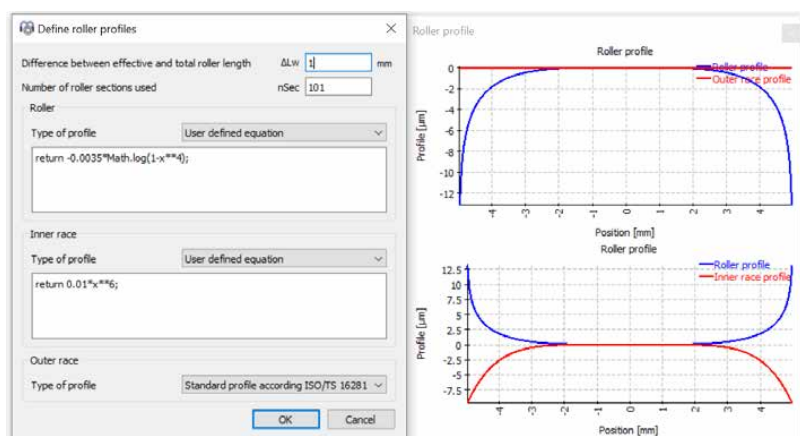
The list for bearing tolerances was extended. Now tolerances like 'FAG P4S-K5', 'SKF VQ253', 'GMN UP+', 'HQW X11' can be selected for spindle bearings.

Profiles for rollers and races can now be defined using equations.

A diagram for reliability of a single bearing was added to the bearing calculation like available in the shaft calculation for several versions. A 2D-grafik for orthogonal shear stresses was added.



— Orthogonal Shear: "Orthogonal shear stress for Hertzian contact"



— Custom Profile: "Definition of custom profiles for rollers and races using equations"

Using a new custom input for the position in the tolerance field, the parameter variation allows to show results using different positions in the tolerance field.

Extensions in the Shaft Calculation

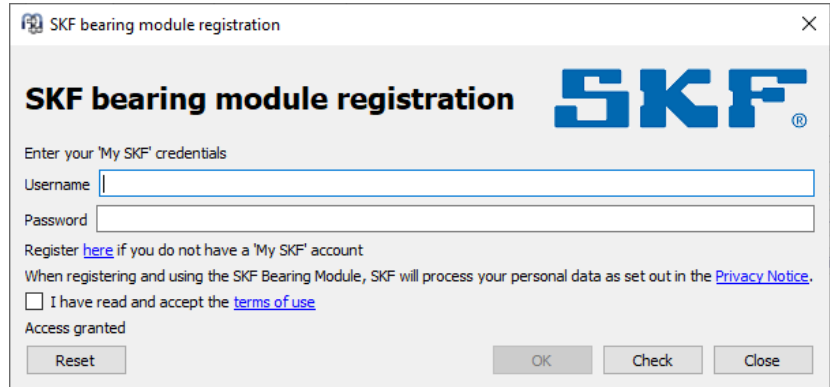
In shaft calculation the geometry import as STEP is now possible too in case of several parts in one file. Gaps or undercut in the geometry in STEP or DXF-Import can be eliminated by selecting the lines and pressing the key 'c'.

The REXS-Interface is updated to version 1.2. For planetary gear stages still only the import is supported, no export.

An interface to the online SKF Bearing Module was added. This adds two results for bearing life and frictional torque to the results. The SKF-Bearing life is using aSKF instead of aISO and is usually larger compared to Lnmh according to ISO 281.

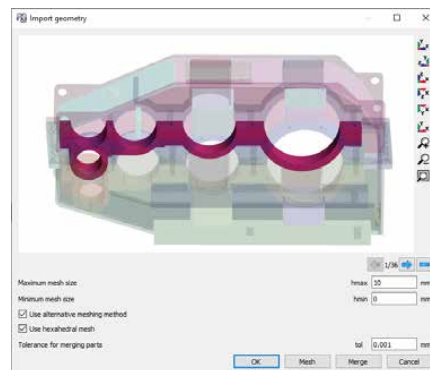
For gear connections an interface to Hexagon ZAR3, ZAR5, ZAR6 for worm gears, planetary gear stages and bevel gears was added. Before only the interface to Hexagon ZAR1 for cylindrical gear pairs was available. For bevel gears a data exchange with KiMOS was added.

For 3D-elastic parts an orthotropic material can be defined for shafts now and an evaluation of surface stresses has been added. On geometry import as mesh, multiple materials can be used for one part. Additional possibilities for contact

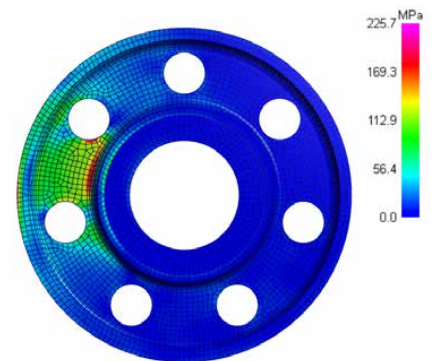


–Skf Interface: “Registration dialog for the interface to the SKF Bearing Module”

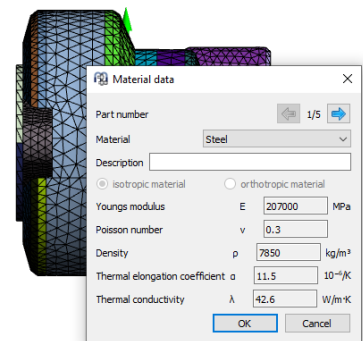
between two 3D-elastic shaft have been added. Now displacements, tilting angles and reaction forces are reported for all condensation points. For geometry import as STEP a preview dialog was added, allowing deleting or merging of parts or remeshing with different settings.



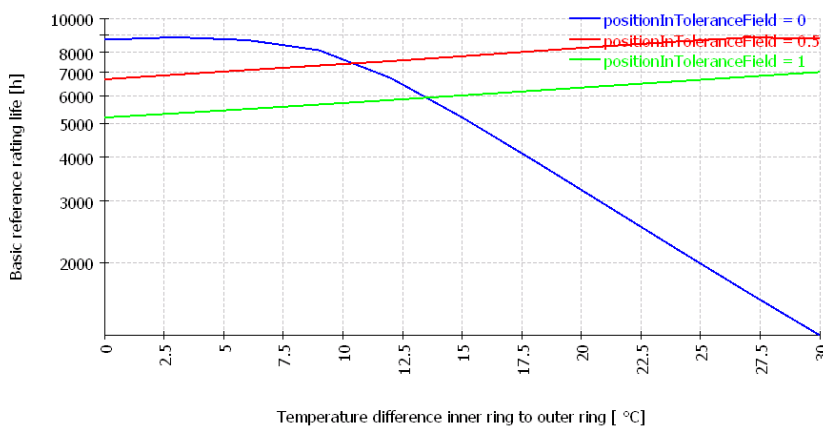
– Mesh Import: “Preview dialog for CAD-Import of 3D-elastic parts”



– Surface Stress: “Surface stress evaluation for 3D-elastic parts”

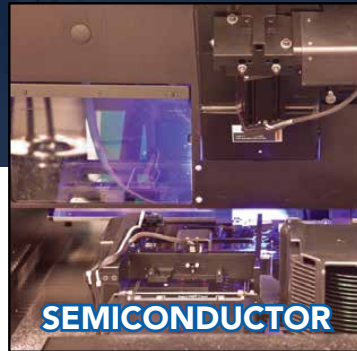
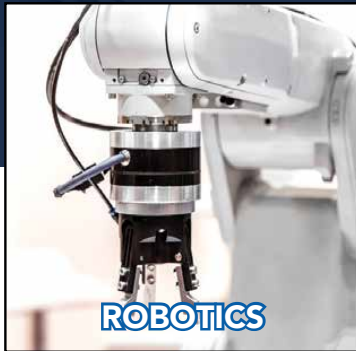


– Multiple Materials: “Multiple materials can be defined for one part in case of mesh import”



– Reference rating life over temperature difference for different position in the tolerance field”

For additional information or a test version, please contact:
MESYS AG
Technoparkstrasse 1
CH-8005 Zürich
www.mesys.ch
info@mesys.ch



Slim Section Bearings, Inc. (SSB) is the manufacturing division of Ritbearing Corp., with experience in manufacturing that began in 1987. SSB offers our customers the ability to obtain USA Made thin series bearing products in standard and customized configurations.

WHY THIN SERIES BEARINGS?

SPACE AND WEIGHT LIMITATIONS

Bearings don't need to be big to get the job done. The size difference between thin section bearings and other bearing styles is a major benefit for any application with space or weight restrictions.

The compact design of thin section bearings is beneficial in a few ways. First, the small size of a thin section bearing make it so that these parts don't take up as much room in an application. Second, the reduced weight makes the overall application lighter and can reduce the amount of friction created during use. That's a major advantage for both initial design of an application and the long-term efficiency of your operation.

MULTIPLE CONFIGURATIONS AVAILABLE

SSB offers a variety of sizes and configurations, allowing you to pick and choose between radial, angular, 4-point designs. Metric sizes can also be manufactured.

While there are a variety of thin section bearings available, these parts can also be specially designed to fit your specifications. Customization opportunities include:

Multiple cage options; Multiple shield and seal options; Materials for corrosion resistance and clean room conditions; Custom sizing; Duplexing; and Custom marking/private labeling.

QUICK TURNAROUND TIMES

Time is not always on your side. Fortunately, SSB's thin section bearing production process is very efficient, meaning that you won't have to wait as long for these parts compared to most other types of bearing. Expedited timelines can help you avoid unnecessary—and costly—downtime.

Your inquiries are welcomed. Please reference our website for further information on SSB.



Can't find a thin section bearing with the specifications that your application needs? Build your own custom thin section bearing online with the **SSB Product Builder**.

www.slimsectionbearings.com

vol.07

TOP100 TIPS_{for} BEARING RELIABILITY

by Per Arnold Elgqvist



Bearing Tip No. 71: Bearing Reliability Assurance – a New Mindset

The past 1st of August 2020 I completed 50 years dedicated to rolling element bearings. Most of the activities are unfortunately closed down for the moment due to the effects of the Covid-1, thus I have got the time to think over all my experiences with bearings. I have been most fortunate to have worked in almost all of the different areas, starting with Bearing Design and Specifications, then Quality Control and Quality Assurance in Manufacturing, Technical Services and Bearing Reliability services.

Thinking back and making reflections, my most interesting and positive experience of all has been the changeover from Bearing Quality Control to Bearing Quality Assurance. This change happened to be a complete change of mindset: Before we had a huge Quality Control organization that could be seen as a police looking for bad products and defects within the production. As the result was a very high cost of manpower but a high percentage of defects – scrapped products.

Then, with the changeover to Quality Assurance, besides of controlling the quality we should first of all focus on assuring the quality of the bearing being

produced even before the production itself was started. We should guarantee that the whole process should be capable to produce only products complying with the SKF quality.

The quality should be guaranteed from the very start of the process, all incoming raw material, and components. Capabilities studies should be made on the machines in the process to guarantee that they were capable to produce components and products completely according to the SKF Internal tolerances which were closer than Normal, to guarantee the very most competitive final products according to the SKF policy.

The above was a complete change of mindset: Instead of looking for defect products, very often in a hostile relation to the Production Area, we were from now on seen as an support area that was helping to produce the required quality in a most effective way. The relation in between Quality and Production changed completely.

As a result, in the actual factory my Quality Organization could be reduced from 123 Quality Inspectors (= Policemen) to 46 Quality Assurance Inspectors and the scrap was reduced by 85%.

2 years later I was happy to receive the first Cero Defect Reward from one automotive manufacturer.

Why do I mention the above?

I do mention the above as I see an enormous opportunity for a similar change of mindset in the Maintenance process. With the development of the new technologies as vibration analysis, ultrasound, oil analysis and thermography we have become experts in finding failures, trying to find them as early as possible. But these failures are in most of the cases irreversible and will sooner or later cause the shutdown of the process.

My idea with the Bearing Reliability Assurance is to use the mentioned predictive technologies to detect symptoms of defects before they have caused irreversible failures if the are not corrected in time. As examples, ultrasound to detect when the lubricating film is reduced, vibration to detect mechanical looseness, misalignment and overload, oil analysis to control the oil quality, thermography to detect each and every abnormal increase of relevant operating temperatures.

Nothing is completely perfect, which means that some failures may still happen. In these cases, a Failure Root Cause Analysis must be performed to identify the root causes and determine the required corrective actions required to avoid further failures of the same kind.

I mentioned the Reliability Assurance earlier in Bearing Tips No. 47 to 50, but based on the enormous opportunities I see in this change I want to mention it again.

Would you not prefer to indicate the possibilities to avoid failures instead of irreversible failures?

Bearing Tip No. 72: Reliability Assurance - the Process

Here I will emphasize the most important information I gave in the Bearing Tip No. 47. The main objective of the Reliability Assurance is to focus on avoiding bearing failures more than trying to detect bearing failures: Detecting failures does not improve reliability! It just reduces their consequences.

This is the intention with my new course **“Bearing Reliability Assurance – Cero Defects and Failures in Operation”** with the idea of avoiding bearings focusing on defect elimination and precision maintenance.

The process starts with defect elimination from the very beginning, the design and specifications, then the mounting and installation, precision maintenance including precision lubrication, proactive maintenance and finally failure root cause analysis for the failures that may have occurred in spite of our efforts to eliminate the defects to avoid them to cause failures and stop these failures to repeat again.

Please have in mind that the objective is to increase the reliability avoiding failures!

More than 80% of the failures are due to human errors according to several statistics. This is why training is a must as an enormous opportunity!

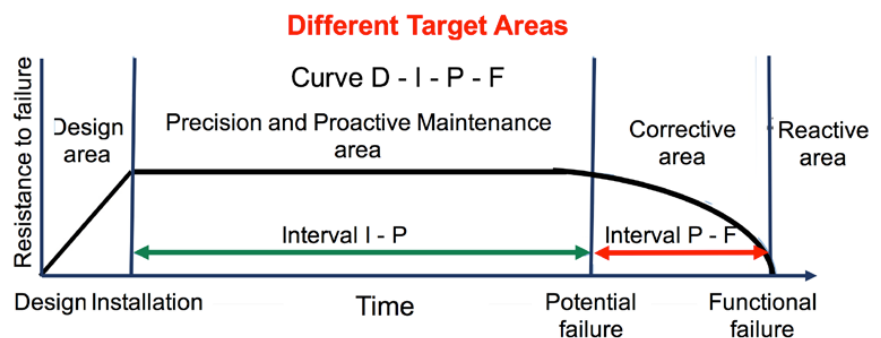
Bearing Tip No. 73: Where does the Assurance of Reliability start?

The Assurance of Reliability should start even before starting the process, reviewing the design of the process and its equipment. The Equipment and every part of it must be the correct (= Capability) to guarantee a process to perform according to the established requirements. So, the very first step is to select the correct bearing for each and every application!

The most common mistakes I have found in the industry are incorrect bearings. In a few cases incorrect bearing type but very common wrong variants of a bearing type and size, being variants defined by different suffixes in the corresponding designation. Variants such as internal clearances, type of seals and lubricants, bearings prepared for mounting in pairs, special heat treatment, etc.

The main reason for these errors is the lack of knowledge as regards bearing designation and the correct equivalents in different brands of bearings: A huge opportunity for training.

What about the following 2 designations? Can you identify all the different variants? Leaving out any of these variants will cause the failure of the bearing thus the failure of the corresponding equipment! 6205-2RS1NRTN9/P63LT20CVB123 23064 CCK/HA3Co84S2W33



— Ref.: Doug Plucknette - RCM Blitz - Reliabilityweb

The above mistakes are most common for replacement bearings, but I have also seen various cases of incorrect bearings in new equipment, mainly due to wrong specification from the end user, or other working conditions than what the manufacturer of the equipment had in mind.

Bearing Tip No. 74: Reliability Assurance by Design: Selection of the Lubrication

The lubrication is the most important factor for bearing reliability: When the lubrication fails, the bearing and the equipment fails!

Most statistics show that incorrect lubrication causes more than 50% of bearing failures. I have had several opportunities to confirm this statistic. For the first time as I started as Technical Service Manager in SKF in 1990. And then I have confirmed the same problem again and again all the time up to this moment.

As you might know, there are several suppliers of training in lubrication as myself on the market, even offering several type and degrees of certification. Please make use of us!

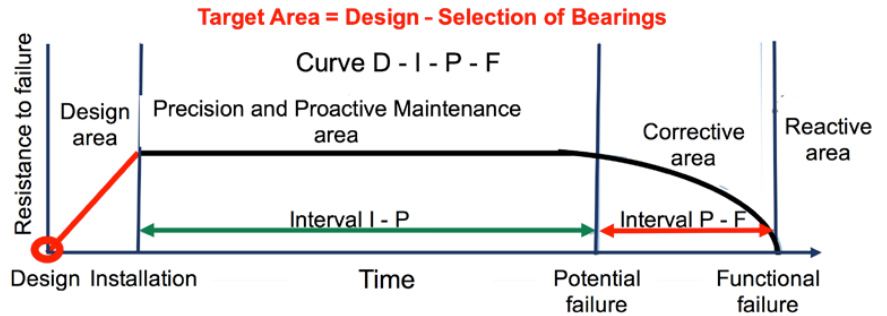
I am offering courses in this area when it comes to the details of the lubrication of bearings to optimize bearing service life.

Most of the improvements of the lubrications end up in reduced maintenance cost, as a better lubricant may have a higher price, but a lower consumption may more than compensate this and thereto come the benefits of in improved reliability!

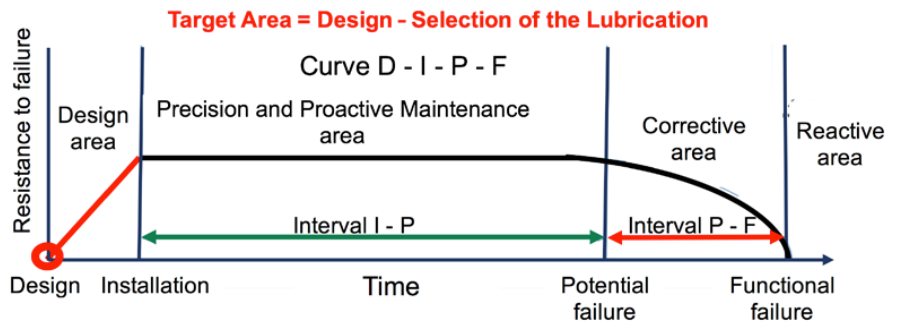
Bearing Tip No. 75: Reliability Assurance by selecting the Correct Bearing Fits

Bearings are precision products and must be handled as such!

Bearings are the products manufactured in series with the highest precision; the tolerances of their dimensions are in ten-thousandths of an inch and the operating tolerances (e.g. the balls) are in millionths parts of an inch. If you really want to take advantage of the complete dynamic capacity of



— Ref.: Doug Plucknette - RCM Blitz - Reliabilityweb



— Ref.: Doug Plucknette - RCM Blitz - Reliabilityweb

bearing as indicated in the corresponding manufacturer's catalogue, its rings or washers should be fully supported around their complete circumference and across the entire width of the raceway. Bearing seats should be manufactured to adequate geometrical and dimensional tolerances and be uninterrupted by grooves, holes or other features.

When you replace bearings, check the seating on the shaft and housing. These may be brown coloured but still within tolerances. DO NOT eliminate the coloured

surface using some abrasive media; just clean it with a cleaning and anti-corrosive oil (e.g. WD40 or similar). The intention must be to keep the original seating from the OEM manufacturer as long as possible due to its extremely high precision: No general repair shop will achieve the same precision again!

Bearing Tip No. 76: Reliability Assurance by Correct Mounting and Installation.

The above should not happen! A 100%



fatigue of the two rows of balls on both raceways and around the whole circumference in a self-aligning ball bearing. This is the result of an excessive drive up of the bearing with tapered bore on a mounting sleeve. Mechanicals with lack of knowledge tightened the locking nut “as tight as possible”. Totally logic tightening of a nut!

It is very easy to avoid defects during mounting just knowing a very few basics. You should always have in mind that “Impacts on the balls hurt”! Training pays off!!!

The same is also valid for the installation of the equipment, following a few basic concepts, as avoiding mechanical looseness, misalignment, and unbalance.

Bearing Tip No. 77: Reliability Assurance by Precision Maintenance

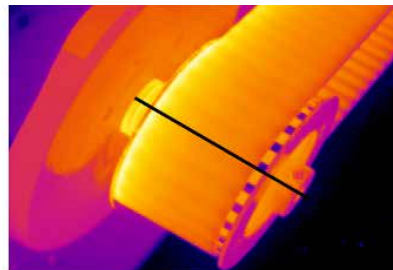
Precision Maintenance is Advanced Proactive Maintenance to Detect Symptoms of Defects Previous to Potential Failures.

The advanced predictive technologies used today are in many cases capable to detect symptoms of defects in such an early stage where these defects has still not caused any irreversible damage to the corresponding bearing or bearings.

As an example, the ultrasound can detect how the lubricating film in the bearing is decreasing and indicate when relubrication is needed and is performed, so on this basis lubricating failures may be avoided. But at the same time, the responsible for the lubrication should analyze if the required re-lubricating indicated by the ultrasound is acceptable. If not, the type of lubricant should be analyzed and improved if possible, in order to improve the reliability of the corresponding bearing.

A second example: Vibration analysis
- Look at the following table:

This table shows vibration levels in centrifugal pumps and fans in a petrochemical refinery. When the vibration analysis was implemented in the refinery, the first stage was to reduce the vibration levels in the pumps and fans indicated in the second column. But in this case the Maintenance area wasn't happy enough, thus analyzed each and every equipment to see which defect was causing the main vibrations and was then capable to apply advanced corrective actions achieving the vibration levels indicated in the 4th column.



(stiffer), balancing the impellers and precision alignment. The lower vibration increased the life of the mechanical seals, which is the most costly part of this type of pumps.

A third example: Thermography.

Excessive tension or misalignment of transmission belts will cause abnormal loads on the corresponding bearings reducing their service lives. These defects can easily be detected by thermography, as shown in the following example:



As a result, there was a large reduction of the maintenance cost for these equipment that was reported to the management of the plant: A total reduction of Maintenance Cost by \$68,077 USD. But this report was wrong, as the management indicated, the benefit was really much bigger as the reported reductions of the vibration levels in reality also had improved the uptime of these equipment.

How was it possible to reduce the vibration levels so much? It was possible by analyzing each equipment to find exactly what was causing the high vibration. For example, the high-speed pumps: Replacement of the bearings by higher capacity bearings

Bearing Tip No. 78: Reliability Assurance by Precision Lubrication

Precision lubrication may be achieved by using the advantages of advanced ultrasound. This will help you to:

- Verify the re-lubricating intervals.
- Verify the quality of the lubricants: Are the re-lubricating intervals acceptable or should they be longer? Do the lubricants behave as required during the operation?
- Identify the correct quantity of lubricant assuring the injection of the correct quantity for the correct lubricating condition avoiding unnecessary friction (= increased operating temperature and destruction of the grease) caused by churning of the grease inside the bearing.

The above will reduce the grease consumption, but more important, it will assure the optimum lubrication of the bearings increasing their service lives and reliability.

Type of Machines	Vibration Level	Maintenance Cost	Vibration Level	Maintenance Cost
Pumps 1,800 rpm	0.15 ips	\$10,298	0.023 ips	\$2,668
Pumps 3,600 rpm	0.26 ips	\$46,383	0.021 ips	\$2,503
Fans	0.338 ips	\$16,793	0.052 ips	\$226
Total		\$73,474		\$5,397

Bearing Tip No. 79: Reliability Assurance by Proactive Maintenance

Predictive Maintenance should, as the name indicates, predict bearing failures. It is very common that the Predictive Maintenance only indicate: Bearing failure. Recommendation: Replace the bearing.

I have had several cases where companies offering Vibration “Analysis” indicate the same. They may even indicate detailed information that the damage is located on a certain component of the bearing based on the vibration frequency, for example the outer ring.

But the above information is not the one that Maintenance need in order to be able to carry out the required repair to avoid further failures of the same kind. This is fulfilled by what we call Proactive Maintenance, where the failure cause is identified, and the required corrective action is determined.

For the above there are 4 excellent technologies available:

- Vibration Analysis.
- Oil Analysis.
- Ultrasound.
- Thermography.

But the very best results are achieved when several technologies are combined. For example, for a medium size electrical motor the combination of the following technologies will achieve the very best result: Vibration analysis + ultrasound + thermography!

For a gearbox: Oil analysis + vibration analysis.

For each case be aware of which technology that will give the most opportune alarm!

Bearing Tip No. 80: Reliability Assurance by Bearing Failure Root Cause Analysis

Nothing is perfect, so in spite of all our efforts to avoid failures by elimination of defects and precision maintenance there may be some failures. Even though these should be detected in time by the proactive maintenance and then, most important to close the circle, bearing failure root cause analysis should be carried out in order to verify if the failure root causes identified by the proactive maintenance were correct and when necessary correct and/or complete them.

The above is a must, especially for critical items in order to avoid these failures to repeat in the future and improve the reliability in a continuous way.

To start with, how do we define bearing failure?

It should be considered as a bearing failure as soon as this no longer complies with the required performance.

This may be completely different depending on different applications:

- In machine tool spindles: As soon as the machining precision and surface finish are out of tolerance. But definitively no fatigue!
- As soon as the reduced performance may generate risks.
- Critical machinery: When the reduced performance may cause stoppages of the production and/or collateral damages.
- When the vibrations and/or noise caused by the bearing damages no longer are acceptable.
- When the increased friction reduces the speed or stops a transport conveying system, etc.

How do we define premature bearing failure?

It should be considered as premature failure when bearing life is shorter than the expected service life according to the design of the corresponding machine.

Be most careful with the called “Workshop Blindness”: This bearing has always lasted only 1 year. Maybe it should last for 5 years!

There is an ISO standard that helps us with the bearing failure analysis:

ISO 15243 - Rolling Bearings – Damages and Failures – Terms, Characteristics and Causes.

Bearings made today by high quality manufacturers very most seldom present defects. These manufacturers utilize the Cero Defect concept; thus the defects are measured in ppm, parts per million, thus I use to say: Bearings are Innocent until the Opposite has been proven!

Previously bearings failed due to fatigue caused by defects in the material, the design or in the manufacturing. This means that the vast majority of bearing failures today are caused by EXTERNAL CAUSES = OPORTUNITY The previous statement leads us to a positive and proactive attitude:

See every bearing failure as a challenge to identify the root causes and to determine and take the required corrective actions in order to avoid recurrent failures.



Spinea continues to innovate *and* expand high-precision gear unit range

Spinea's comprehensive range includes TwinSpin® high-precision gear units and DriveSpin® motorised rotary actuators which are each characterised by Spinea's unique zero-backlash trochoidal gear reduction system which integrates heavy-duty radial-axial thrust bearings - effectively removing the need for separate load-support bearings in high accuracy speed or position control systems. With comprehensive technical support from Heason Technology and through proven use in robotics, automation, medical equipment, research, defence and security systems, Spinea's innovative and compact precision gear products are continually evolving - and during 2019 several new models have been added to the range.



— Spinea's TwinSpin® high-precision gear units (top L to R, the G- and GH-series) and DriveSpin® motorised rotary actuators (bottom L to R, the DS-, DSH- and DSM-series)

Recently updated with an improved gear reduction design, Spinea's TwinSpin G series gear units feature a higher torque density and reduced lost motion for significantly improved performance over previous generation models.

Available in wide choice of modular configurations, with an input flange or input shaft, the range covers rated torques from 34 to 4000 Nm in seven frame sizes; with an exceptionally high tilting stiffness, low friction and high overload torque capability. Each model size offers various reduction ratio options and through the complete standard range the lost motion and hysteresis specification is less than 1 arc-min. A new addition to this range, the GH series, combines the performance capabilities of the G-series in hollow shaft versions with outer diameter dimensions of 85, 115 and 125 mm. With rated torques of 41, 130 and 180 Nm respectively, the GH series through-hole design can accommodate slip rings, electrical cables, fluidpower hose or other services for convenient machinery installations.

DriveSpin DS series servo actuators are ultra-compact motorised gear units capable of withstanding extremely high radial and axial loads, and offer rated torque output from 18 to 460 Nm. A newly available 60 mm diameter version, the DS60 complements the previous seven frame sized variants which range from 50 mm to 155 mm diameter. The DS series feature Spinea's high precision gear system and a high performance AC servomotor for dynamic heavy load movement or exacting position control, and is a compelling motion enabling component particularly where space is at a premium. The hollow shaft variant of the DS-series, the DSH, has also been 1/3 extended with three new models with nominal outside diameter of 85, 125 and 170 mm for rated torque output of 41, 180 and 420 Nm respectively.

The DriveSpin product series is also available as the DSM variant which has similar performance characteristics but include durable housings with multiple mounting capability and are typically combined in X-Y configurations for handling and assembly machinery

or for pan and tilt precision motion systems. The DSM also suits direct interfacing of end effectors and other automation components without the need for adapters or support brackets.

A new 252 page catalogue covering Spinea's comprehensive product range is available from Heason Technology. With more than a decade working closely as Spinea's distribution partner, Heason Technology, through its in-house engineering consultancy, its design and manufacturing service, has integrated many TwinSpin gear reducers and DriveSpin servo actuators as part of complete motion systems that include single and multi-axis motion controls, servo or stepper motors and complementary drive technology with standard and customised positioning mechanics. Application areas include but are not restricted to aerospace & defence, printing & packaging,



— Spinea's trochoidal gear reduction and radial/axial bearing technology - a new generation of power transmission systems

medical & laboratory automation, research & development, motorsports and industrial automation.



High-end gearbox
simulation software
based on
50 years of research



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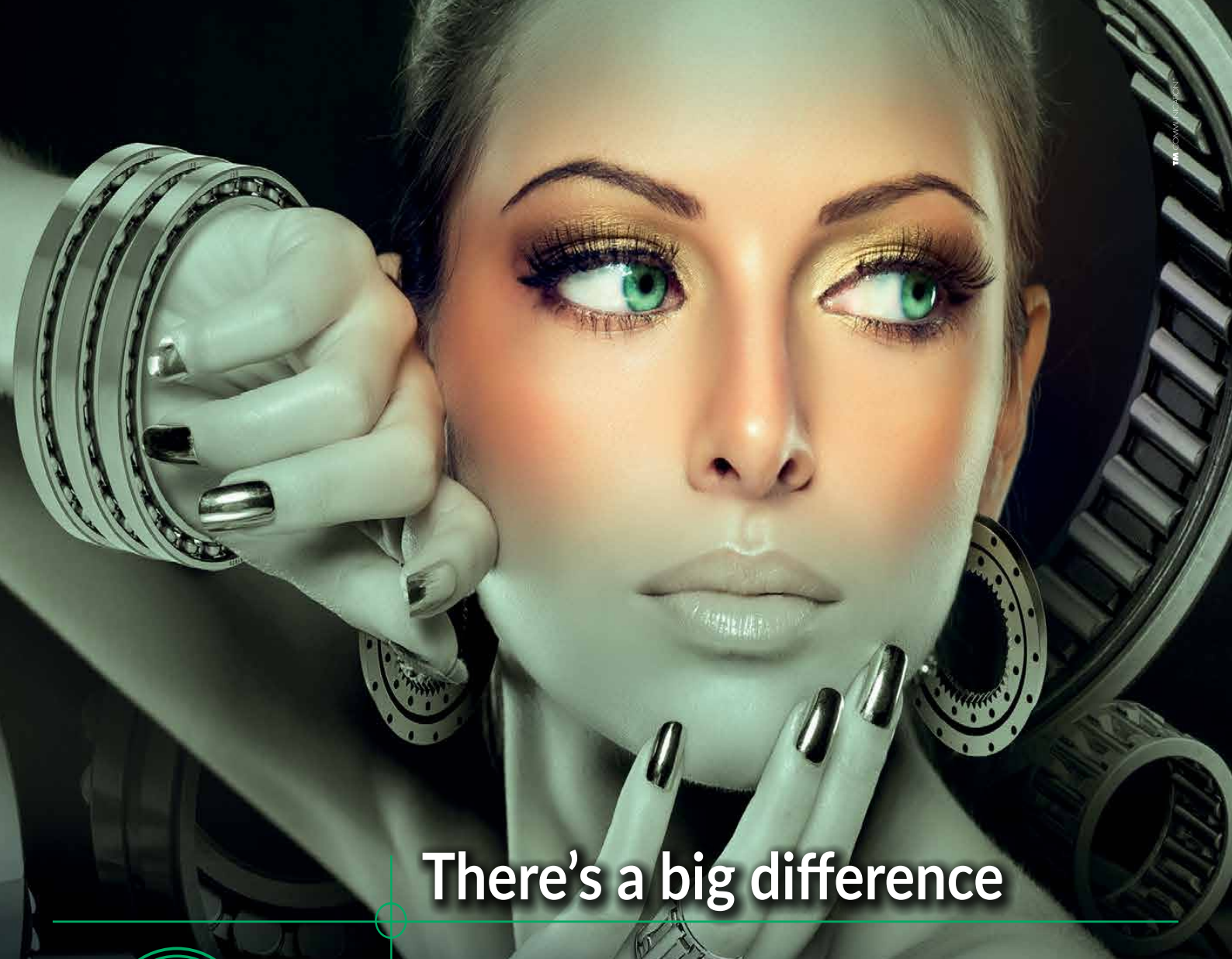


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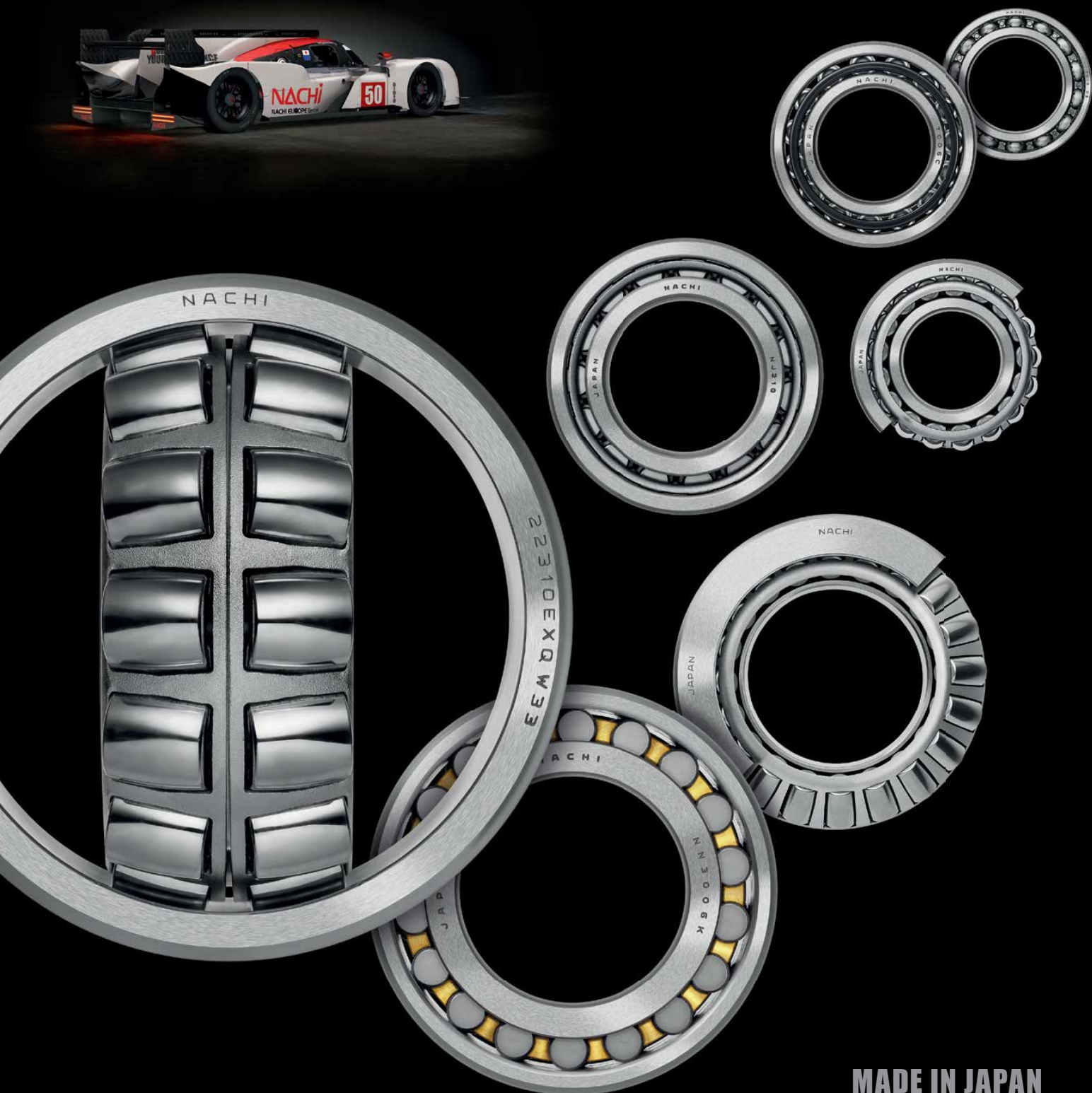
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