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Bearing NEWS

BEARING INDUSTRY MAGAZINE

The Bearing Industry Enters a New Era

Interview with Rickard Gustafson

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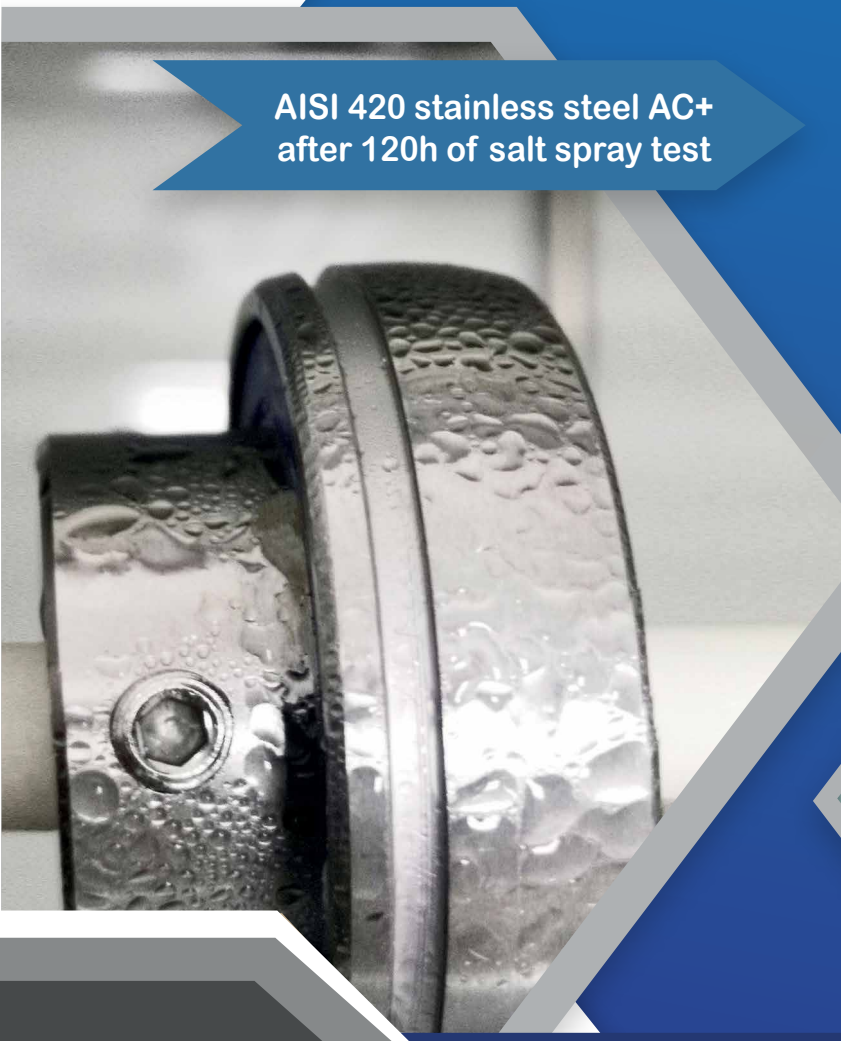

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Camille Huysmanslaan 27/15
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Fax : +32 (0)3 303 52 82
E-mail : info@bearing-news.com
Web : www.bearing-news.com

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iMotion Events debuts NEW all-year event format for the Bearing & Power Transmission community

This new edition of BearingNews Magazine celebrates the start of Industrial Motion Events' NEW groundbreaking event format that is uniquely designed for the Bearing and Power Transmission community. Beginning March 21st, this year-long networking event aims to connect PT/MC buyers and suppliers from 6 different industries. Registration is open to all companies and professionals looking to make an impact in 2022 (www.imotion.events).

Further in this issue, read interviews from a heavy hitting line up of industry leaders. Mr. Rickard Gustafson, CEO and President of SKF, candidly discusses his new role within the world's largest bearing company. Hear from Mr. Wang Wenjin, Executive Vice President at CITIC Pacific Special Steel, a powerhouse organization and strategic supplier for all the leading bearing makers. Later, the BearingNews team speaks with Mr. Sławomir Łukaszewski, CEO of FLT Polska, to discuss a new era for FLT following the recent acquisition by one of China's most technological bearing manufacturers, XCC group.

What's Rolling..

What's Rolling in the Bearing Industry. See what has happened in the last 6 months, learn details about key companies and trends, announcements, product developments and other news worthy advancements. All this and more can be found in this March issue of BearingNews magazine.

I 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.**
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Editor-in-Chief
Kenan M. Özcan

Editorial Team
Thomas Johnson
Mia Mctigue Rodriguez
Dize Purde

Guest Editor
Mike Brandt

Marketing
Tapaswee Dixit
Victor Vialet
Vincent Yang

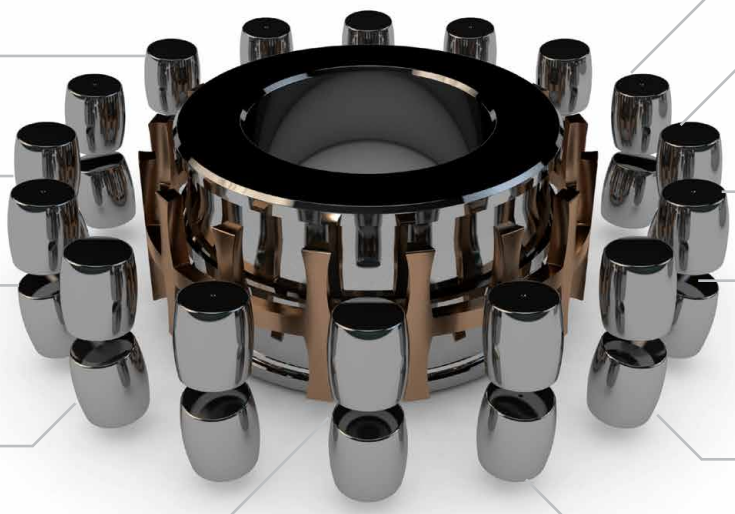
Project Coordinator
Merve Zhunuskanova

Art Director
Diydem Deniz Koç

Photography & Illustrations
Ksenia Shamanaeva

Web & IT
Canbey Bilgili
Birsen Aydın
Onur Uz

Subscriptions
info@bearing-news.com



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September 01, 2021 // Changes to Executive Board of Schaeffler AG. The Supervisory Board of Schaeffler AG has appointed Claus Bauer (55) to the Board of Managing Directors of Schaeffler AG as Chief Financial Officer (CFO), responsible for Finance & Information Technology, effective September 1, 2021, under a two-year contract. Claus Bauer succeeds Dr. Klaus Patzak (56) who left Schaeffler AG at his own request effective July 31, 2021. Claus Bauer joined the Schaeffler Group in 1998 and has been its Chief Financial Officer Americas since 2016. He has been working at Schaeffler's American headquarters in Fort Mill, South Carolina, since 2002, initially in the role of Chief Financial Officer North America. Previously, he was Head of the Tax Department and Chief Accounting Officer at INA Werk Schaeffler oHG in Herzogenaurach, Schaeffler AG's legal predecessor. The business graduate ("Diplomkaufmann") and certified tax advisor spent his first professional years from 1991 to 1997 with Roedl & Partner in Nuremberg.The Board of Managing Directors of Schaeffler AG has also appointed Sascha Zaps (46) Regional CEO Europe, effective September 1, 2021. The appointment makes Sascha Zaps a member of Schaeffler AG's Executive Board comprising the eight Managing Directors and the four regional CEOs. In his new role, Sascha Zaps succeeds Jürgen Ziegler (62) who has retired effective July 31, 2021.

September 14, 2021 // SKF acquires lubrication filtration business. SKF has completed the acquisition of EFOLEX AB, a Gothenburg-based manufacturer of the Europafilter-branded industrial lubrication and oil filtration systems. EFOLEX offers offline filtration systems used in process manufacturing and energy industries. They currently have approximately 10 employees.

September 24, 2021 // Bowman International appoints new business unit manager for their split roller bearing division. Bowman International has announced the appointment of Chris Ager, as the new Business Unit Manager for its rapidly growing Split Bearings division. Having worked in the split bearings industry for 16 years, the last seven of which was for a leading competitor, Chris brings to his role a wealth of industry knowledge that will undoubtedly benefit Bowman's increasing split bearing customer base, with the implementation of leaner ordering processes, increased distribution channels and the research and development of further split bearing innovations.

September 28, 2021 // The Liebherr-Component Technologies AG has started construction of a new plant at its Dalian site in China. This will strengthen the Liebherr-Components' product segment and further expand its global foothold. Bearings, drives and hydraulic cylinders are due to be produced there by the end of 2022. For that, the Liebherr Components (Dalian) Co., Ltd. will build new halls with three production lines, as well as office and auxiliary buildings on a floor area of around 44,000 m². Liebherr has been present at the Dalian site since 2002 and is currently manufacturing drive components and earthmoving machinery. With this construction project, Liebherr is not only tying together the production of components in one plant but is also making one of the largest investments in the Dalian region in recent years.

October 08, 2021 // EIS Legacy, LLC ("EIS"), a leading value-added distributor of material and supply chain solutions, announced that it has acquired Midpoint Bearing. This acquisition broadens EIS's product offering and technical expertise in the apparatus repair industry, as well as increasing their presence in high-

growth industries, such as alternative energy and wind. EIS is a portfolio company of Audax Private Equity. Midpoint Bearings was founded in 1985 by Dan & C.C. Vest and is an authorized distribution partner of world class manufacturers such as Dichtomatik, Garlock, Koyo, NTN, SKF, Schaeffler, Nachi, and many more. Their commitment to providing an exceptional customer experience is recognized throughout the market.

October 12, 2021 // New Nomo Group Managing Director in 2022. Nomo Group, part of Axel Johnson International's business group Power Transmission Solutions, has appointed Henrik Walter, currently Sales & Marketing Director, to take over the position as Managing Director for Nomo Group from January 1st 2022. This follows from existing Managing Director, Mattias Jaginder, moving on to a new role to form and build a new business group, Industrial Automation, within Axel Johnson International. With Henrik's extensive experience from the industry through more than 20 years in the company, he is the natural successor to lead the further development of Nomo in order to strengthen the position as the leading Nordic multi-brand specialist distributor of bearings, power transmissions, seals and related services.

October 19, 2021 // Liebherr-Components Biberach GmbH has produced one of the largest main bearing for tunnel boring machines to date. The main bearing is to be installed in one of the world's largest tunnel boring machines. With main bearings for constantly growing tunnel boring machines, Liebherr takes a step towards meeting the increasing demand for tunnel construction systems. With its main bearing for Shanghai Tunnel Engineering (STEC), a Chinese system provider of tunnel boring machines (TBMs), Liebherr has reached the next dimension in tunnel construction. With the diameter of almost eight meters and the weight of 44 tons, the roller bearing is a real heavyweight to be used in one of the largest tunnel boring machines. At the same time, the bearing is the largest TBM main bearing of its kind produced by Liebherr to date. When a main bearing weighs as much as 44 small cars at once, it is expected to be able to do a lot. Used in the cutter head of a TBM, it helps to bore a tunnel about the height of a six-story building. This is possible due to its double rollers in the bearing track, an extremely precise internal gearing, as well as due to 20 pinions, that drive the bearing on the inner ring. And that's not the end of it. In addition to the main bearing, Liebherr also manufactures the erector bearing for the said tunnel-boring machine. With a diameter of 7.3 meters and a weight of 5.7 tons, it may not seem quite as big in comparison, but it still has an important function in tunnel construction.

October 25, 2021 // Schaeffler extends contract with Chief Technology Officer Uwe Wagner. The Supervisory Board of Schaeffler AG renewed the contract with Uwe Wagner (56), Chief Technology Officer, early for five years until September 30, 2027. Uwe Wagner has been with the Schaeffler Group in various functions since 1993. Before his appointment as Chief Technology Officer of the Schaeffler Group in October 2019, the mechanical engineer was Head of Research and Development of the Automotive and Industrial divisions.

November 9, 2021 // RBC Bearings Incorporated Completes Acquisition of ABB's DODGE Mechanical Power Transmission Business. RBC Bearings,

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a leading international manufacturer and marketer of highly engineered precision bearings and products for the industrial, defense and aerospace industries, announced today that it has completed its previously announced acquisition of the DODGE mechanical power transmission division of Asea Brown Boveri Ltd for approximately $2.9 billion in cash subject to post closing working capital adjustments. RBC Bearings, together with DODGE, creates a leading manufacturer with strong brand recognition for premium performance-critical bearings, components and motion control products for the industrial, aerospace and defense markets.

November 10, 2021 // LYC produces a Slewing Bearing with an 11M OD. At the end of October 2021, the Chinese bearing manufacturer Luoyang LYC Bearing Co., Ltd. presented its new extra-large bearing, which was developed and manufactured at their own facilities. The slewing bearing with an outer diameter of 11.47 meters has become the largest bearing ever produced by the company and any other Chinese bearing manufacturers, setting a new record holder in China. The bearing is intended for a shipbuilding engineering company and will be used in a 1000-ton heavy offshore crane serving offshore wind turbines. A distinctive feature of the manufactured bearing is the end runout. Despite the large diameter and weight of several tens of tons, the end runout is only 0.14 mm. Luoyang LYC Bearing Co. is one of the largest bearing manufacturers in China. For many years it has been producing large slewing bearings. The company produced in 2017, a bearing with an outer dimension of 9.785 m with a weight of 76 tons.

December 6, 2021 // Fredrik Stjernholm has been appointed new Managing Director for Sverull ElektroDynamo AB, one of Axel Johnson International's companies within business group Power Transmission Solutions. Fredrik will start his new position with immediate effect. Fredrik succeeds former Managing Director Martin Elm who has decided to leave Sverull after three years in the company. The process to find a new CFO has been initiated, and Fredrik will during this time act as both CFO and Managing Director.

December 15, 2022 // Genuine Parts Company, a leading distributor of automotive and industrial replacement parts, announced that it has entered into a definitive agreement under which its wholly-owned subsidiary, Motion Industries, Inc. ("Motion") will acquire Kaman Distribution Group ("KDG") from private investment firm Littlejohn & Co., LLC. The acquisition is valued at a total purchase price of approximately $1.3 billion in cash. The transaction is expected to close in the first quarter of 2022, subject to the satisfaction of customary closing conditions. The waiting period under the Hart-Scott-Rodino Antitrust Improvements Act of 1976 has expired. Established in 1971, KDG is a power transmission, automation and fluid power industrial distributor and solutions provider with operations throughout the U.S., providing electro-mechanical products, bearings, power transmission, motion control and electrical and fluid power components to MRO and OEM customers. Headquartered in Bloomfield, CT, KDG's 1,700 employees serve more than 50,000 customers. KDG is expected to generate approximately $1.1 billion of revenue in 2022. Additionally, GPC expects the acquisition to be accretive to its adjusted earnings in the first year after closing. Other transaction highlights include: $50M+ annual run-rate synergies, expected to be achieved over three years; Anticipated leverage at closing of ~2x, within range of GPC targeted levels; Funded at closing via existing revolver and accounts receivable sales agreement; Expected to maintain liquidity in excess of $2 billion.

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What Rolling in the Bearing Industry?

December 17, 2021 // Miba Industrial Bearings Houston celebrates its 30 year anniversary with a babbitt room expansion. Miba Industrial bearings US (Houston) has a long history when it comes to servicing the end user market for the repair and replacement of industrial bearings and labyrinth seals. The site in Houston, Texas looks back on 30 years of history. In 1991 TCE (Turbo Components and Engineering) was founded and quickly became one of the leading service providers for hydrodynamic bearings in the US by offering Engineering expertise and high quality. 20 years later the company was bought by John Crane and its name changed to John Crane Engineered Bearings. In 2018 the company was acquired by Miba Group and together with 3 other sites, Miba Industrial Bearings were

established. In the last three years Miba Houston has undergone some exciting changes: ISO Certification and a new state-of-the art babbitt facility to name a few. With Phase 1 of the babbitt room expansion in Houston complete and Phase 2 planned for January 2022, there is reason to celebrate, not only Miba Houston's history but also the future.

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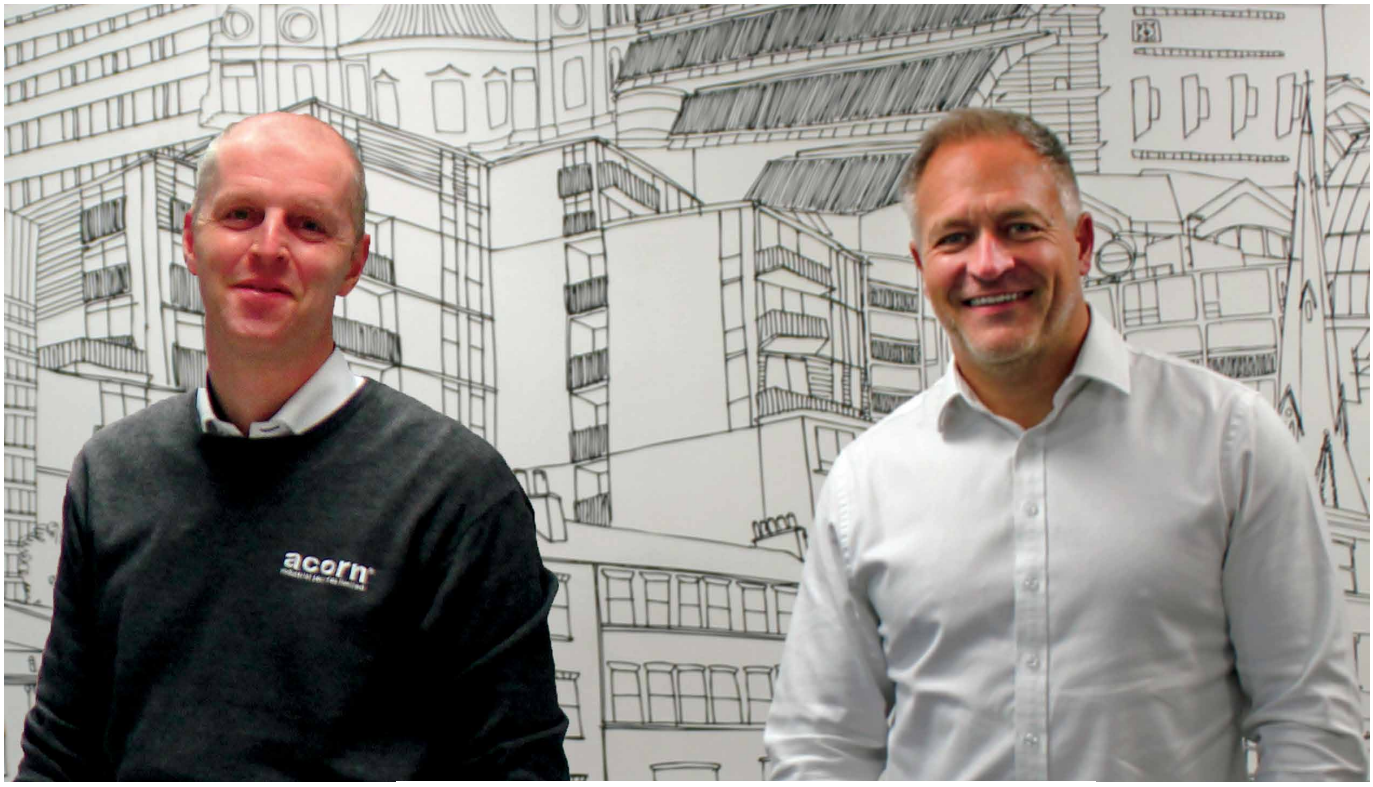

January 1, 2022 // Gavin Stacey takes the lead as Managing Director for Acorn Industrial Services. Acorn Industrial Services Ltd, part of Axel Johnson International's business group Power Transmission Solutions, has appointed Gavin Stacey, currently Sales Director, to take over the position as Managing Director of Acorn Industrial Services Ltd from January 1st 2022. This follows from existing Managing Director, Martin Povey, who will remain as Managing Director of Acorn Group, including Acorn Industrial Services Ltd, Gerald Summers, Town & County Engineering Services, Bearing Station and RW Bearings.

On his appointment, Gavin commented: *"I am very excited with my new appointment as MD, I look forward to leading the business and shaping it's very promising future."*

Gavin has over 26 years' service with Acorn and has served in a variety of roles, the last 3 years as Sales Director. His track record, industry experience and leadership will be invaluable in guiding the company forward. The move to promote Gavin into this role follows the company strategy of promoting from within the business wherever possible and practical.

Managing Director, Martin Povey added: *"The company has seen many big changes in the last 26 years and with our long serving and knowledgeable team, we are perfectly positioned to see many more. Gavin is the ideal person to continue leading us forward, and I wish him every success."*

Acorn Industrial Services Ltd provides full-service supply solutions on engineering components to an international customer base. Their impressive stockholding of over six million items is available from regional distribution centers throughout the UK. Acorn Industrial Services Ltd is part of Axel Johnson International, a global industrial group of more than 150 companies in 30 countries. Axel Johnson International drives business development and growth through a long-term approach to ownership in strategically selected niche markets, primarily technical components, and solutions for industrial processes.

Axel Johnson International is organized in six business groups: Fluid Handling Solutions, Industrial Solutions, Lifting Solutions, Power Transmission Solutions, Transport Solutions and Driveline Solutions. Axel Johnson International is part of the Swedish family-owned corporate group Axel Johnson.

January 3, 2022 // Solve Industrial Motion Group, a portfolio company of Audax Private Equity, has acquired Bearings Limited, a leading manufacturer of bearings and power transmission components under the Tritan brand. Headquartered in Hauppauge, N.Y., Bearings Limited has an extensive offering of more than 25,000 Tritan products and services customers from six regional locations, including Los Angeles; Chicago; Houston; Atlanta; Columbus,

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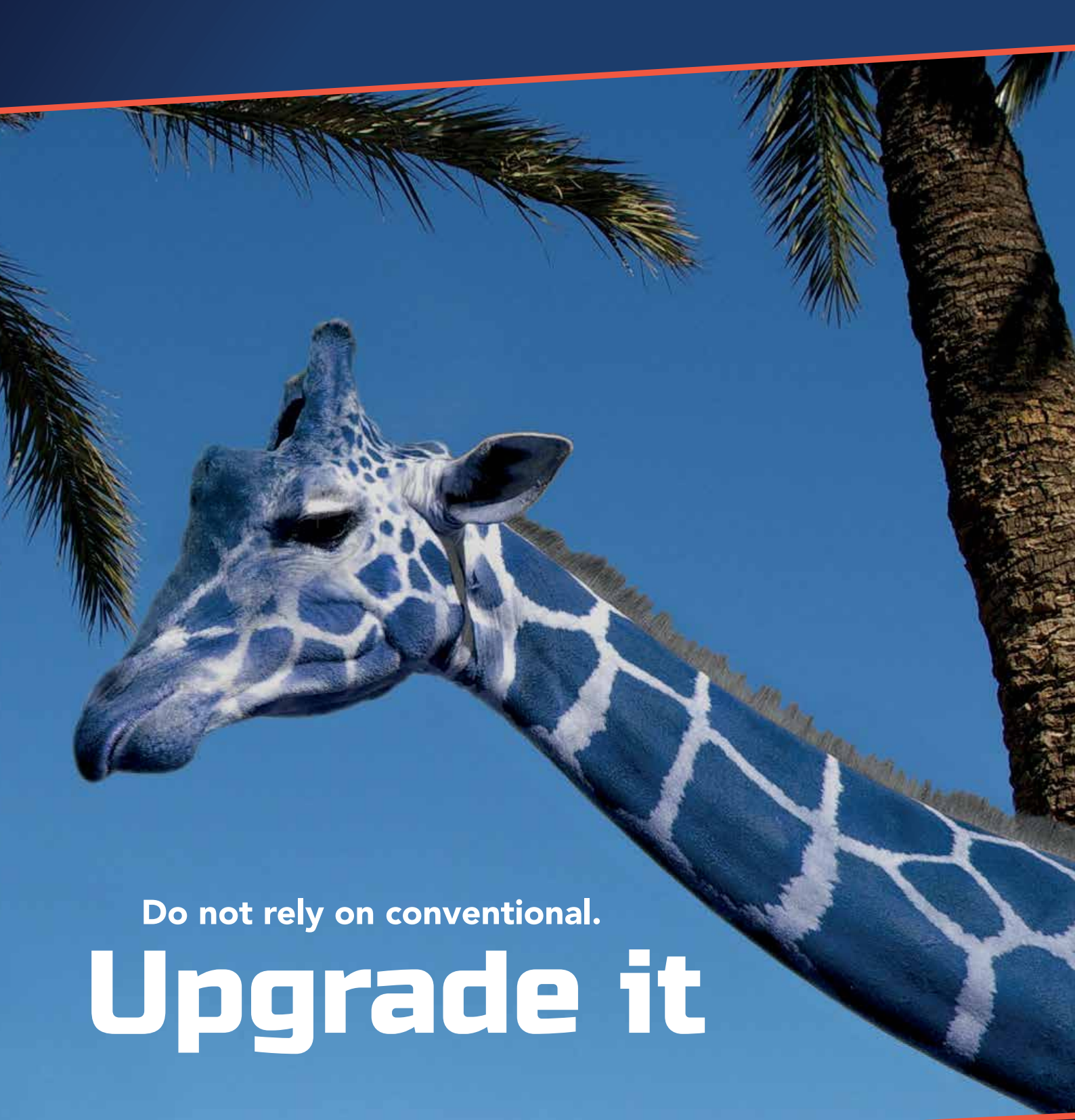

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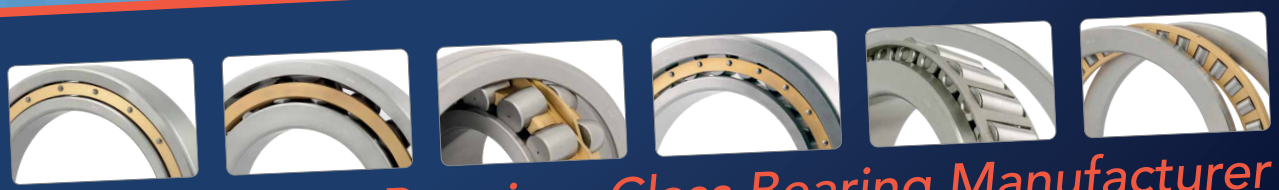

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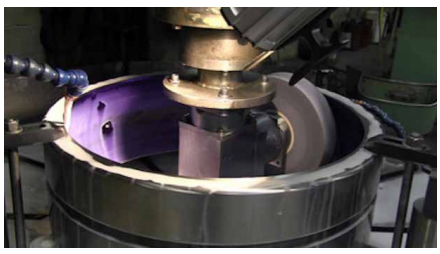
Ohio; and Hauppauge, N.Y. In 2020, the Solve brand was established, bringing P.T. International ("PTI") in North Carolina, IPTCI Bearings in Minnesota, and LMS Bearings in Colorado together under one umbrella. Tritan is the fourth brand to join the growing portfolio. Solve is a one-stop resource for both metric and American standard power transmission products, serving multiple verticals, including food and beverage, material handling equipment, agriculture, automotive, textiles, mining, building products, and pharmaceuticals.

January 11, 2022 // NSK, a global leader in bearing and linear motion control technology, has expanded its owned bearing services capabilities in the Americas with the acquisition of Alliance Bearing Repair and Reclaim, LLC. Alliance Bearing Repair was founded in 2005 in Alliance, Ohio, serving major industrial customers in the metals, pulp and paper, power generation and quarrying/ mining industries. Reconditioning services include a wide array of restoration processes, repair and replacement of bearing components, as well as bearing modifications. By augmenting core technical service expertise with diagnostic technologies, Condition Monitoring Systems and Reconditioning Services, NSK is acutely focused on bearing product life cycle management to deliver stable operation with reduced maintenance costs, and to contribute by available means to reducing the carbon footprint of our business.



January 21, 2022 // Bowman International appoints Exec Vice President For North America. Global innovator of performance-driven bearings and 3D printed mass production components, Bowman International, has announced the appointment of Alistair Brixey, as Executive Vice President of Bowman North American Operations. The appointment comes following a period of intensive growth for Bowman across North America, in which the manufacturer has expanded its network of reliable distributors in the region, as well as its portfolio of OEM and MRO clients covering virtually every sector of industry. English-born Alistair brings to his new role over four decades of industry experience both in the UK and America, most recently dedicating 13 years to a well-known plain bearing manufacturer and distributor in the states and before that, working for Oilite bearings for 30 years in the UK. Alistair is also a committee member of the US Bearing Specialists Association. With a wealth of knowledge serving OEMs and large distributors, Alistair will become an extension of all three Bowman International divisions, giving North American distribution partners and customers a direct point of contact in the region.

January 30, 2022 // Customs in China detained counterfeit SKF bearing on 30 January. Shanghai Old port area Customs confiscated 1,000 counterfeit bearings of SKF trademark. The Customs has detained the relevant goods and started an investigation, after SKF confirmed that the product violates the exclusive right to the trademark. The port of Shanghai is the most important transportation hub in China. In addition to the world's largest seaport there is also an airport and different land transport routes, which sellers and carriers of counterfeit goods try to use to transfer the products out of country.

February 01, 2022 // Nomo Kullager AB, part of business group Power Transmission Solutions, acquires S.E. Lodéns Industrimontage AB, a Swedish technical solution provider of advanced industrial maintenance, effective as of 1 February 2022. Through the addition of Lodéns, Nomo strengthens its position in the Swedish market and launches a new industrial services concept. Founded in 1975, S.E. Lodéns Industrimontage AB is a highly skilled industrial service provider and distributor offering advanced on-demand customer solutions. The company is located in Gävle, about 170 km north of Stockholm, and offers service of industrial power transmissions, including both field service and in-house workshop, as well as distribution of roller and ball-bearings, bearing houses, clutches, industrial gears, couplings, seals, and motor gears.

February 5, 2022 // Schaeffler has signed an agreement to acquire all of the shares of Melior Motion GmbH. The acquisition of this supplier of precision gearboxes for robotics and other applications in automation expands the robotics portfolio of the Schaeffler Group's Industrial division. As automation of both simple, repetitive tasks as well as complex mounting and manufacturing processes is progressing rapidly, the Industrial division consistently expands its position as a supplier for robotics components and systems. In a first step, the division has brought a Strain-wave gearbox equipped with an electric motor and sensors for use in collaborative robots (cobots) to the point of volume production. In a second step, it is now adding more powerful gearboxes for higher payload capacities in industrial applications to its portfolio. Over several years, Melior Motion GmbH has developed and successfully brought to the market an innovative planetary gearbox for industrial robots that is highly precise, features outstanding repeat accuracy, low noise emissions as well as very sound robustness. A modular platform concept has been developed based on this technology. The first gearboxes of this design have been on the market since 2017 and are proving their worth, whilst meeting with rapidly growing demand. The company, which generated revenue of around 23 million euros in 2021, has over 100 employees and is located in Hameln, Germany. It is currently planning another production site in China. Europe and China are currently the main sales markets of Melior Motion GmbH. The company was established in 2017 and traces its origins back to the Stephan-Werke founded in 1908, which was acquired by Premium Ltd. in 2011.

February 10, 2022 // The Timken Company, reported fourth-quarter 2021 sales of $1.01 billion, up 13 percent from the same period a year ago, and over 10 percent higher than the previous record fourth quarter. The increase was primarily driven by strong organic growth across most end-market sectors led by industrial distribution and off-highway, and the impact of higher pricing. For 2021, sales were $4.1 billion, up 17.6 percent compared with 2020. The increase was primarily driven by organic growth across most end-market sectors and the favorable impact of currency. Net income was $369.1 million or a record $4.79 per diluted share for the year, compared with net income of $284.5 million or $3.72 per diluted share a year ago. The year-over-year increase reflects the impact of higher volume, favorable currency, positive price/mix, and the net favorable impact of special items, partially offset by significantly higher operating costs. Excluding special items, adjusted net income was $363.4 million or a record $4.72 per diluted share in 2021. This compares with adjusted net income of $313.1 million or adjusted earnings of $4.10 per diluted share in 2020. Net cash from operations for the full year was $387.3 million, and free cash flow was $239.0 million. Timken ended the fourth quarter with a strong balance sheet; financial leverage as measured by net debt to adjusted earnings before interest, taxes, depreciation and amortization (EBITDA) was 1.7 times as of December 31, 2021 compared to 1.9 times at the end of 2020. During the year, Timken continued to invest in operational excellence initiatives and grow its presence in attractive market sectors. The company made additional capital investments in the renewable energy and marine sectors, expanded its linear motion portfolio with the acquisition of Intelligent Machine Solutions (iMS) and continued to improve its global manufacturing footprint. Additionally, Timken paid dividends totaling $1.19 per share in 2021, which represents its eighth consecutive year of higher annual dividends, and repurchased 1.25 million

shares of company stock. Between dividends and share repurchases, the company returned a total of $185.2 million of cash to shareholders in 2021.

February 15, 2022 // Counterfeit spare parts and bearings detained in Russia and China. The mobile team of Samara Customs (Russia) found 23,000 counterfeit spare parts for cars, production equipment, lifting and materials handling components in a truck. A truck with illegal cargo was stopped near the village of Bolshaya Chernigovka, Samara Region. As a result of customs inspection, spare parts with various trademarks were found in the cargo compartment of the vehicle, including WEBER fuel pump engines, BOSCH and SIEMENS fuel pumps, ATS electric fuel pumps and SKF bearings. Information about the violation of the companies' exclusive rights was confirmed during the interaction of customs officers with representatives of the right holders. According to preliminary estimates, the damage to copyright holders exceeds 35 million rubles (450,000 USD). In addition, the brand copyright holders noted that the spare parts are not safe, since the country of origin, manufacturer, production date, technical and operational characteristics are missing. On this fact, the issue of initiating a criminal case was executed under Art. 180 of the Criminal Code of the Russian Federation.

February 21, 2022 // Bartlett Bearing Appoints New President, Continues Family-Led Succession. The company announced today that its longtime company President Gayle Musser is moving into the role of CEO, appointing Sarah Musser to the role of President. Sarah will be the third member of the Bartlett family to lead the company, now in its 71st year of operation. Gayle, who served as the company's President for 31 years, will remain onboard as the CEO of Bartlett Bearing. Family has long been at the core of Bartlett Bearing and the company is excited to continue the Bartlett family legacy under Sarah's leadership.

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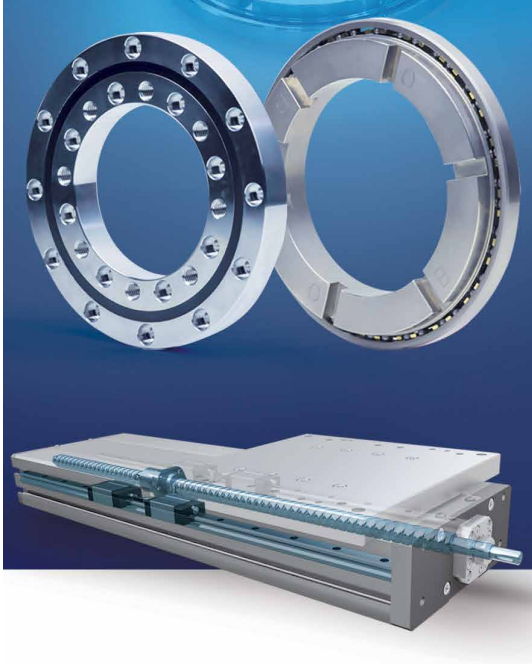

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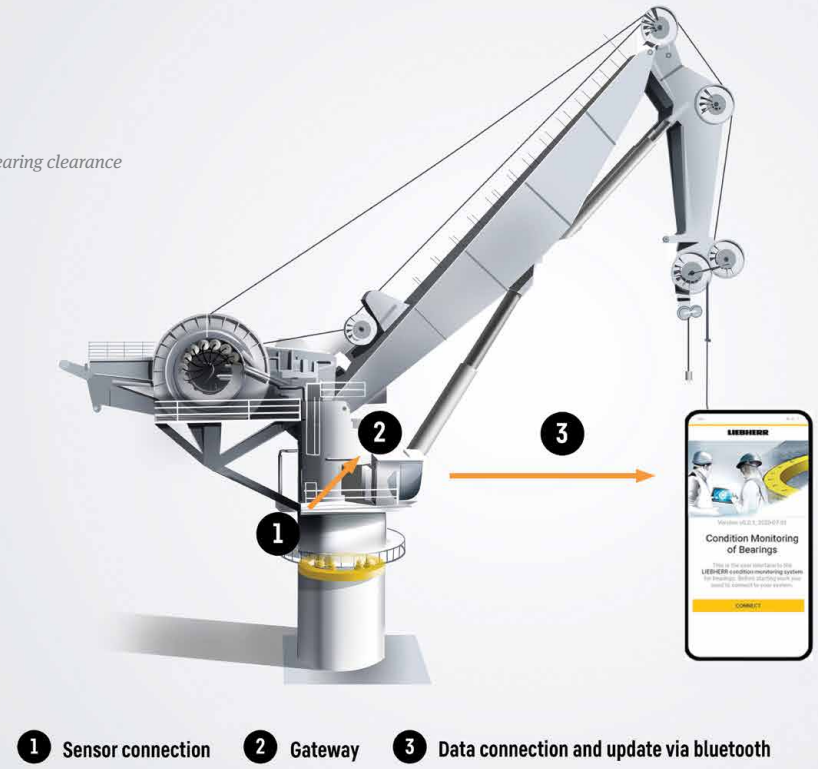
Digital clearance monitoring for slewing bearings

—The danger zone of the excavator is located directly at the point, where the service personnel attach the measuring device during a manual measurement.

- Liebherr enables high-precision wear measurement from a distance.
- The new technology ensures greater safety in the danger zone.
- Condition monitoring is also available for lubrication and temperature measurement.

Nussbaumen (Switzerland), February 23, 2022 – With the condition monitoring system for slewing bearings, Liebherr has created a digital monitoring system. The integrated wear measurement system, bearing clearance monitoring (BCM), ensures optimum remote monitoring of the slewing bearings in various applications, such as mining, material handling or maritime equipment. The BCM system can be used to measure bearing wear in axial and radial directions, as well as tilting clearance. Such a remote diagnostics does not only ensure flexibility in measurement, but also reduced downtime, lower costs in maintenance and, above all, higher personal protection.

—This is how Liebherr's bearing clearance monitoring system works.



More safety: No service personnel needed in the danger zone

The focus of digital remote clearance maintenance lies on personnel safety. "A distinct disadvantage of all common wear measurement methods is the necessity for service technicians to mount dial gauges or other measuring devices directly on the slewing bearing in the danger zone under the excavator or other machines," explains Wolfram Halder, Product Manager of the slewing bearings business unit. "The Liebherr BCM system makes this unnecessary, as the measuring devices are already permanently installed on the bearing." Another advantage is flexibility in terms of time. Currently, machine operators commission external service providers to measure the bearing clearance. This makes them dependent on the experience and schedule of third-party companies. "With digital maintenance for slewing bearings by Liebherr, measurements can be carried out at any time outside the danger zone, independently of external service providers," explains Wolfram Halder.

Measurement within a few minutes: This is how the BCM by Liebherr works

How does it work? The right technology and the right connection make it happen. The sensor connection box receives the data from the sensors attached to the slewing bearing and supplies the entire BCM system with power. The gateway stores the sensor data and updates for the BCM. This allows using the system autonomously even in regions without data connection. This is the case in mines, for example, as these often do not have the necessary mobile reception. A direct connection via Bluetooth makes the measurement process possible from a safe distance and without a network connection. Smart, integrated and remote, the BCM system is a small helper with great effects.

About Liebherr-Components AG

In this segment, the Liebherr Group specialises in the development, design, manufacturing of high-performance components in the field of mechanical, hydraulic and electric drive and control technology. Liebherr-Component Technologies AG,based in Bulle (Switzerland), coordinates all activities in the Components product segment. The extensive product range includes diesel and gas engines, injection systems, engine control units, axial piston pumps and motors, hydraulic cylinders, slewing bearings, gearboxes and winches, switchgear, electronic and power electronics components, and software. The high-quality components are used in cranes and earthmoving machinery, in the mining industry, maritime applications, wind turbines, automotive engineering or in aviation and transport technology. Synergy effects in s other product segments of the Liebherr Group are used to drive continuous technological development.

About the Liebherr Group

The Liebherr Group is a family-run technology company with a highly diversified product portfolio. The company is one of the largest construction equipment manufacturers in the world. It also provides high-quality and user-oriented products and services in a wide range of other areas. The Liebherr Group includes over 140 companies across all continents. In 2020, it employed around 48,000 staff and achieved combined revenues of over 10.3 billion euros. Liebherr was founded in Kirchdorf an der Iller in Southern Germany in 1949. Since then, the employees have been pursuing the goal of achieving continuous technological innovation, and bringing industry-leading solutions to its customers.

More information about Liebherr can be found at www.liebherr.com

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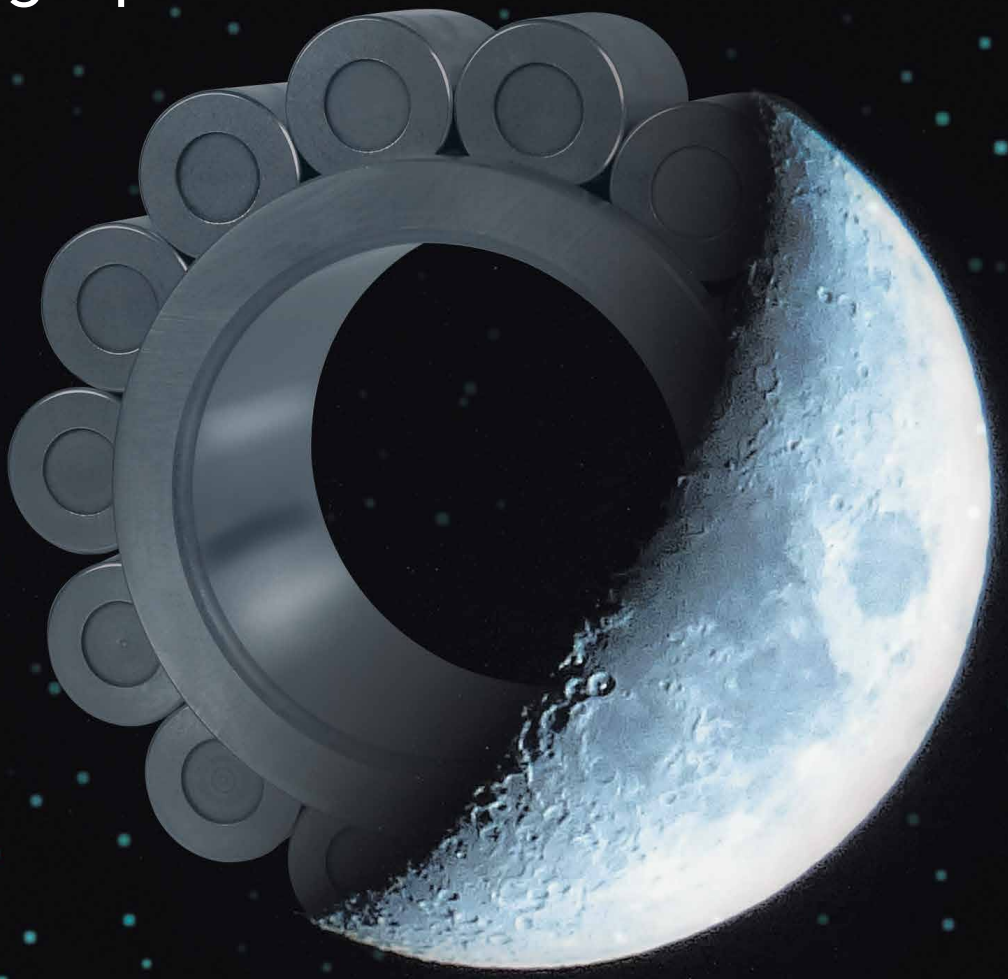

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Launch loads in space applications – Analysis and recommendations for design optimization

„ The systematic analysis of the effects of launch loads is a key part of the process to select the best bearing solution for a given application. „

Dr.-Ing. Rahul Dahiwal – Gebr. Reinfurt GRW

Space consists of everything from the big bang and the creation of the Universe to the galaxies and planets, right down to objects around 10 cm^3 we call satellites. Satellites are designed to fulfil specific tasks like Earth observation, communication, navigation and of course human life support. They are deployed normally in a low Earth orbit to allow real time data tra nsfer. According to the Bryce Tech reports around 40% of small satellites were launched in 2020 alone and the prediction is that around 1400 small satellites per year will be launched over the next ten years. Therefore, it is clear the business potential is significant.

This increasing number of satellites means an equally large increase in the number of subsystems on board. For example LIDAR sensors for pose estimation, reaction wheels and gyros for positioning and actuation mechanisms for solar panels. In each of these applications, to achieve the desired accuracy of operation, super precision ball bearings from GRW are employed. These bearings need to be carefully designed to avoid common failure mechanisms. One important but often overlooked area is the ability of the bearing to withstand the significant shock loading during launch and sometimes re-entry. If the bearing design somehow overlooks or underestimates these loads during the system design, this can result in catastrophic results. Such a bearing failure can cause whole system failure.

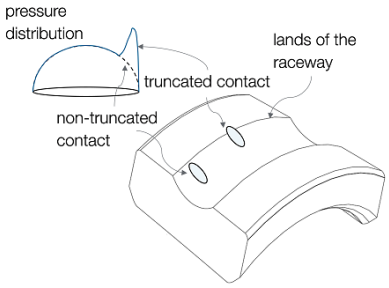
This article outlines some of the lessons learnt both positive and negative by GRW over years of design experience in space applications. A standardized strategy to understand what happens when shock loads occur and their systematic investigation is introduced here. In conclusion, the article provides general guidelines and recommendations that can help the space community to avoid early design errors, to optimize their solution and assist in selection of the correct bearing for the application.

Understanding the Issues

Clarification of the following issues helps to define the objectives:

- Can the momentarily occurring shock loads seen during launch be accommodated in such a way that they will not affect the normal operation of the bearing during its normal duty cycle?
- Is the level of damage, under these shock loads, that might occur to the bearing raceway and lands due to the ball moving to the track edge, so called truncation, be considered acceptable (refer to Figure 1)?
- Do we need to employ a bigger size of bearing for the application?

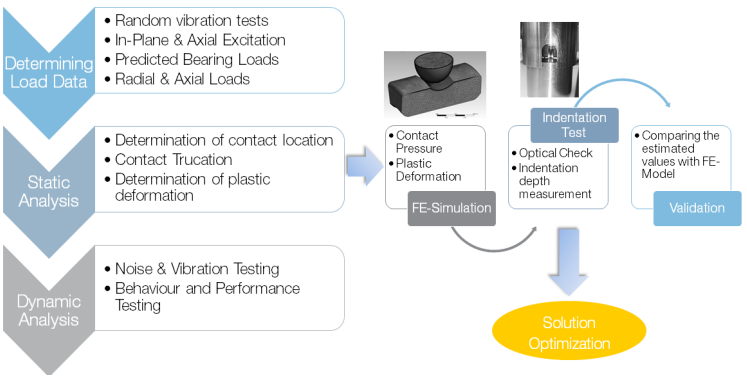
Therefore, I tried to provide the convincing explanation to the issues mentioned.



— Figure 1: Raceways showing the truncated and non-truncated contact along with the pressure distribution profile [FL01] [1]

Methods and Techniques for Bearing Design and Selection

GRW possesses the expertise and employs various simulation and experimental techniques to investigate the bearing quasi-statically as well as dynamically. This helps the designer to critically consider the operating scenario in their design process and accordingly select the bearings that suit the application. So, how do we do it? The strategy is standardized and can be easily self-explained through the following process chart (refer to Figure 2).



— Figure 2: A process chart for a systematic analysis of effects of shock loads on the bearing performance and bearing selection

Mesys bearing calculation program helps to determine the overall load distribution inside the bearing (Figure 3 a) & b)) and based on that performs the bearing life calculation as per ISO 281. Together with this, program also estimates the influences of bearing and shaft-housing tolerances and temperatures on the resulting operating clearance in the mounting situation.

Similarly, Figure 4 shows the FE-Ansys full bearing model, which is then reduced to a single ball-raceway contact (Figure 4. b) to have an advantage of computation and convergence efficiency. This replicates the exact loading scenario and aims to simulate the detailed contact situations to determine the contact stiffness and deformation (Figure 4. c).

Based on the loading situation, resulting contact angles and pressure distribution (refer to Figure 3 b) can be determined. This makes possible to identify whether, under the shock loads, truncation of the contact ellipse occurred or not. Because this is a critical situation, that one should avoid. The maximum resulting rolling element load is extracted and used as an input for FE-Contact simulation.

In this way, we can make a qualitative as well as a quantitative statement whether the given shock loads tend to cause the plastic deformation or not.

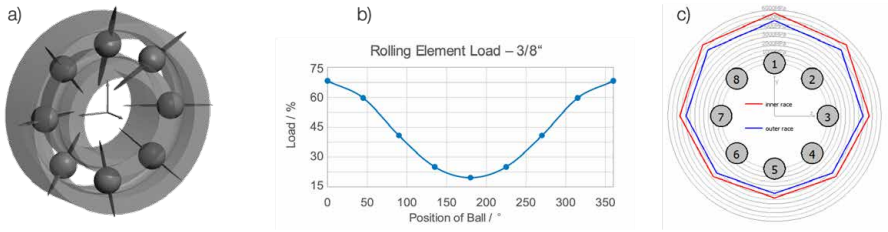
Nevertheless, an indentation test setup (see Figure 5) is developed to verify the simulation model. A single ball is pressed against a ring to find the impression. The indentation is optically investigated, measured, and evaluated (see Figure 5 d).

Static testing is followed by the dynamic noise and vibration testing to investigate the behavior and performance. It is made assured if in case under the shock loads truncation occurred, it is away from the running track and the operating behavior of the bearing will not be influenced when the bearing is operated under the normal operating conditions.

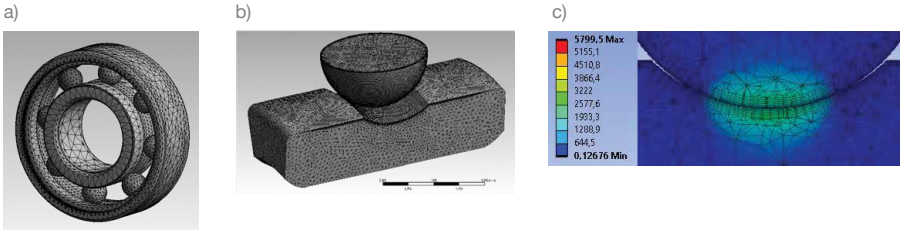
Recommendations

By performing the critical analysis, we can make recommendations; say for example, for the right bearing selection in the following ways:

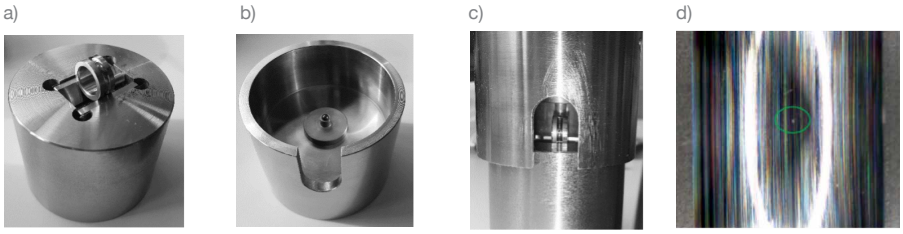
- Design Changes: We need to think of adapting the shoulder height of the raceway lands to avoid the truncation of the contact region if we recognize the problem with the selected bearing.
- Material Selection: In case the selected bearing is not able to ensure the expected static load capacity, then one must think of considering other advanced bearing materials that offer a higher static load rating.
- Bearing Dimensions: Even after taking into consideration the design and material changes, still, we are unable to achieve the static load rating that can withstand the expected shock loads, then we can think of the next bigger size of the bearing in the series and run the whole analysis systematically as mentioned to make sure that the customer requirements fulfill. Nevertheless, you have to make sure that bigger size bearings cannot always be the right solution, as you have to take into account the size-to-weight ratio of the applications.



— Figure 3: Mesys Bearing – Calculation; a) Mesys-Bearing Model - Loading situation inside the bearing; b) Contact loads at each ball-raceway contact; c) Pressure distribution under the combined load for deep groove ball bearing of type 3/8”, radial load 1200 N, axial load 1500 N



— Figure 4: FE-Ansys Simulation; a) FE-Full bearing model 3/8” deep groove ball bearing; b) Reduced model of ball-raceway contact with a fine mesh at surface & subsurface contact; c) Exemplary contact pressure for the maximum load of 800 N



— Figure 5: Indentation test set-up; a) Prism holding the ring; b) Punch holding the ball; c) Assembled situation; d) Indentation on the ring

These guidelines and recommendations from GRW can certainly help the designer to consider the factors arising due to shock loads, accordingly find the suitable solution of bearing selection for their applications, and avoid the potential failures of the systems.

More information can be found at www.grw.de

[1] *Frantz, P.P.; Leveille, A.R.: “An Approach to Predicting the Threshold of Damage to an Angular Contact Bearing During Truncation”, Space and Missile Systems Center Air Force Materiel Command, 2430 E. El Segundo Boulevard, Los Angeles Air Force Base, CA 90245, 2001.*

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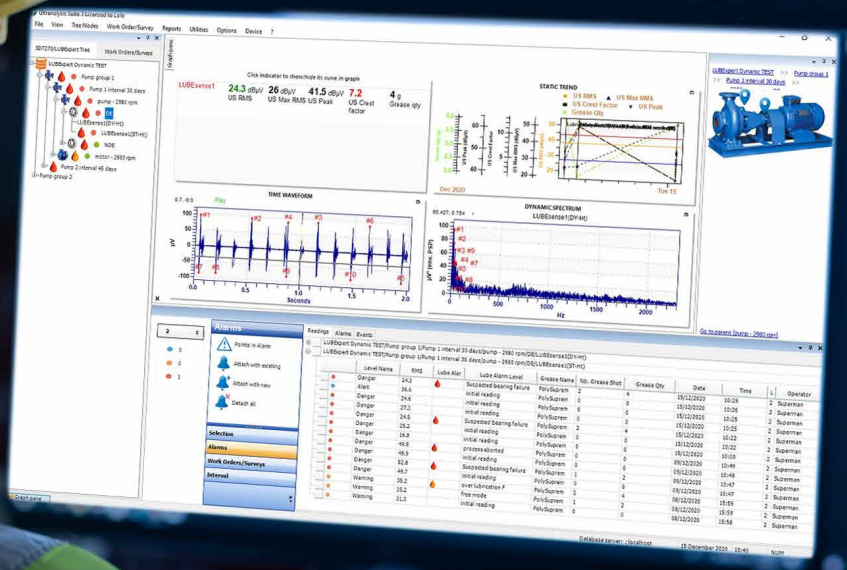

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Stories from the Melt Shop

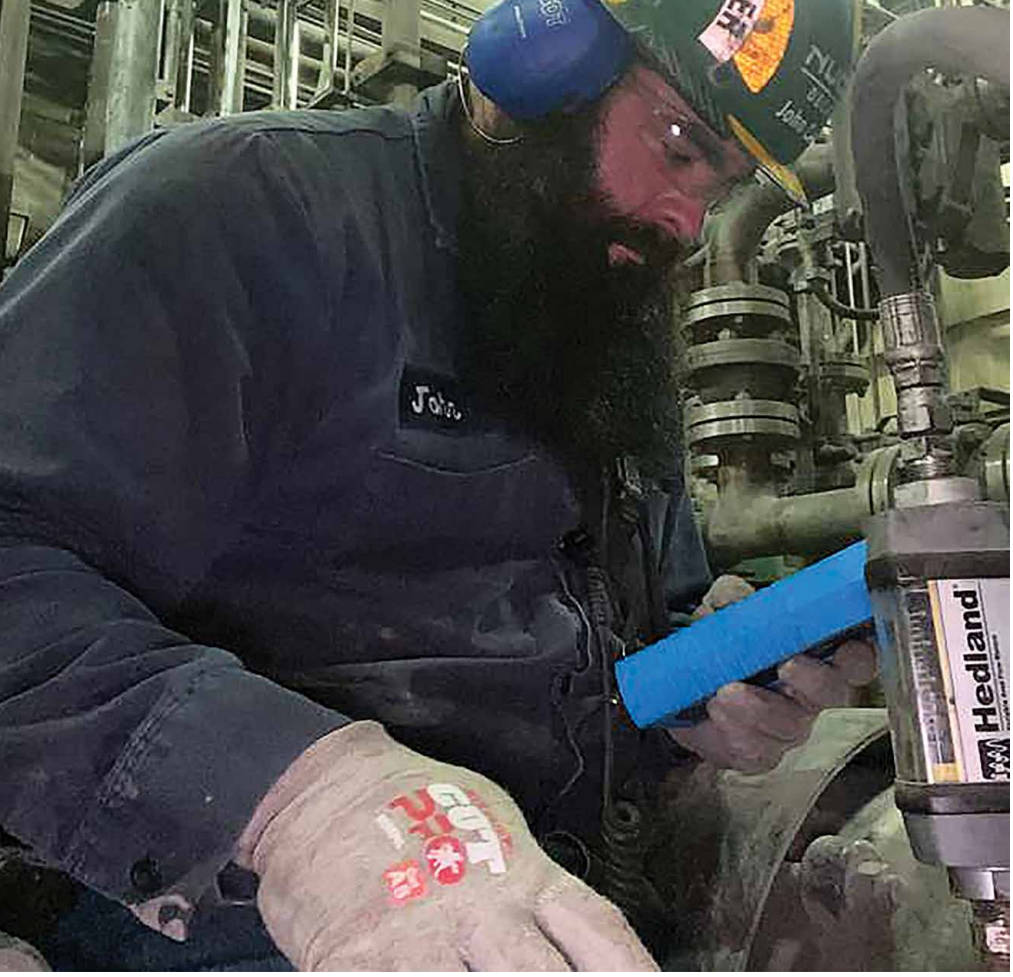
Level One Ultrasound Inspector, John Garrison's Testimonial & Case Study

John Garrison is a SDT Level One Trained Ultrasound Inspector working as a Melt Shop Mechanical Technician in Alabama. This is part of his reliability journey as told by him.

As a mechanic in charge of a portion of the mill, safety and reliability are a must for myself, my company, and our customers. Giving our Operations group the best equipment and training possible are key to our success. For years we have outsourced the vibration, oil, and thermal analysis of our predictive maintenance program, and for years we have thought it was acceptable. But I can recall many occasions when components said to be good, turned out to be bad, or components said to be bad, turned out good. It was clear that our reliability program needed more.

I was approached by management and asked to lead an ultrasound campaign to improve our reliability program. The first thing we did was buy an SDT270 unit. When it arrived, I found myself staring at an expensive, little blue box which I had no clue what to do with. Shortly after I discovered SDT had a Live Online Level 1 Class starting soon, so I registered. I was pleased with all the additional on-demand webinars, lessons, and hours of learning from experienced reliability professionals that also came with the course.

The structure of this class was phenomenal



and suited to the way I learn, who wants to sit in class for 8 hours a day? Definitely not me! This class takes place over 8 weeks, 2 classes a week, 2 hours each class. This helped me retain the information learned and gave me the time in between classes to go out in the field and practice what I had learned! Paul Klimuc, SDT's Level 1 instructor is very engaging with the class and gets students involved. He has a way of teaching that sticks with you. I was able to learn the 8 pillars of ultrasound, their applications to my facility, as well as the process of heterodyning which is how the SDT units converts ultrasound signals to audible signals for us to listen to, and much, much more! We also dove deep into the UAS3 software, learning how to build equipment lists, and work surveys. Each class began 30 minutes early for questions, concerns, or just general friendly chit chat, as well as ended late for more of the same. The most common theme throughout the course was Paul driving home the point of safety.

I would recommend this course to anyone interested in becoming more familiar with ultrasound regardless of current skill set. There is something to be learned for all levels of ultrasound inspectors. While some classes make you feel like a prisoner voluntold to be there, not here. It is fun, engaging, and flourished with a plethora of useful knowledge and information. In the short 8 weeks of this class, I have found several failing components in our mill. I've been able to prevent unplanned downtime multiple times by planning to change the components on our time rather than running them to failure.

Main Hoist Input Shaft Bearing on Crane

On June 2, 2021, I was asked to check a main hoist input shaft bearing on a crane. Vibration analysis is not very useful for this application because of the amount of vibration and movement the crane makes. We knew ultrasound was the way to go. Upon arrival to the crane, I began listening to the bearings on the input shaft and the brake drum side of the gear box. Immediately, I recognized something didn't sound right. I made it known to

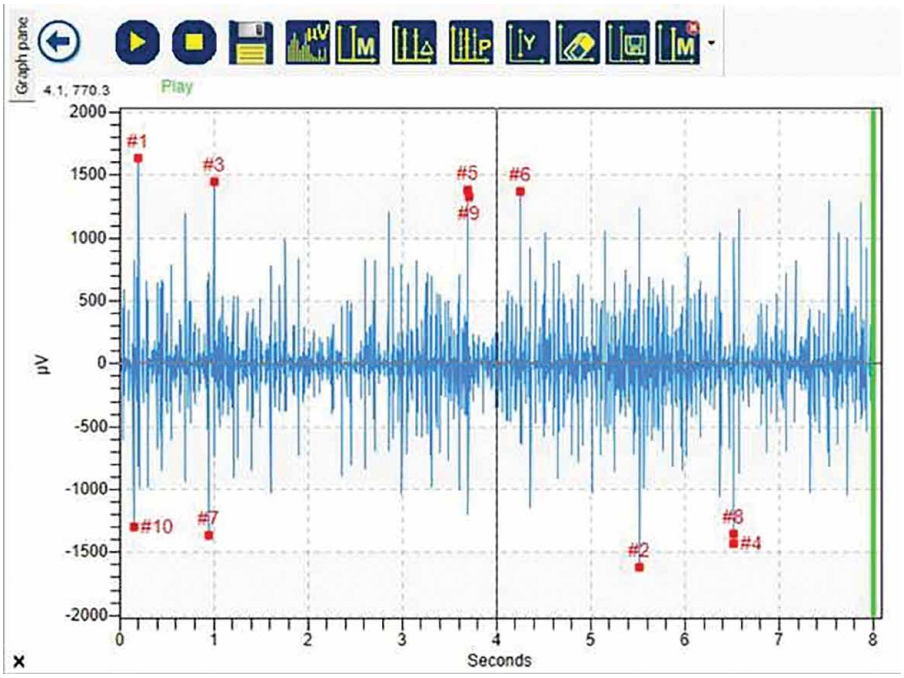
the crane technicians and went to upload the data to UAS3 so I could perform my analysis. I immediately recognized very high peaks in the wave form as well as an audio signal full of impacts.

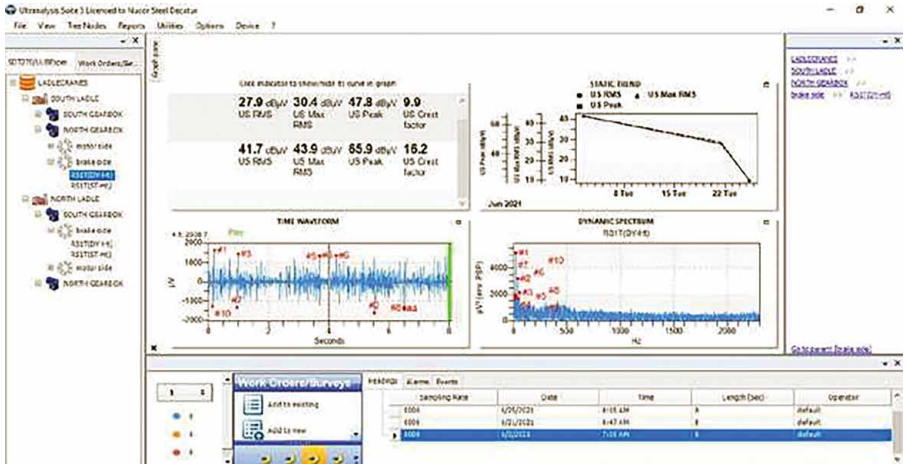
I immediately went back to the crane technicians to review with them the data I had found. I briefed them on the 4 condition indicators (41.7 dBµv rms, 43.9 dBµv max rms, 65.9 dBµv peak, and 16.2 crest factor).

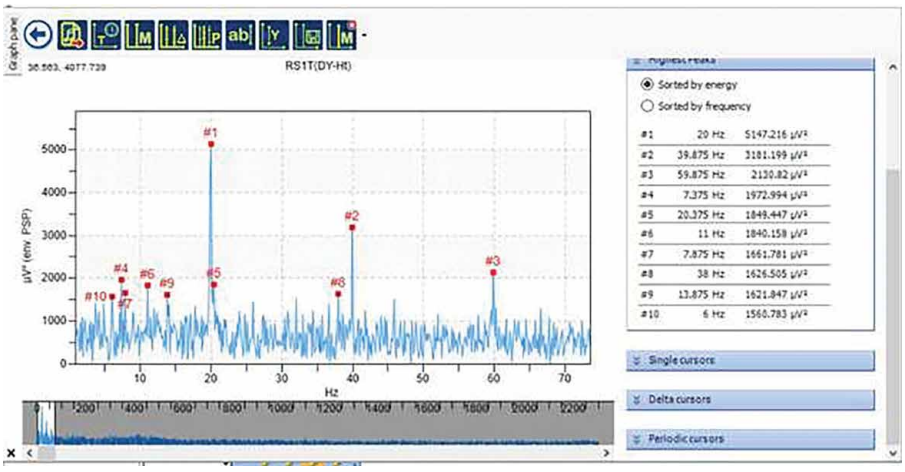
The crane crew technicians had two reservations... One being I haven't been doing ultrasound analysis long, and the other was that this was the newest bearing on the crane being installed less than a month ago. The resulting action was that the bearings weren't changed even though the following week was a down day and the repair could have been a planned. Unfortunately, it wasn't and two weeks later the bearing failed. The unplanned downtime to repair the damaged input shaft and replace the bearing took approximately 6 hours. The loss of production was expensive enough, not to mention the cost of parts and labor.

Since the repair was made, the crane technicians have much more belief in ultrasound technology, and we have been routinely monitoring the bearings on the crane.

The photo on the next page is the input shaft bearing right after being pulled out of the gearbox. As you can see all the rollers are gone and had to be fished out of the bottom of the gearbox. Fortunately, they didn't get caught in the gears causing further problems.







Pillow Block Bearing Analysis and Repair

Just the other day I was taking some bearing readings. Some of which turned out to be bad, so I informed the mechanics responsible for that area of the plant. Coincidentally, our vibration analyst contractors were performing their analysis on the very same bearings the next day. Their report came back indicating that the bearings were in fact good, causing debate amongst the mechanics as to whether the

bearings should be changed or not. After presenting my case with the 4 condition indicators, letting them listen to the audio of each bad bearings alongside their time waveform, and taking them to the bearings so they could feel the popping, and heat generated by the excessive friction for themselves, they opted to change them. It turns out the bearings were indeed bad. The vibration analysts couldn't believe it. They immediately started questioning me about ultrasound, and how I was able to detect problems with those bearings they weren't. I simply told them that SDT just ***"Hears More"***.

I will end this story on the most important thing covered in SDT's Live Online Level One Certification: SAFETY! I can now use my ultrasound equipment to do my job more safely, limiting break downs, and keeping my fellow team members out of harm's way. Sending my team home every day to their families the way they came to work is the most important accomplishment we can do in the industry. So, if you want to "Hear more" sign un for this course, you won't regret it! And with the words that Paul said in every class:

"FFF"

Family, Friends, and Fingers!

Authors:

John Garrison and Tristan Rienstra

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Navigating The Global Bearing Shortage

Awareness is the first step to preparedness for supply chain management

In March 2021, a huge container ship wedged across the Suez Canal caused severe disruption to global supply chains. According to one estimate, the blockage held up an estimated 9.6 billion of trade every day. For businesses that rely on global supply chains, a single event like this can wreak havoc. When multiple factors converge, you can face a prolonged crisis. Here, Chris Johnson, director of specialist bearings supplier SMB Bearings, explains why the world is currently facing an unprecedented bearing supply shortage.

Events like the Suez Canal blockage have served to demonstrate the fragility of global supply chains over the last two years. This is especially so in manufacturing industries, like automotive, which rely on just-in-time logistics. Over the last decade or two, buyers have become accustomed to the convenience of quick deliveries from anywhere in the world, whether that is in a consumer market or in a B2B environment.

The supply shocks unleashed by the pandemic provided a painful exposure to the fragility of global value chains and both companies and governments are formulating new ways of operating in a post-pandemic world. For those that rely on miniature bearings, a series of factors have converged to create an unprecedented strain on supply.

Those that rely on bearings are finding that these crucial components are increasingly difficult to get hold of. For example, as exclusive UK agents for EZO bearings manufactured by Sapporo Precision of Japan, we recently received a quote of 690 days for production time. Two years ago, we would have expected it to have been with us within six to eight weeks.

While this might be problematic for amateur hobbyists, it is potentially much worse for certain industries where bearings are key components in vital equipment. Bearing

failure can cause major safety issues and bring production to a standstill. Unless you can secure replacement components quickly, the financial costs of lost production can be severe.

The perfect storm

What is most unique about the current situation is that it is truly global in nature. Although some of the factors that are contributing to the crisis predate the coronavirus, it is the pandemic and its impact that bears significant responsibility for the current situation.

Shipping times increased significantly as flights and shipping were cut by approximately 75 percent during the pandemic. As many more people wanted goods shipped, such as personal protective equipment (PPE) during the pandemic, this put increasing pressure on services that were already struggling. The situation is comparable for air freight too. Prices rose dramatically as a result of the pandemic and although they will gradually return to a more sustainable position, they are unlikely to return to pre-pandemic levels.

Rising labour costs and ongoing worker shortages have also been a key factor. Here in the UK, we have seen an increasing number of workers retire early following the pandemic and we have witnessed major shortages of commercial vehicle drivers, with a drastic impact on supply chains. Although the situation is not identical in every country, similar problems with labour supply exist across the world.

As the factory of the world, events in China have a major impact on all of us, particularly those that rely on manufacturing supply chains. There are several factors contributing to labour shortages and rising labour costs

in China. An ageing population, combined with a low birth rate and low immigration has resulted in a demographic gap, while a mismatch between the type of jobs available and the skills necessary to fill them has led to an educational gap. With labour costs rising, many companies are relocating production to other Asian countries like Indonesia and Vietnam, a process known as near-shoring.

Increasing energy prices have also resulted in cuts to production. This can be partly attributed to the government's attempts to reduce pollution, which has forced many manufacturing plants to limit production. However, coal supply problems and other government policies have also contributed. Energy intensive sectors such as metals and cement production are expected to be among the worst hit.

Raw material shortages have also contributed, particularly for stainless steel bearings. China dominates global steel production. Between 2005 and 2018, the country quadrupled its share of the world's stainless steel, from 12.9 to 52.6 percent. Stainless steel shortages have driven up the cost of bearings. In comparison, ceramic bearings and plastic bearings, which are smaller batch production in any case, have been less severely affected.

In Japan, different pressures are contributing to the shortage. The rising cost of labour at a global level has made it too expensive to outsource production, encouraging some manufacturers to bring production back home. However, the result of this is that capacity is more limited. In some cases, it is extraordinarily high demand that is leading to shortages and increased lead times. That has been the case, for example, for EZO bearings.

Preparing for the storm

The situation is not expected to improve substantially over the next couple of years. In the highly unlikely event that there are no further shocks and disruptions, things might stabilise during this period.

Simply understanding the reality of the current situation is not going to solve the problem, but is the first step toward greater preparedness. Those that have relied on just-in-time deliveries will likely have to fundamentally change their approach to supply chain management, but anyone who has been accustomed to short delivery times is likely to find greater forward planning is key.

Holding stocks is one possible way of preparing for a prolonged bearing shortage. This can allow companies to respond quickly to shortages and protect against future price rises. However, if everyone reaches for this option at the same time it is likely to further increase demand at a time of limited supply. At SMB Bearings, we are doing our utmost to order ahead to ensure a plentiful stock of bearings and we will continue our approach of working closely with our customers to support them with our assistance and expertise.

Author

Chris Johnson, director at SMB Bearings. SMB Bearings is a specialist supplier of miniature bearings. To view the company's full range of stainless steel and ceramic bearings, visit www.smbbearings.com

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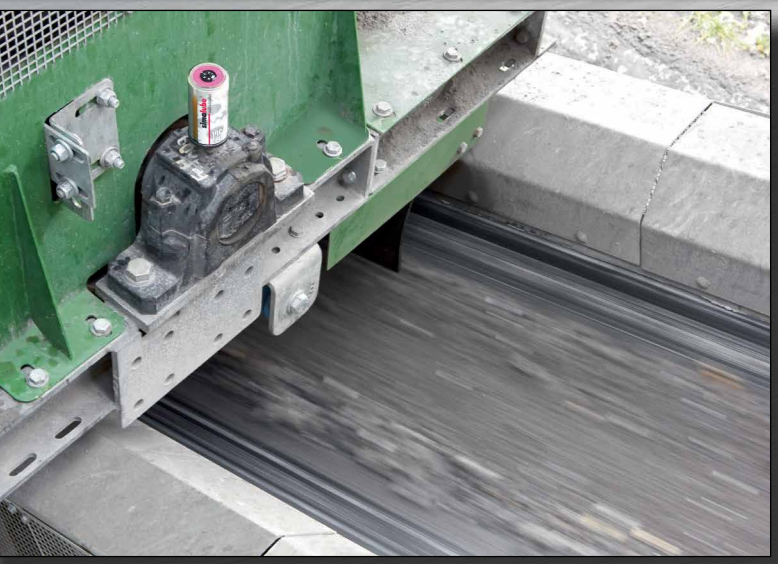

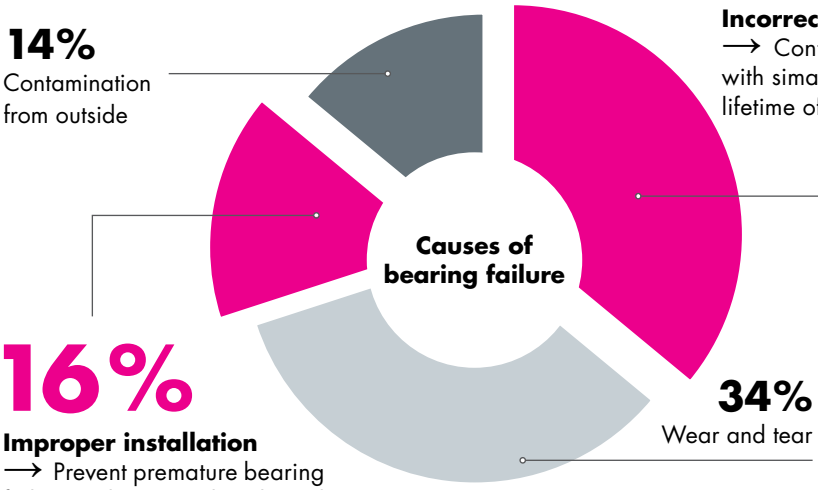

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More information on p.83

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acorn Appointed as the Sole Master Distributor for Nadella Linear Products in the UK

In January 2022, Acorn Industrial Services Ltd was delighted to be appointed as the sole Master Distributor for Nadella Linear products in the UK. ACORN® has been a key Distributor for Nadella for many years and this partnership has now been further strengthened, as part of Acorn's commitment to the brand and to providing their customers with even higher levels of service, product choice & availability, whatever the linear application may be.

With Brexit related issues causing delays and uncertainty in sourcing products from outside of the UK, there is a clear demand from customers for stock to be available within the UK for quick, reliable delivery. With this in mind, Acorn has committed to a very large stock of Nadella linear products which will be held at their Rotherham National Distribution Centre ready for dispatch within 24 hours of order. Acorn's stock includes a wide range of Nadella rails which can be cut on site to customer requirements, using specialist high quality equipment.

The UK market also has a strong demand from Special Purpose Machine builders and smaller OEMs for high quality linear products to be available for quick delivery. Many will be aware of the current global situation with product availability, whether caused by production delays, raw material shortages or shipping challenges. Acorn recognised these developments in early 2021 and has taken actions to ensure availability of their products remains as high as possible. Holding the right stock is a key part of that and this is a strategy to which Acorn is committed.

Nadella linear products are primarily based around rollers, rather than recirculating ball bearings. Recirculating bearing systems are very common in profile rail guide systems. Profile rail guide systems are now very common components in many machines and automation in general. However, they are not always the optimum solution for linear guidance.

In applications where there is a high degree of contamination, or other similar harsh environments, profile rail guide systems can be problematic. Contamination enters the recirculation system and commonly causes poor performance and even premature product failure. It is almost impossible to clean out this contamination once in the recirculation system. Whilst there are various seal options to help in mitigation, none of these are 100% effective in many applications. Nadella uses sealed rollers running primarily in 'open' rail guides.

In this manner contamination cannot enter the rollers and can easily be cleaned from the rail guides. Stainless steel products and special surface treatments are also available, if demanded by the application.

Profile rail guide systems are also very demanding with regards to a suitable mounting surface and rail alignment. These requirements can be costly to implement, as a result of increased machining and installation time & difficulty. Nadella uses fixed rollers combined with floating rollers; in this way alignment tolerances are far greater than profile rail guide systems (e.g. typically 0.5-1.0mm, rather than 50 microns [50/1000th of a mm]). This can result in a considerable cost saving, as installation is quicker & much more straightforward.

Acorn's dedicated Linear Division has grown significantly since its inception in 2007, to now being the leading UK stocking Distributor of linear products.

For further information about Nadella, contact our specialist linear division at linear@acorn-ind.co.uk or visit www.acorn-ind.co.uk/nadella.

Acorn Industrial Services Ltd is part of Axel Johnson International, a global industrial group of more than 150 companies in 30 countries. Axel Johnson International drives business development and growth through a long-term approach to ownership in strategically selected niche markets, primarily technical components and solutions for industrial processes.

Axel Johnson International is organised in six business groups: Fluid Handling Solutions, Industrial Solutions, Lifting Solutions, Power Transmission Solutions, Transport Solutions and Driveline Solutions. Axel Johnson International is part of the Swedish family-owned corporate group Axel Johnson (www.axinter.com).

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SKF® Enters a New Era *with* **Rickard Gustafson**

Rickard Gustafson,
CEO and President at SKF

Rickard Gustafson,
CEO and President at SKF

Bearing industry leader, SKF, recently welcomed Mr. Rickard Gustafson to the position of CEO and President. The BearingNews editorial team had the distinct pleasure of sitting down with Mr. Gustafson to candidly discuss his new role. In this exclusive interview, readers are provided a unique opportunity to hear directly from one of the industry's most prominent new leaders.

Mr. Gustafson brings a breadth of professional experience to SKF. Having held previous leadership roles within several well-known organizations, he is most notably recognized for his decade long tenure as CEO of SAS. Now, with a keen understanding of the bearing industry, Rickard Gustafson weighs in on current trends, objectives, and future insights, with particular attention dedicated to the utilization of technology, the importance of sustainability, and finally, the capacity to navigate today's rapidly evolving world.

Q: First of all, we would like to congratulate you on your new position at SKF. Can you tell us more about your background? Who is Rickard Gustafson?

It's my pleasure to be a part of this very iconic company, SKF, a company with such a global footprint. I have an engineering background, (a long time ago) I graduated in 1989 from the University of Technology in Linköping Sweden. I joined what is now known as Accenture for 7 years, back then it was Anderson Consulting. Following this role, I spent 10 years with GE and GE capital in various positions, and eventually I became the CEO of a property and casualty insurance business here in Scandinavia called Codan/Trygg Hansa where I spent 7 years running that company. I was recruited to lead the flag carrier here, Scandinavian Airlines, SAS, and I did that for 10 years. And since June 1st I'm here at SKF, so I'm delighted. It's a new industry for me and a new company.

things we are already doing. We have set very ambitious targets for ourselves. For scope 1 and 2, we will be net zero by 2030, and as of today, some of our facilities are already net zero. Such as the one here in Gothenburg for example. For Scope 3 are aiming for net zero by 2050 and the reason why we need a longer time is because we need to transform the steel industry so that we can source green steel and that is going to take a bit longer. So those are things that we do. But our products, they also serve our customers well in order to help them to transform their businesses towards a more sustainable future.

Because the whole idea of the bearing is to increase energy efficiency and reduce friction, it's a natural thing for us to support our customers. And we do that through innovation. I'm excited about the activities we have now for remanufacturing of bearings to create a circle, rather than a constantly re-buy and re-make. You can actually re-manufacture the bearings, I think that's exciting. I also think it's exciting

Q: What will be your strategy for a profitable growth and sustainable development for SKF in the coming years?

We have initiated a rather comprehensive strategic review process that is not yet completed. We aim to announce in the beginning of 2022. Basically, what we have done is that we are taking a very holistic view on our business, looking into the big mega transport, how they will impact our customers and thereby us longer term. We are scrutinizing our portfolio looking into the profitability and potential in all parts of our portfolio, and based on this, we will articulate a strategy going forward. Even though I can't go into many details, I think some key components that will be part of that. We do see some industry segments that are likely to grow very rapidly in the years to come. And of course, we want to be there. And most of them are linked in some shape or form to the ongoing transformation to a more sustainable future. Wind, rail, electric vehicles and so forth. So, we are going to play there.

> "For scope 1 and 2, we will be net zero by 2030, and as of today, some of our facilities are already net zero. For Scope 3 are aiming for net zero by 2050."

Q: You are remembered for your sustainability initiatives at SAS, which became the starting point for a new era in the entire aviation industry. May we expect a similar trend and change within the bearing and power transmission industries?

I do hope so, I think within any industry we all need to do everything we can to transform our businesses towards a more sustainable future, and I will be keen to do whatever I can to ensure that SKF is perceived as a leader within our industry and think there are number of

to see our leading technologies in some industries such as magnetic bearings, which will be vital for hydrogen conversion. Hydrogen will require a lot of compression, and magnetic bearings fit very well into high-speed rotation which will be required in compression. So, there are a number of things we do both internally and then of course to help our customers by using our products to become even more sustainable. So long answer to your question, but the short answer is yes, you should expect the same.

I think it's also going to be a lot about ensuring that we connect digitally, the entire supply chain. I think that is going to be key to come close to our customers and even closer to the customer needs, and we understand that. And the journey that we started a few years ago and the trends that we see that would, what we call **"region for region"**. You need to have a manufacturing footprint so that you're fairly close to your customers in different regions, and that will be part of our journey going forward. So again, I need to ask for your patience, you will get a more comprehensive

Rickard Gustafson,
CEO and President at SKF

story from us in early February next year, but we do see a number of exciting opportunities for SKF going forward.

Q: What are currently the biggest challenges for manufacturing industries?

Short term is obvious, the challenge we foresee related to logistics, related to cost inflation, we have experience in raw materials, now its energy costs that are going up. Costs for logistics are extremely challenging and now we are starting to see the cost for labor is increasing across different regions. So, those tactical things, and our ability to actually deliver to our customers, it's something that we are wrestling with every day, but hopefully those are short term issues. Longer term, there are a few key things that we need to get right, one that I mentioned is to transform the footprint, so we have the right footprint in each region. And it's not just to build the manufacturing capacity in the different regions, but we need to build very robust supply chains in all regions, so you can source your entire supply chain in a robust and effective way in those regions that you plan to operate. This is a massive work that will be undertaken in the years to come from most industrial companies to rebuild some of those capacities.

Europe that also supports other regions, so for us, our European challenge will be rather how do we automate, and how do we consolidate our capacity in Europe. In other regions, such as Asia or North America, we focus partly on consolidation, but it's more about building new capacity to replace some of the capacity that is being sourced from Europe to be sourced more locally. The journey will look bit different depending on your starting point.

Q: New technological innovations are creating, more than ever before, fully integrated systems, with various benefits such as production automation, energy saving, and machine learning. How do you see this trend evolving in the coming years? How will this shape the future of manufacturing?

I do see that this will significantly change a traditional manufacturing company. Today, when you walk into a facility that has been upgraded to the latest technology it's a completely automated environment, highly robotized, it's hard to distinguish a traditional blue-collar job from a white-collar job. They blur because those colleagues of ours that man those production lines, are primarily monitoring the whole digital flow and also making adjustments, digital adjustment to the equipment, rather than working at the machines themselves.

> "The buzz word digitization will become a reality"

Q: Do you foresee that the reshoring of manufacturing will speed up back in Europe, the US, or other regions?

Broadly across the board, but depending on your starting point, it might look a bit different. For us, we have a long history and a rather large footprint in

That's the starting point. Going forward, I think we are going to see much more sensors coming into this, we capture a lot of data, in the whole manufacturing footprint. How we leverage that data is going to be important for predictive maintenance, for quality enhancement, and so forth, that's going to be key.

Related to sustainability, traceability is going to be key over time. The end product needs to be marked so that you can fully understand and have an audit tract on the footprint (CO_2) of that component all the way from the steel that went into it how it was manufactured when it was manufactured, in what batch and so forth.

Again, that is going to be one thing. And that whole thing I mentioned about remanufacturing is going to be bigger, how we are going to integrate some of those loops. Again, when we have sensors out with our customers, we should be able to, in a much smarter way, provide predictive maintenance, so we can do the re-manufacturing when they have their planned stops in their own production lines for their maintenance, so we can avoid un-planned stops or breaks in our customers production environment.

So again, the buzz word digitization will become a reality, not just a buzz word. But truly how we use data, and integrate that through our value chains and in our production lines going forward will be important.

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- Self aligning ball bearings
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When To Use A Thin Section Bearing **To Boost Performance?**

It would be difficult to imagine how the modern industrial age would have developed without...bearings. Every kind of machine that requires motion makes use of bearings in some way to smooth their path and reduce friction and such an important piece of technology has a long and well documented history stretching back to the stone-age. A huge leap forward in the development of bearings was helped by improved metal forming processes at the start of the industrial age which is when Philip Vaughan received a patent for a ball bearing made of steel in 1794, the design of which became the basic blueprint for today's ball bearing.

Fast forward to now and the ubiquitous ball bearing and bearing assemblies continue to be vital motion control components within a huge range of industrial and manufacturing machines. Today, the rapidly increasing demands of **robotics** and advanced automation has seen the development of more compact, lightweight thin **section bearings** and these high precision components have become essential across many industries. For example, **aerospace, defence, satellite systems, optical lenses, semi-conductor** manufacturing to camera gimbals.

Oxfordshire based **precision bearings specialists CARTER MANUFACTURING** are the European Distributors for **Silverthin Precision Thin Section Bearings** and offer many years of experience in the application and use of thin section bearings.

Why use a thin section bearing?

Typically where applications have critical space and weight restrictions yet still have loading and torque requirements which demand a bearing solution but without the space and weight requirements of standard deep groove ball bearings. There are various definitions used in the industry to highlight the difference between 'standard' section bearings versus thin section with the most common being when the bore diameter is more than 4 times greater than the radial cross section.

Whilst cross-sectional size can vary, it is typically 2 x the ball diameter. Of course one design won't suit all applications which is why these types of bearings are generally available in a variety of configurations. These are; radial, angular contact, 4-point contact, full complement, duplex pairs and different cross sections.

How do you select the best thin section bearing configuration?

Selecting which type of thin section bearing configuration is usually driven by the type and magnitude of loading required in the application. In environments with axial loads present in one direction, **Silverthin** recommend their A-Type angular contact ball bearing which also works well in radial or combined thrust applications. However, this option on its own is not best suited to applications which require the support of moment loads, or reversing axial loading. Contact bearings, such as Silverthin Type-C bearings are the best choice for these situations as their deep ball grooves have the ability to withstand higher loads.

Although this type of bearing is used primarily in applications with radial loads, it can also withstand moderate axial loads, reversing axial loads and also moment loads which **Carter** is best placed to advise on.

What about applications demanding heavier load capabilities?

Where significant moment loads prevail Carter would specify their Silverthin Type-X point, or 4 point contact ball bearing option. This is designed with 'gothic arch' raceways to create 4 contact points between the balls and the raceways and is recognised to be excellent for moment loading and also for reversing axial loading. Carter says that whilst the X-Type bearing can also be used for other light loading conditions, it is not recommended to replace the C- or A-Type bearing for pure radial loads.

As a general rule, Silverthin advises that when specifying the X-Type of bearing for axial or moment loads combined with radial loads, the application speed (RPM) needs to be carefully considered. Carter's engineering department has extensive data available and can supply information on combined load, limiting speeds as well as advising on radial bearing use with combined radial loads, with axial or moment loading and for limiting speeds and separator selection.

Understanding the difference in types of thin section bearings?

When the main application specifics, such as space, load and other operating conditions are determined, it's then time to consider the type of thin section bearing to use. Thin section bearings are often used where wiring or tubing passes through the bore in a hollow shaft, such as a slip ring, or in wire forming machinery. They are also used in mechanisms such as Gimbal platforms within optical and targeting systems on ships, aircraft and also in radar and satellite communications equipment on land, sea and air-based.

Are there other applications for thin section bearings?

They are ideal for achieving smooth action in articulating parts such as in the elbows of robotic arms, or other articulating joints and can also be used in all types of work holding devices such as turntables, indexing and rotary tables.

Carter can provide application advice on all aspects of their Silverthin thin section bearings so are well placed to deal with design challenges where space is at a premium and repeatability, combined with absolute accuracy and longevity is vital over prolonged periods of time.

The precision thin section bearings they offer are in sizes from 1" ID (Internal diameter) specified for uses that are as light as miniature gimbal mounts on satellites, up to 40" OD (Outer Diameter) for large rotary tables for both commercial and military applications.

More information at www.carterbearings.co.uk/bearings/thin-section-bearings

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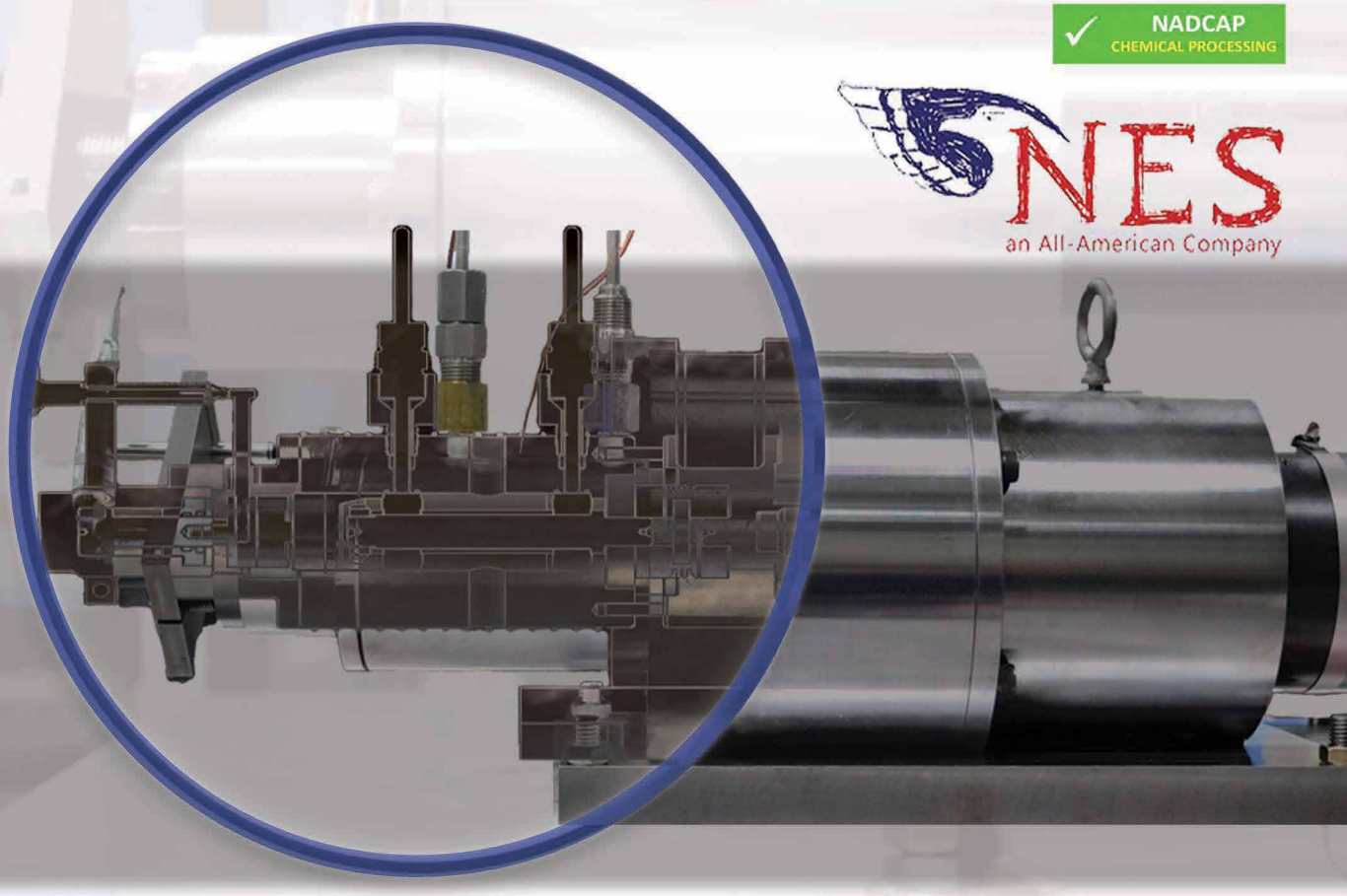

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NSK Self-Lube® Bearings prove reliable in harsh conditions

NSK Self-Lube® bearing units with triple lip seal and end cap protectors provide an extended service life in harsh operating conditions, such as those prevalent within the quarrying, mining and construction sectors. This proven performance is vital in these industries, where contaminants can easily penetrate poorly specified bearings, bringing machinery and equipment to a halt.

Downtime is the enemy of quarry/mine operators and construction project managers. Critical plant and equipment must offer reliable performance to meet demanding output targets, project deadlines and budgets.

Whether extraction, transportation, preparation, separation or enrichment, these processes are subject to contamination and debris, not to mention heavy loads, shock loads and vibration. Bearing selection is vital to ensure long service life. Getting it right means that mining and construction sites can maximise their uptime and productivity while simultaneously reducing maintenance costs.

—Self-Lube® bearing units with triple-lip sealed inserts are ideal for applications where bearings face exposure to dust and water contamination

Leveraging state-of-the-art design, material, lubricant and seals, NSK Self-Lube bearings exceed the life of conventional bearings. Furthermore, by selecting Self-Lube bearings with triple lip seal and shaft end protectors, it is possible to reduce the costs associated with downtime and repairs.

Reliable protection

NSK recommends its specially developed triple-lip seal for applications with a high degree of contamination. Bonded to a protective outer steel pressing (secured in the outer ring), this one-piece moulded nitrile seal with three lips makes for a highly efficient sealing design that protects the bearing in severe operating environments.

Standard Self-Lube bearing inserts also have a locating groove to allow the easy fitting of an optional end cap protector. The cap helps to protect personnel from rotating components and the bearing from external contamination.

NSK Self-Lube bearing units comprise a broad portfolio of reliable inserts and housings. Notably, these cost-effective solutions provide a fast and straightforward solution for mounting bearings without the need for complex housings or special shaft arrangements.

Reduce costs

The combination of easy use, self-lubrication and long service life mean that increasing numbers of companies in the quarrying, mining and construction sectors are now reducing their costs for replacement bearings, maintenance and downtime. A case in point involves a company that was experiencing frequent reliability problems with the bearing units assembled in a vibrating drum. These bearings work in severe environments, where they suffer exposure to sand that often wholly covers the units. In addition, due to the nature of the application and its difficult access, the regularity and increasing cost of maintenance was proving an issue.

— NSK's specially developed triple lip seal is a one-piece moulded nitrile seal with three lips for maximum protection against contaminants

— Self-Lube® end cap protectors help to protects personnel from rotating components, and bearings from external contamination.

Following a comprehensive failed bearing analysis as part of its AIP Added Value Programme, NSK proposed Self-Lube bearing units with triple lip seals, which increased the operating life by a factor of 10 against the previous solution. In addition, the three highintegrity nitrile seal lips with lubrication traps have provided an effective way of stopping the ingress of contaminants.

Design innovation

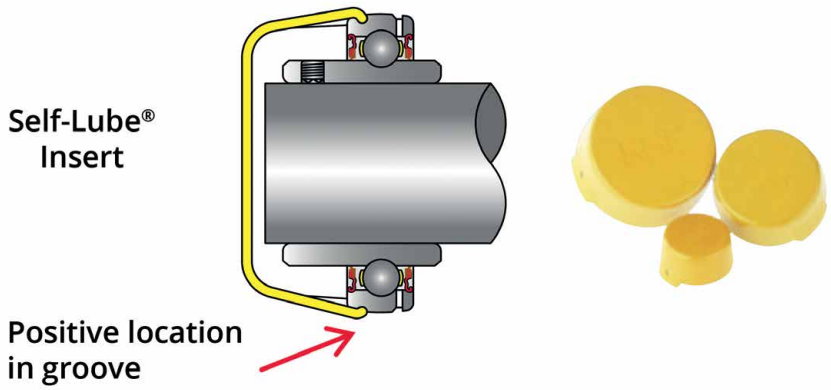
In another customer success story, a company supplying ready-mixed concrete and other construction materials invited NSK to perform an application review of its augur screw pump bearings. The augur pumps transfer ash (an abrasive mixture of ash, sand, glass, fibres and metal grit) into waiting containers. Here, the screws lift the ash at an angle of approximately 40 , where the lower bearing units frequently fail.

Upon examination of the failed bearings, NSK was able to identify several issues. For instance, after removing the flinger seal, it was evident that no contact seal was running against the inner ring of the bearing. It had likely worn away, and there was now a direct contamination path into the bearing. Further problems included heavy cage corrosion and the absence of lubrication. The ingress of fine dust and particulates had probably soaked up any grease and created a grinding paste, eroding the rubber seal.

To rectify the situation, NSK again recommended its Self-Lube bearing units. In this case, NSK also suggested the inclusion of a small disc plate with an additional seal. This minor redesign would help stop most of the contamination and significantly reduce pressure on the bearing seal as it features a path for the debris to escape.

By further improving the sealing, using the triple lip sealing solution on the Self-Lube insert bearing, it is likely that reliability will significantly improve. In addition, the use of an end cap protector for the bottom bearing could also benefit the company as it will help reduce any dust ingress.

These examples are just two of many successes that NSK is encountering in quarrying, mining and construction applications.



— Self-Lube® end cap protectors easily clip into place on the outer ring of the bearing insert.

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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A 30-Year Journey

To Become the World's Most Competitive Special Steel Group

Interview with Mr. Wang Wenjin,
Executive Vice President at CITIC Pacific Special Steel

CITIC Pacific Special Steel had reached today a total production capacity of 15 million tons and 2 million tons of bearing steel sales a year. The company has become a strategic supplier and partner for all the leading bearing makers, who's bearing steel products are widely used in automotive, wind-power energy, high-speed railway and other premium industrial applications.

Mr. Wang Wenjin, Executive Vice President at CITIC Pacific Special Steel

Q: Can you tell us more about your history at CITIC, your background and current activities?

I have been working in front-line sales in special steel industry for 31 years. My first job started in Daye Special Steel, which is now also a steel plant under CITIC Special Steel Group. As the executive vice president, I am still directly responsible for sales. To me, it is a very pleasant experience to be with sales and customers! In China, I am one of the few special steel professionals who have been working in front line sales consecutively for more than 30 years. After many years of baptism of wind and rain, I am still discovering new knowledge and

opportunities, and deeply in love with the special steel industry and the sales work.

Q: What is the main reason why CITIC grow so fast from 1990s, from a small local steel mill to a global player?

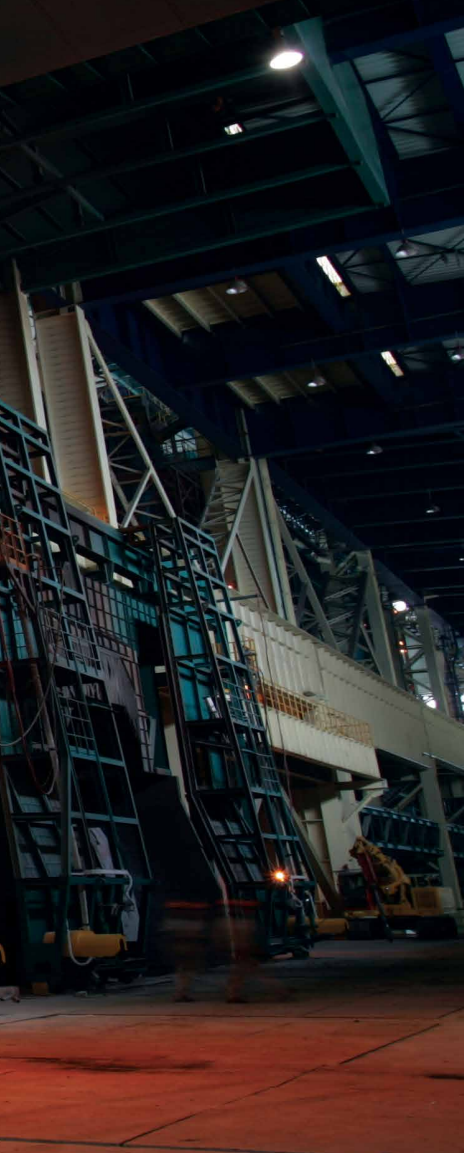
Among many factors, I believe the core key to our steady and rapid growth is “stay true to our founding mission with consistent execution”. Despite from time to time we saw competitors invested less but made more profits in regular steel products, we withstood the "temptation" and continued to unswervingly focus on what we do best - special steel, invest in equipment, technology and talents to meet the needs of world customers. The industry calls CITIC the “united nations” of special steel technology and a melting pot for talents, because top technical and business talents with different backgrounds continue to join our team. Our company founders and core management team have also taken this industry as the direction of our company and their own personal career development since the very beginning. To be honest, special steel has been integrated so much into our blood, it is impossible for us to deviate.

Q: How did the current pandemic impact the activities at CITIC so far? Which challenges have been faced since the start of the outbreak?

The epidemic has indeed posed significant challenges especially at initial stage, including external logistics. Our strategy is to focus the work that we can control and make them perfect. We keep our production running at 100% in the epidemic, even during the Chinese New Year holidays. Another factor that has made us overcome many difficulties is the full understanding of our social responsibility. With our continuous supply, many downstream enterprises including world key bearing producers can continue supply much needed products to societies. Many customers wrote letters to us to express their sincere appreciations! It is worth to mention that, in a market of short supply, despite many large companies offered higher prices to buy additional materials, we continued to supply our long-term strategic customers according to contract prices and not sell the materials to others for more profits. But in retrospect, yes, the pandemic was difficult to cope with.

Q: How is the impact of the changing supply chain strategies and increasing raw material prices on the industry?

There are indeed some negative effects, especially for a special steel company like us with customers in different industries across the globe. Supply chain cost factors such as shipping and fiscal policies by some governments to cope with epidemic and economic problems tend to continue increase special steel price in near future. We will adhere to " stay true to our founding mission with consistent execution”, perfect the work to control factors under our control, and serve customers, especially long-term



customers, from a strategic perspective. If we maintain our comparative advantages, we can continue to meet customers' needs and effectively help them cope with current and future challenges and changes.

Q: Do you see the trend of Green Steel a challenge or as an opportunity to your company?

Green steel is a clear advantage for us. When seeing the red crowned cranes, a level-1 national protected bird, and black and white swans in a large number living and raising families on our steel mill campus, visitors were all impressed by the achievement of our environmental protection work. They know such birds can only live with very good air and water quality. In terms of environmental protection and carbon reduction, we have been investing heavily and now have a good accumulation of equipment and technology. At the same time, we are actively planning to make additional investment and development in near future. It is part of our culture to do better than what we say. Some companies may be temporarily ahead in publicity and green steel advertisement. But we believe improving on green is just like improving on quality, it requires long-term and sustained effort, focus, and disciplined execution, all of which are what CITIC team is good at. I hope we can publish a specific article on green steel on your magazine to let the world hear the green voice of China's special steel industry.

Q: Besides the shear volumes and competitive price, what are the other competitive advantages and values you can bring to the bearing industry?

It may be that China speed is too fast, there are still people abroad lack a comprehensive understanding of China special steel enterprises' actual capabilities and development level. While the published production capacity data is easier to see on a chart, the internal performance, quality and service levels sometimes are not. In fact, our current equipment, technology, talent pool, as well as ability for future additional investment are now all leading in the world. All these ensure that we can provide the most comprehensive and effective values to global customers and help them win in the fierce competitions in their industries. The world's top bearing companies all have certified and been using our steel for a long time including on most demanding applications is a good proof. Here I would like to welcome worldwide bearing producers and special steel industry professionals to contact and visit us to see and learn our capabilities.

Q: How do you see the future of the steel industry for the coming years ahead?

In future, as mankind's pursuit of a better life gets higher and higher, the demand for critical industries and materials will increase greatly. This is true for both China and the world. For example, people will move more business and social activities, even residence, from land to sea. This trend should result increasing demand of relevant materials including special steel in both volume and performance and offer a significant and long-term growth opportunity for global special steel companies who are able to deliver the values. To summarise, I have full confidence in the future development and growth of special steel!

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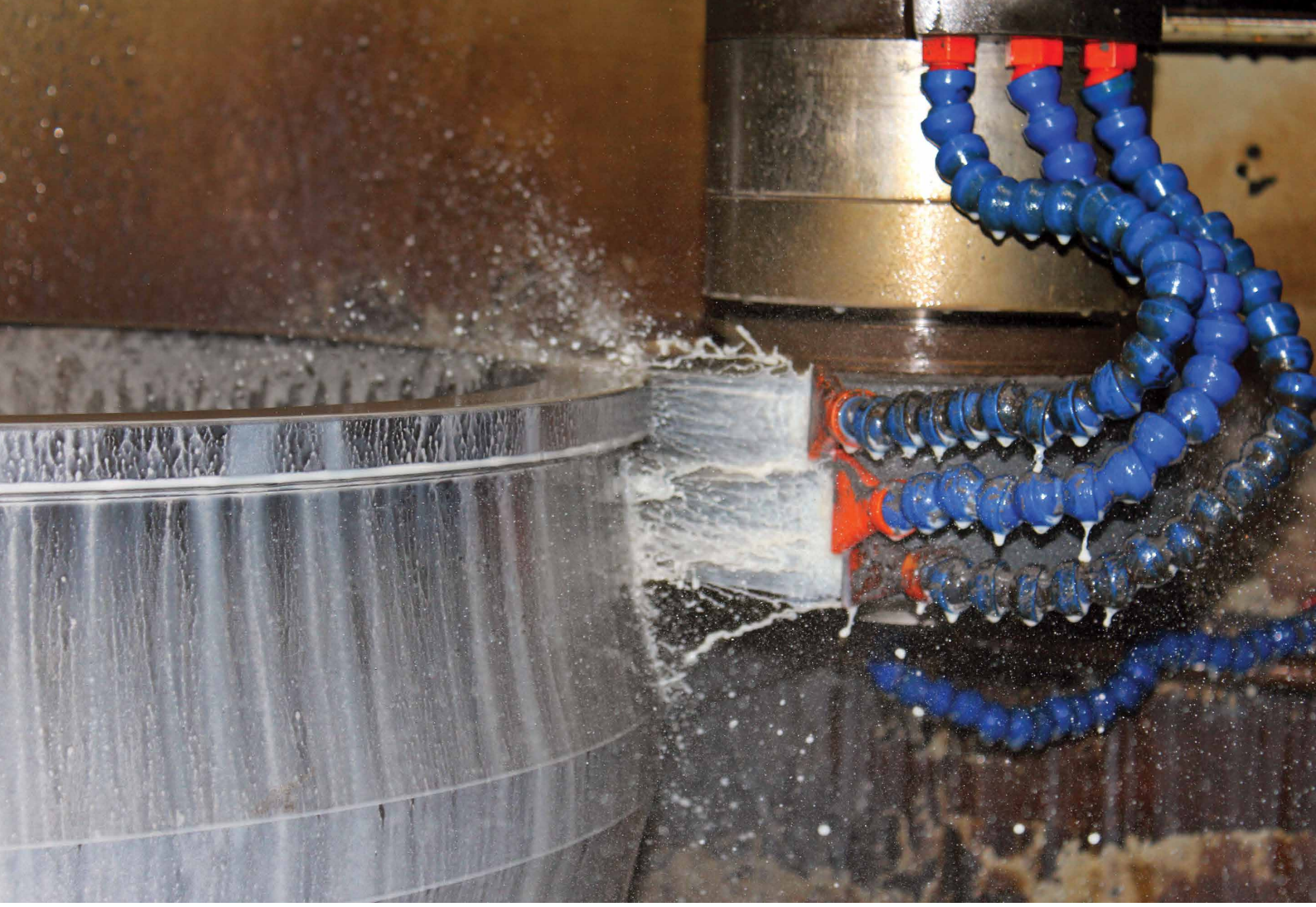

RKB multi-level quality control system for rolling bearings

It is a widely shared statement that, regarding manufacturing, effective execution of all production stages is compulsory for actually achieving high-quality, competitive products. RKB fully complies and supports this integrated production framework, in which each stage preserves its distinctive status and contribution in the production chain. This presentation focuses on the RKB multi-level quality control system for rolling bearings.

A reliable, exigent, comprehensive, and well-organized quality control system is a must for producing high-performance rolling bearings. The RKB quality control program is rooted and sustained by our entire team's focus on quality, encompassing controls performed on multiple levels, from raw material procurement to pre-process and in-process operations and ending with post-process check activities.

As a part of the RKB Technical Division, the Quality Control Bureau is the main operational structure dedicated to creating quality procedures and performing tests and measurements to issue the quality certificates throughout the manufacturing process.

Quality Control Bureau first comes into play during the choice of all RKB suppliers. In this sense, the raw material selection process is one of the most critical topics. It is of paramount importance to provide customers with products of the highest possible reliability, and this implies, among other prerequisites, the use of only high-class raw materials. Besides the certificates provided by RKB suppliers, before allowing the clearance to its perimeter, the Quality Control Bureau arranges for its specific tests inside HQ's laboratories and facilities. The raw material quality control performed by RKB applies to both through-hardened and case-hardened steel, being based on multi-test inspections, according to our Material Guidelines and Protocols. Our advanced equipment and experienced personnel make possible the achievement of one of the most important tasks: the correct evaluation of steel cleanliness level. It is a crucial task in tribology, letting the real bearing life meet the minimum life estimation, theoretically calculated according to the fatigue theory.

Following confirmed positive results of quality controls on raw materials, the pre-process control level is performed. This procedure mainly involves the use of masterpieces for rings and rollers manufacturing. The masterpieces are extremely accurate bearing component prototypes. They have high-quality machined surfaces and very tight ranges of dimensional and geometrical tolerances and are used to calibrate the measuring instruments involved in the production process. The decision to use masterpieces for all product lines rises from the need for more precise and, therefore, reliable products. We produce the masterpieces with ultra-high precision machine tools endowed with the latest technologies. Using them reduce manufacturing time and errors, ensuring long-term consistent top quality. The final approval implies accurate measurements of the dimensions, geometrical and surface quality parameters, using precise measuring instruments, in a strictly controlled environment, according to main International Standards and internal protocols.

The in-process quality operations refer to the controls performed throughout the strictly speaking "bearing manufacturing process". They ensure consistency in product quality during all stages of bearing production by adopting the most modern and advanced quality control techniques in forging, heat treatment, machining and assembly.

More in-depth, after the raw material approval, the forging process begins, encompassing steel bar or ingot cutting, heating, upset forging, or upset pressing and rolling. Every steel bar or ingot lot enters the forging area accompanied by the related Quality Control Data Sheet that specifies, besides other data, type and quality grades of steel, dimensions and weight of the material. This way, according to the Forging Operational Plan, the technicians can easily set the correct heating temperature ranges and forging ratios, which are crucial parameters for this process. After forging, the components are dimensionally examined, and the relevant data is recorded.

All our bearing steels are heat-treated in-house to get optimum mechanical properties and the complete traceability of the process. After the heat treatment, we check a series of parameters concerning form, hardness, and microstructure. If the test results are below the specifications set by the afferent applicable International Standards and RKB internal protocols, the cause of the error is determined, and all suspected components are isolated and carefully reinspected after the corrective actions are applied. Whenever they are recoverable, they can be properly retreated once again. To get complete traceability, RKB records all the parameters specific to every lot in a special database.

The quality controls connected to the machining process start with the set-up of every machine tool according to the RKB production method. RKB specialists and operators verify these settings at regular intervals during production through inline quality control and at the end of each single manufacturing phase, according to RKB Quality Control Plan.

At the end of every turning and grinding operation of rings and rollers, a check for compliance with the tight tolerances of masterpieces is then performed. An integral calibrated system that ensures all measures are within the allowable tolerances and under RKB internal manufacturing drawings control a series of dimensions and geometrical and surface quality parameters.

Specific non-destructive controls like the Magnetic Particle Inspection for detecting superficial micro-cracks and the Ultrasonic Micro-Crack Detection for under-surface micro-cracks location are regularly performed on rings and rollers during the production process.Moreover, a visual check of the parts ready for assembly is always carried out to avoid any noticeable anomaly.

Selections and sorting of rolling elements and rings in groups of defined grades for correct matching are made to get the radial internal clearance specified by the pertinent bearing technical drawing.

As yet another confirmation of our support for the clients' specific needs, RKB releases, on request, additional quality certifications.

To produce state-of-the-art bearings of Swiss origin, RKB Group has been unceasingly implementing a serious investment plan that involves R&D, design and engineering, quality assurance, machining and logistic activities.

More information about RKB can be found at www.rkbbearings.com.

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Princeton, USA

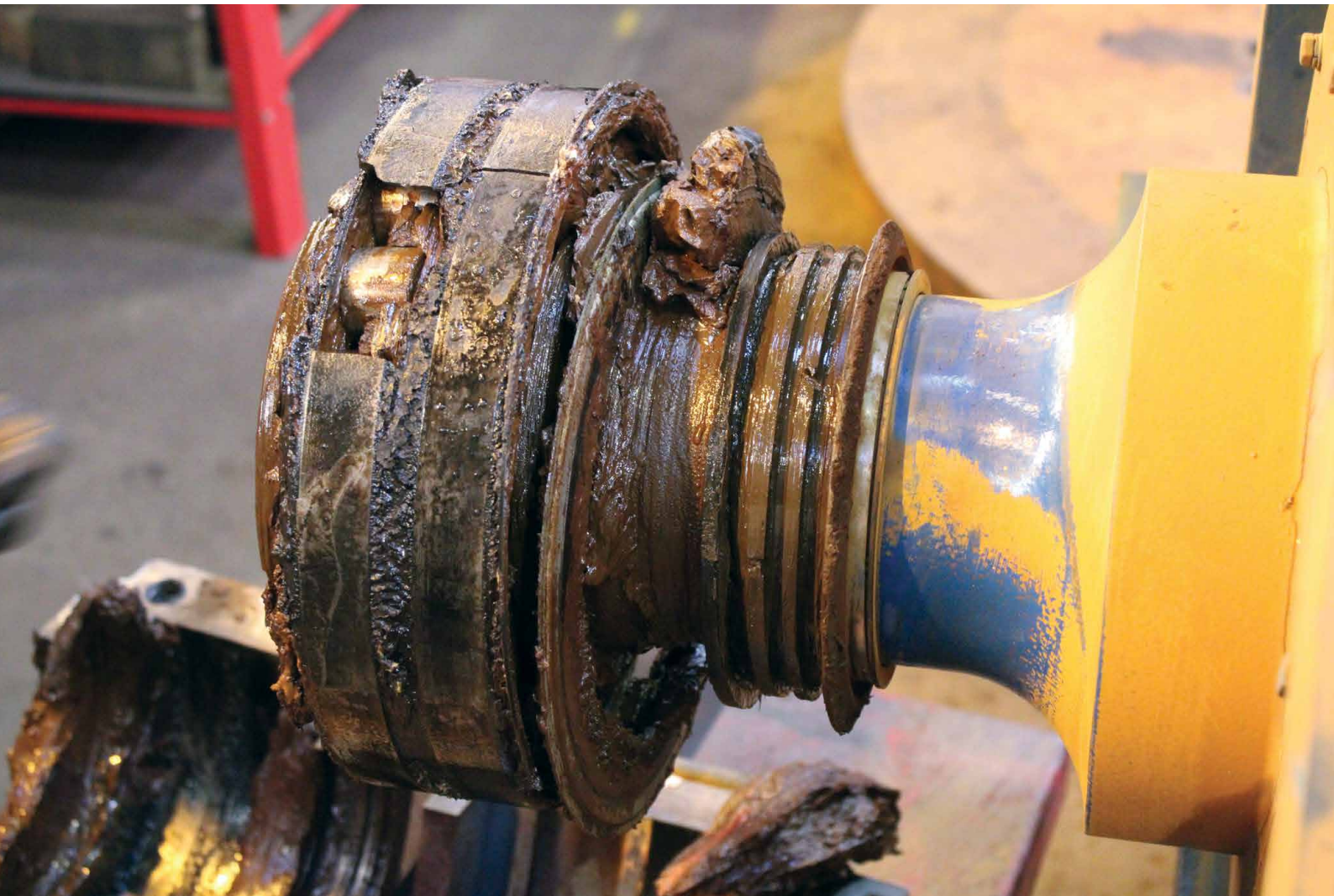
Revolutionary Bearing Housing Sealing Solution for the Mining Industry

For several decades, conveyor pulley bearing housings were protected from the environment with labyrinth type sealing methods. While there have been iterations over the years, they fundamentally adopt a 'grease filled torturous path' approach to sealing.

DASH Engineering are impartial and independent bearing consultants located in Perth, Western Australia, specializing in failure analysis of rolling element bearings. Having conducted hundreds of conveyor pulley failure investigations, with the majority of failures attributed to contamination ingress, DASH Engineering have proven that traditional sealing methodsand the industry standard – 'Three Barrier Solution' – are not effective in preventing dirt and water ingress into the bearing housing. Independent testing and numerous case studies have demonstrated that grease acts as a carrier for contamination rather than a barrier. Additionally, traditional sealing methods do not accommodate the misalignment and float that is required in conveyor pulley applications.

> "... this is a step change in Mining"
>
> *– Manager-Asset Management*

— Premature bearing failure from contamination ingress



With the overwhelming majority of DASH Engineering failure reports recommending to 'review sealing methods', it became evident that there was no other effective method of keeping contamination out of the bearing housing, sparking the development of the SAPO® Seal.

„ ... savings will be comparable to AutoHaul "

– Site-based Project Manager

The SAPO® Seal does not rely on grease as a sealing medium. Positive pressure oil is used to ensure the oil seal lips remain lubricated and simultaneously captures fine dust particles. Regular oil sampling and flushing ensures seal performance is monitored and maintained throughout its life.

Current plummer block sealing methods tend to damage shafts – often damaged beyond repair. SAPO® Seals eliminate this problem with a simple solution. The units are designed to run on wear sleeves to prevent abrasive damage to shafts.

„ ... we need to make them all like this "

– Fitter-Site Installation Team

SAPO® Seals are fully maintainable, monitorable and predictable with state-of-the-art intra-bearing housing endoscopic monitoring via the SAPO® Scope. Maintenance personnel are able to visually monitor the housing cavity

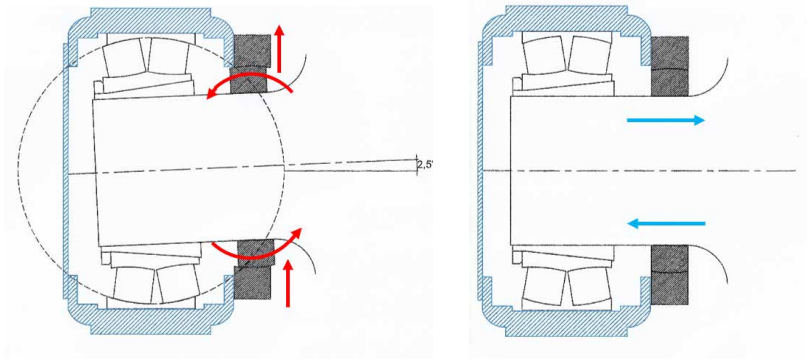
The Self-Aligning Pressurised Oil (SAPO®) Seal is a patented, engineered sealing solution that will accommodate misalignment requirements without compromising on sealing effectiveness. Furthermore, SAPO® Seals are fully maintainable, monitorable and predictable providing peace of mind to the end user.

— SAPO® Seal

— Before SAPO® Seals

— After SAPO® Seals

In order to effectively maintain positive sealing, the SAPO® Seal is designed to float with respect to the housing as well as remain parallel with the shaft. This unique design allows for articulation to the allowable misalignment limits of spherical oller bearings.



— SAPO® Seal articulation and axial float

— Bearing housing endoscopic monitoring with the SAPO® Scope

— *Installation of critical pulley with SAPO® Seals*

for contamination ingress and excessive bearing greasing whilst the machine is fully operational. This type of visual monitoring is truly unique in providing peace of mind and removes any doubt in regard to contamination ingress.

SAPO® Seals can also be used to assist with pulley alignment during installation, reducing set-up time and risk, increasing safety and efficiency. A simple yet effective technique allows for on-the-go visual alignment guidance and final quality assurance checks to remove any doubt during pulley install.

„ ... most significant benefit will be that we finally have effective, multi-level monitoring of bearing condition as risk mitigation against unplanned failures "

– Site Engineer

Key facts

The implementation of SAPO® Seals have enabled multiple critical pulleys to achieve upwards of two times the previous mean time between failure (MTBF) across Australia's Pilbara iron ore operations.

Case studies on high grade iron ore conveyor systems have resulted in:

- increased production
- elimination of unplanned downtime
- cost savings in the order of tens of millions of dollars

Rolling stats

SAPO® Seals allow clients to switch from time-based maintenance techniques to condition-based maintenance methods.

Case Studies

A large 2m diameter pulley weighing approximately 28 tonnes on a system conveying bulk material across the Pilbara was changed out every six months due to repeated rapid contamination ingress related failures. The site team decided to make the switch to SAPO® Seals and have experienced reliability and predictability to another level.

Another critical pulley on a ship loader conveyor system was experiencing reliability issues that caused unplanned downtime costing hundreds of thousands of dollars. The pulley was fitted with SAPO® Seals at the next opportunity and has been operating reliably since the switch.

— *SAPO® Seal in operation*

The implementation of SAPO® Seals required no modifications to standard 'SD' type bearing housings.

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FLT Expands Production Base after Acquisition

XCC Group, one of China's most technological bearing manufacturers, has recently acquired FLT Polska, starting a new era for the FLT brand bearings.

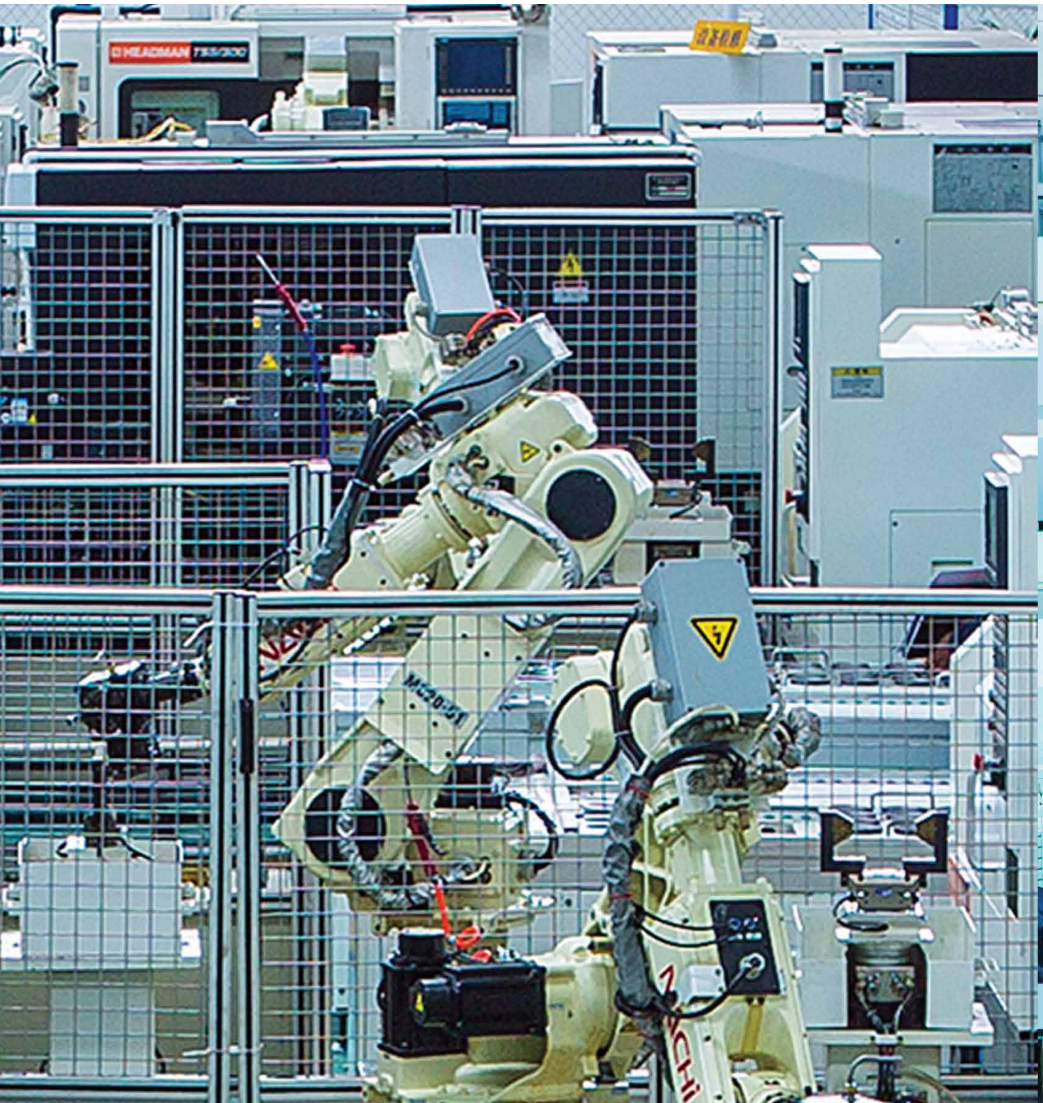
In this interview, the Bearing News team speaks with Mr. Sławomir Łukaszewski, the CEO of FLT Polska, to discuss the recent acquisition and the future outlook for FLT Polska.

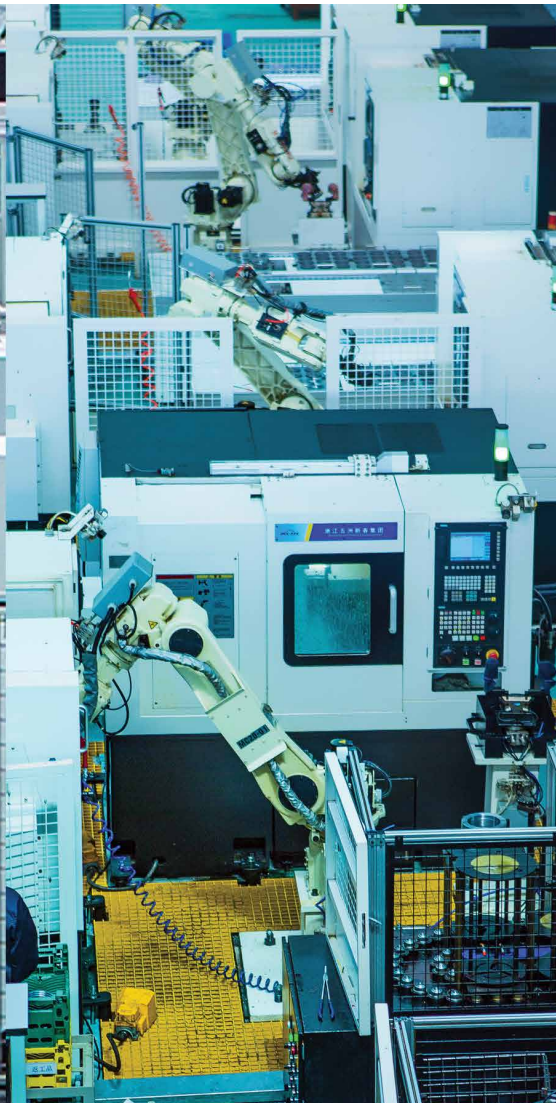
Mr. Sławomir Łukaszewski, CEO of FLT Polska

First of all, we would like to congratulate you with the new organization for FLT. Can you tell us more about the history and evolution of FLT and your role within the new organization?

FLT Polska has been operating in the bearings market since the 1950s – at the beginning as a part of Impexmetal company and since 1999 as a separate company named Impex-Łozyska. In 2007 the name changed to FLT Polska

FLT POLSKA GROUP consists of foreign companies operating for many years in Great Britain, France, Germany, Italy, USA and China in bearings and bearing parts sector. XCC Group has strong bearing manufacturing





capacity as biggest bearing rings supplier for SKF and Schaeffler, After FLT joined XCC Group family, and we will extend our service range for our customers because of XCC Group production and R&D base.

What types, range and precision level of bearings, for which industry applications will FLT offer the market?

FLT focus on providing high precision, long-life roller bearing and technical service mainly for on and off-highway vehicles, industrial gear-boxes electric motors field. Our biggest customers are: Bonfiglioli, BPW, Dana, GKN, Carraro, SEW, Stellantis and others.


C-CVJ-A-1
C-CVJ-A-2
设备运行

To which regions and countries are you mainly exporting FLT bearings?

The biggest region of our sales is in Europe about 96% second is Asia and the third is North America.

Will you mainly serve OEM and end-user companies? Are there any plans to establish a new global distributors network?

Yes it is about 95% of our sales are OEM customers. We are planning to extend our network in North and South America in the coming period ahead.

How is the impact of the changing global supply chain strategies and increasing raw material prices on the market?

Raw material price increased approximately 40% last year. I do even not mention about cost of transportation, electricity, gas and labour costs, while end-users almost do not accept any price increases. It is currently a big challenge for the entire bearing manufacturer to keep costs under control. FLT engineers are working hard to provide our customers solutions which are resulting in cost reduction, and our production base continuously improve productivity, so I believe facing the tough competition it is a new opportunity of FLT growing.

Beside the manufacturing of bearings, are there any design, engineering or related services that you offer?

XCC Group has vertical integration bearing production chain, beside bearings we can provide machined component such as gear-blank, special form shaft, precision large size Rollers, and unit like elevator sheave, one-way clutch and so on.

How do you see the future of the industrial motion industries, in particular the bearing applications and the rising electrification of systems? Has this evolution an impact on your R&D or design processes?

We must follow up the tendency, electrification will impact industrial future, FLT is strong player in this field because we have developed and provide solutions of new energy car bearings, integrated unit of electric drive system many years, our R&D is benefit of electrification because FLT invested in this field already.

What is the main difference of FLT from the competitor companies on the market?

FLT has good reputation and loyal clients especially in OEM field, because we are always close to our customers and can offer the flexibility, technical support, and competitive prices.

What are your main plans for 2022 – 2023?

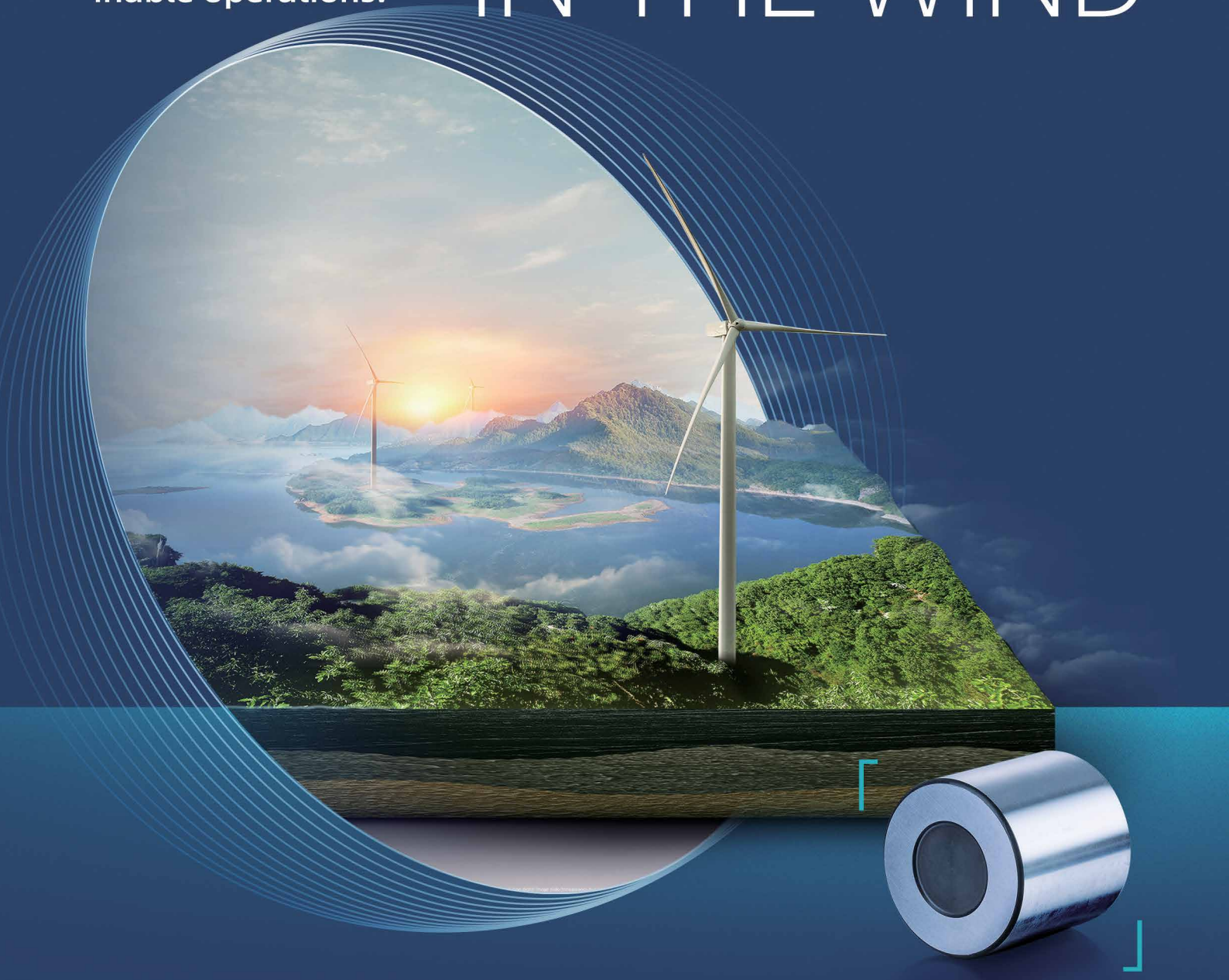
Our main targets are:

1. To extend cooperation with our major customers through signing the long-terms agreements
2. Participation in new projects by proposing technical solutions, based on our experience and expertise of our R&D facilities
3. Lower our cost by increased efficiency in order to stay competitive and propose our products to new customers
4. Despite all obstacles due the pandemic to quarantine just-in-time deliveries.

「 」 is creating value for next generations.

「 」 is here to support susta -inable operations.

THE「ANSWER」IS BLOWIN' IN THE WIND



BEAUTY IS IN THE ROTATION

WEB: WWW.XCC-ZXZ.COM | EMAIL: XCC@XCC-ZXZ.COM

ZHEJIANG XCC GROUP CO.,LTD

Hybrid ceramic bearings help skateboarder to make more spectacular acrobatic acts

Koyo Bearings, a division of JTEKT Corporation, specialized in design and engineering of a wide range of rolling bearings for numerous applications, ranging from automotive- and windmill applications to aerospace and tunnel drilling equipment, has now developed a special hybrid ceramic bearing for skateboard application. “Hybrid” in this case stands for the combination of steel and ceramic materials used for this specific bearing.

Background of the development

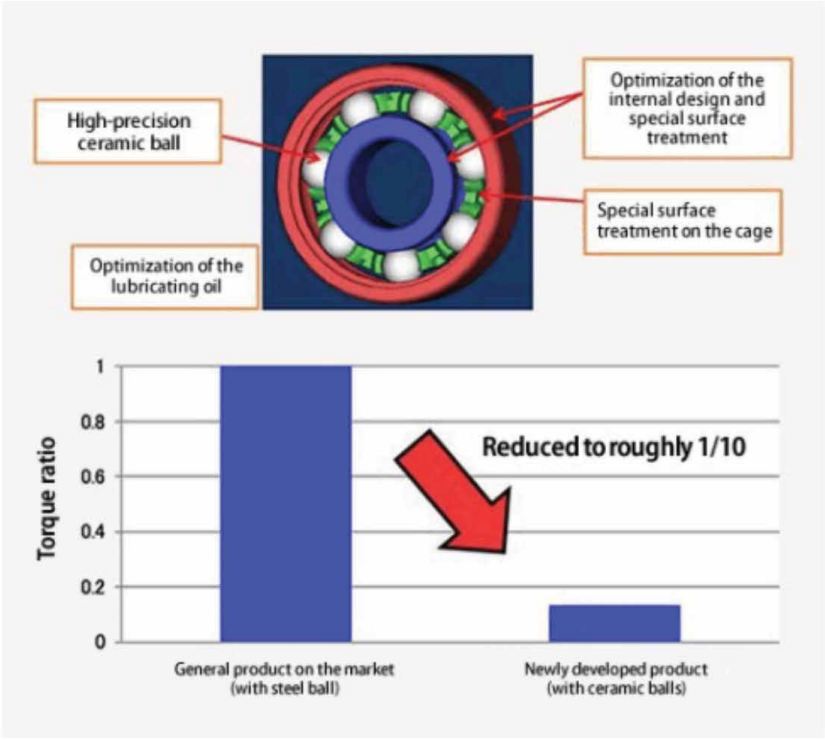
Very specific technical requirements are needed for bearings for skateboards to satisfy the needs of the fanatic skater. Skaters are seeking ways to increase the comfort of the ride, as well as speed & heights of their jumps to be able to impress the public with ever more spectacular acrobatic acts in the air. One of the ultimate acts is the “Backside Heel Flip Indy” (YouTube courtesy - https://www.youtube.com/watch?v=dOaUwftBVBg)

Features of the new product

Key of success for bearings for skateboards is to reduce rolling resistance (to avoid losing speed due to friction, during skating) while at the
same time maintaining sufficient durability (to minimize deterioration of the performance during multiple use)

Reducing friction and maintaining bearing life – so how did Koyo get this done?

The main challenge was to reduce the contact area of the rolling elements with the raceways and the cage, without losing the robustness of the design required for durability.



In technical terms this means:

1. by optimizing the internal race way design, the rolling resistance is reduced
2. high-precision ceramic balls with high sphericity and very low surface roughness are used special surface treatments on the inner and outer rings, and the cage are applied:

a) by performing special heat treatment on the inner and outer rings a "hard skin" is created, leading to an improved seizure- and indentation resistance.

b) by performing surface treatment on the cage, the sliding friction between the cage and the balls is reduced.

3. ABEC 7 standard (equivalent to ISO/DIN/JIS Class 4) is applied for the bearing precision.
4. the lubrication grease is optimized for this specific application.

Final results of this development

"Smooth and easy rotation" and "the skater's sensitivity and feeling" are what is required of bearings for skateboards, but it was very difficult to convey that "feeling" into the specification of bearings. Thanks to the lower bearing friction torque, we succeeded in developing a bearing that can contribute to better speed, higher jumps, and more effective pulling off tricks, including the famous backside heel flip indy...

Availability of this product

These hybrid ceramic bearings are in Koyo serial production and are available for the AM and for (small) OEM customers. Please do not hesitate to contact your regular Koyo contact for more information about applicability and availability of this special Koyo bearing type.

Please do not hesitate to contact KOYO, or your official Koyo distributor in case you would like to have more general information about Koyo products and services.

Get to know KOYO bearings at www.koyo.eu

Volution®

Advanced Bearing Lubrication Solutions

VPL4000FB (NSF H1 Certified)

VPL-9000F

CHEMICAL RESISTANT VPSL

Volution Polymer Solid Lubricants (VPSL) have set the standard for solid polymer bearing lubrication for decades. Volution offers the only VPSL suitable for harsh chemical environments.

VPL-9000F is:

- NSF H1 certified
- Delivers superior performance in harsh environments
- Chemical resistant/non-reactive to typical elastomer and process chemicals
    - Including quaternary ammonium compounds, sodium hydroxide, and nitric and citric acid

Our wide range of VPSL formulas tackle various problems found in food and beverage processing, industrial, and many other applications. VPSL's eliminate the risk of grease leakage and protect the environment by keeping grease out of the waste stream. They also eliminate cost associated with re-lubrication and downtime caused by cleaning or bearing failure.

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For more information on Volution products: visit volutioninc.com or email mitch@volutioninc.com

Volution Sp. z o.o. will begin operation in Poland in late 2021 to better serve our European customers

iMotion .events

industrial motion hybrid meetings
for PT/MC Buyers & Suppliers

March - December 2022

6+ Events in 2022

www.imotion.events

6+ Online Events in 2022

The iMotion Events Hybrid Meetings will host six online events, with focus on the power transmission solutions, and in connection with the audience from 20+ physical events. The main online events and matchmaking meetings will be as following:

Bearing & Power Transmission Meetings

21-23 March 2022

Agriculture & Food Meetings

13–15 April 2022

Motion Drives & Automation Meetings

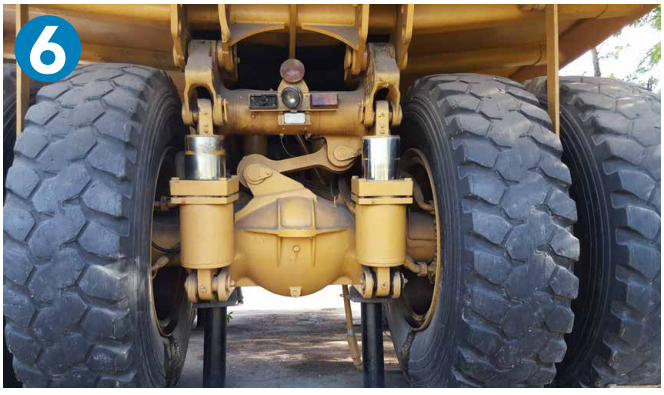
23-25 May 2022

Marine & Offshore Meetings

10-12 October 2022

Steel & Metals Meetings

14-16 November 2022



Mining & Construction Meetings

05-07 December 2022

**Additional online events can be added to the planning during the year.*

Full Year Online Matchmaking

The online matchmaking and event platform of iMotion Events Hybrid Meetings will be available for a whole year during 2022, and accessible with one single account. The platform will feature pre-scheduled meeting, matchmaking, exhibitors area, sponsor presentations, networking, Q&A sessions and many more features…

Connect with 20+ Physical Events Globally

Apart from the online matchmaking and industry events, iMotion Events Hybrid Meetings will conduct a whole list of activities before, during and after 20+ physical events, covering more than 15 different industries where power transmission and industrial motion solutions will be the center of attention.

Why Industrial Motion Hybrid Meetings 2022

The Future of Events and Networking is Hybrid

Hybrid events are here to stay, and it is safe to say these changes are permanent. In order to understand why, it's important to first comprehend the structure of a hybrid event. In a basic format, hybrid events incorporate features from both in-person and online event structures with a shared experience for all participants. The utilization of technical capabilities will allow participants to reach their specific audience on a magnified level, increasing the productivity of events, while also socially engaging face-to-face.

Top 10 Reasons to Join

1. Connect with the global power transmission industry peers for 1 year
2. Pre-schedule meetings with potential leads and partners [in-person or virtual]
3. Market your product in 15+ different industries
4. Present your solutions within 20+ physical events in 2022
5. Organize your customized company event within the community
6. Expand your brand visibility worldwide, in print and digital
7. Find new suppliers
8. Receive monthly international event reports and contacts
9. Keep track of your ROI
10. Reach 100,000+ industry peers

Who Will Attend?

160+ Exhibitors

2,400+ Attendees

35+ Speakers

6+ Events

15+ Industries

60+ Countries

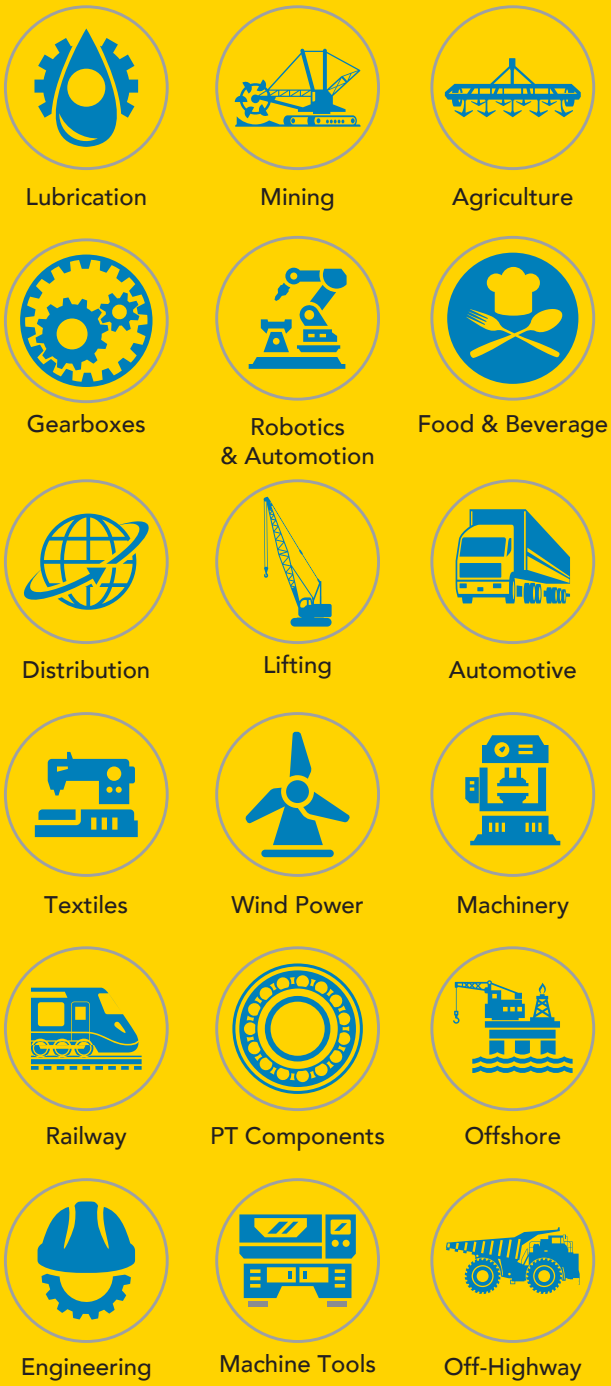
More than 2,400 participants have attended our industrial motion events since 2016, both in-person and online, connecting 160+ exhibitors and 35+ speakers with power transmission and motion control industry peers globally

Exhibitors Profile

- Power Transmission Companies
- Component Manufacturers
- Distributor Companies
- Lubrication Companies
- Equipment Manufacturers
- Industrial Machinery Companies
- Solution Providers
- Engineering Companies
- Associations and Service Organizations

Attendee Profile

- Original Equipment Manufacturers
- Distributors
- Service Providers
- Mechanical Engineers
- Reliability Engineers
- Lubrication Engineers
- Maintenance Engineers
- Machinery Engineers



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Servicing procedures for roller bearings during operation

Smooth production operations without any downtime is the goal for every company. Small issues like a defective roller bearing can cause major problems. Are there any ways to carry out servicing on roller bearings during operation? In this article, we will show you what to look out for.

Modern production facilities that work according to the industry standard 4.0 are operational around the clock. This requires a trouble-free process. Malfunctions or maintenance work led to downtimes. In production plants, moving parts in machines are particularly delicate. At the centre of every rotating system is the bearing arrangement. Thus, the servicing of roller bearings, for example, is an important factor to enable efficient production. But how do you achieve perfect maintenance and bearing lubrication to avoid breakdowns?

The failure of a roller bearing in a complex machine can lead to the shutdown of the entire production line. For this reason, it is essential to determine the appropriate time for servicing in order to avoid costly repairs. The following questions and procedures are important to ensure that every bearing works perfectly:

- What are the signs of wear?
- How do you know when a bearing needs to be replaced?
- Maintenance plan for different roller bearings
- Strategies for an effective maintenance process

We would like to take a closer look at the individual aspects. But first, let us tackle the question:

What is a roller bearing?

The roller bearing is a crucial part of any machine that transmits power and motion. Rolling parts between an inner and an outer ring ensure that the frictional resistance is reduced. This allows shafts and axles to be fixed in place. Power transmission causes the shafts or axles to rotate or move. Optimum lubrication of the rolling parts in the inner and outer ring ensures minimal friction.

A tiny roller bearing can be the reason that your entire production operation comes to a standstill. To prevent this, servicing roller bearings during operation and lubricating them well should be carried out to guarantee successful production!

What are the signs of wear?

Causes of bearing damage include vibration, friction, imbalance or misalignment. These triggers are transmitted by the bearing and can be heard before bearing damage occurs. In addition, there is natural wear and tear, which is difficult to predict despite careful observation and monitoring. Among other things, the reasons for this occurring in roller bearings are:

- Corrosion
- Insufficient lubrication
- Abrasive particles
- Pivoting movements
- Impurities

If any of these phenomena occur, the bearing's running profile may change, resulting in uneven sliding behavior. Over time, this leads to stress concentrations in the load areas. The result is material fatigue up to complete bearing damage due to fatigue fracture. What can you do to help with early detection?

Condition monitoring through sound analysis to determine bearing wear

Ultrasound technology has proven to be an effective early warning system for detecting bearing wear. If the ultrasonic measurement level rises by 8 dB above normal, it is an indication of a lack of lubricant or the first signs of wear and tear. This continues through several warning levels up to an increased level of 35 to 50 dB above normal. If this limit value is reached, a short-term failure of the affected bearing is likely.

How do you know when a bearing needs to be replaced?

Using the example of a ball bearing, we explain the clear indications that lead to the replacement of the affected bearing:

- Bearing clearance has exceeded tolerance limits and leads to shaft "tottering"
- Falling out of the worn cage is imminent
- Excessive impact forces have penetrated the bearing rings
- Damaged running surfaces in the bearing rings
- Coarse contamination stops the ball bearing from functioning
- Breakage of the ball inside the bearing
- Increased noise level during operation
- Deposits on the ball prevent smooth working

Sometimes, rinsing, blowing or cleaning the bearing and its components can prevent the need for replacement. If it turns out that bearing rings or ball are damaged, replacing the bearing is unavoidable. In any case, it is essential that the ball bearing is sufficiently lubricated.

Increased resistance when turning the bearing

In many components, precision and positioning accuracy are vital in production. If there is increased resistance when the bearing is turned during the servicing process, it should always be replaced. At the same time, the time between maintenance work must be kept to short intervals so that possible damage due to wear and tear is detected at an early stage. Regular maintenance increases the service life of the delicate ball bearings.

Maintenance plan for different roller bearings

Regular inspection is part of the maintenance plan for roller bearings in order to detect any problems in good time. Part of this maintenance includes:

- Checking the noise during operation
- Determining the bearing temperature
- Measuring vibrations
- Lubricant condition

Here is an overview of the most important maintenance tasks:

Checking the noise during operation: An experienced employee of the company is able to detect a slight deviation from the normal operating noise using an ordinary stethoscope. This may be caused by slight damage to the raceway inside the bearing.

Determining the bearing temperature: In many cases, touching the housing cover is enough to detect rough temperature differences. Measuring with a thermometer is more accurate. The hole can be used to refill the bearing with lubricant.

Measuring vibrations: Vibrations are usually recognized by unusual noises during normal operation.

Lubricant condition: Inspecting the lubricant for moisture and foreign matter during operation provides an insight into the condition of the bearing. In the event of a deviation from the normal condition of the lubricant, the roller bearing in question should undergo a closer examination.

Maintenance-free as a goal for Industry 4.0 production

Nowadays, some plain bearings can be supplied lubricated and sealed. This allows maintenance-free operation in areas with a low to medium degree of contamination. Another groundbreaking system with TS seal (Triple Seal) ensures a service life that is up to 50 percent longer. Two outer sealing lips keep dirt and moisture away from the roller bearing. The lubricant inside the bearing is shielded from the outside by the inner lip.

Strategies for an effective maintenance process

Every piece of production equipment is subject to wear and tear and maintenance work is part of the daily routine. It is extremely annoying for the company when servicing work leads to prolonged downtime with a loss of production. Predictive maintenance is a proactive strategy that can be used to plan or even avoid downtime. The core of this strategy is the ongoing analysis of machine data. For example, the condition of a roller bearing can be used to determine when to expect part fatigue or complete breakdown.

With the help of digitally networked systems, this makes it possible to collect status information on all sensitive components in the machinery via the IoT. The aim is to carry out maintenance work continually or to find the most suitable time to stop production for a general overhaul.

What are the advantages of predictive maintenance?

From the company's point of view, proactive servicing means a lower risk of unplanned downtime. Because maintenance can be planned precisely, the working time and personnel costs are reduced. The duration of servicing is shortened because there is no need to look for a possible fault first. Using the connected company database, historical life cycles of a roller bearing, for example, can be determined and analyzed.

Small things sometimes lead to major setbacks. For example, a defective roller bearing can cause your entire production to come to a standstill. Modern machinery plants based on industry standard 4.0 can no longer afford such outages. With a predictive servicing process, it is possible to detect possible production errors before they occur. Maintenance work carried out proactively ensures smooth operation and also saves costs.

Summary

Wear and tear, maintenance work and servicing processes are also part of day-to-day operations in modern production plants. The difference compared with the past is that now you do not first react when wear leads to the shutdown of individual machines but act as proactively as possible. It is important to analyze what the signs of wear are. For example, if you know when a roller bearing needs to be replaced, you can plan the repair. Predictive maintenance is the best strategy for an effective servicing process and reduces costs for your company at the same time.

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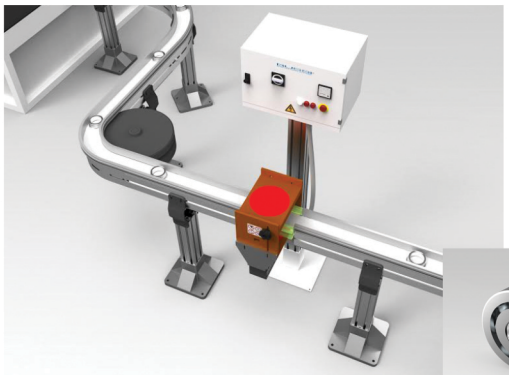

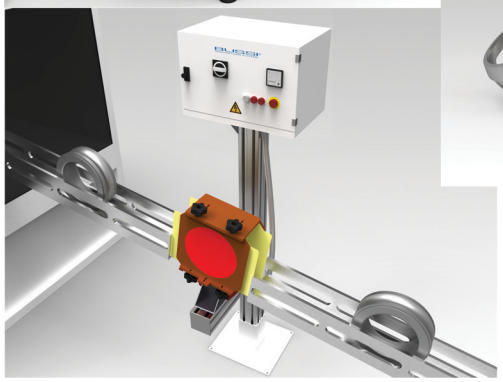

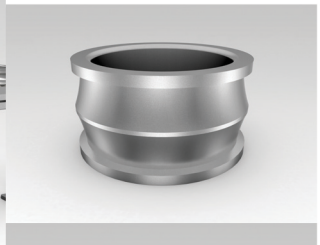

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Reduce Unplanned Downtime: Learn the Warning Signs of Bearing Failure

Bearing failure is almost entirely avoidable if you have a proactive mindset and put effort toward learning your equipment. In fact, bearings should last a minimum of 8-12 years, so if you're changing them quite frequently, this is for you. By learning to pick up on warning signs of bearing failure, you can stop replacing bearings and start focusing on the bigger reliability picture.

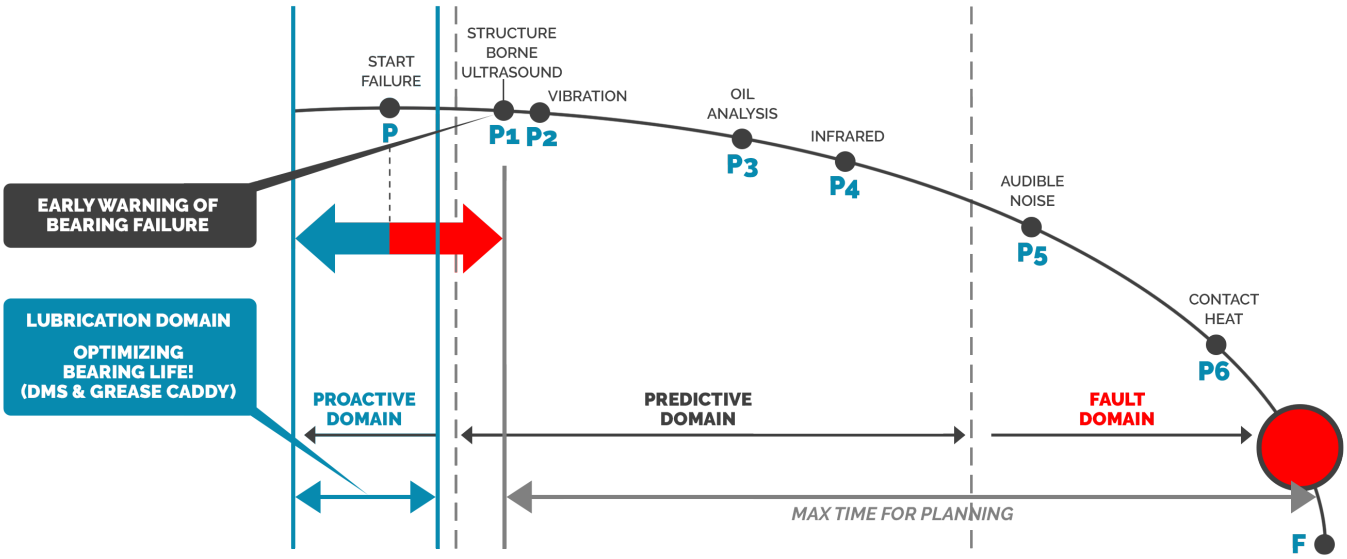
The 4 Stages of Failure

Bearing failure occurs in 4 distinct stages—the higher the stage, the less likely you will be able to revive it. However, by using the proper tools, you can easily identify the early stages of failure and remedy the situation.

Stage 1: Friction causes the bearing to emit a 250 to 350 kilohertz (KHz) frequency. This is the earliest detectable point using vibration analysis.

Stage 2: A 500 to 2000 hertz signal rings.

Stage 3: At the onset of the third stage, the harmonics of the fundamental frequency are very apparent. Defects in the races are now obvious and visible on vibration analysis of the noise signal. At this point, there is also a significant temperature increase.



Stage 4: During the fourth stage, there is very high vibration. The fundamental frequency and harmonics begin to decrease as the random ultrasonic noise is boosted. Temperatures will skyrocket as the bearing self-destructs.

Regreasing should occur no later than stage 2 to effectively save it, but you must know how to identify these failure stages.

Detecting Failure

Vibration analysis and oil analysis can accurately predict a failure but are not always the most cost-effective.

Thermography is a less expensive way to detect failure. Bearing manufacturers have long known of the relationship between bearing life and temperature and have developed formulas that accurately calculate safe operating temperatures. These formulas and calculators show that once a bearing starts operating outside its ideal temperature range, its life will begin to degrade at an accelerated rate. In theory, for every 15 degrees C above 70 degrees C that the base oil operates, its life is more than halved.

Knowing this, why is thermography not a more popular method for bearing life prediction? Monitoring temperatures is not always considered reliable because of the sheer amount of variables that contribute to the heat generation. Ambient temperature, friction, speed variability, load and runtime all influence the temperature that will be measured.

Ultrasound technology, on the other hand, provides an advanced approach to detecting failure while producing a high return on investment. Systems like the OnTrak SmartLube monitor the dB levels emitted by an under-lubricated bearing and automatically dispense the appropriate amount of grease.

As soon as early-stage failure occurs, the operator simply receives an alert on the cloud-based system and gives the device permission to lubricate. No searching for the grease gun, no lubricant mix-ups, no scheduling—the bearing gets lubricated with the push of a button, essentially "resetting" it to a healthy state.

Proactivity is Key

Now that you know how to identify the warning signs of bearing failure, it's important to keep your team accountable and look for these signs regularly, whether that's scheduled thermography inspection, oil analysis sampling or investing in ultrasound equipment.

In respect to industry 4.0, automation is becoming increasingly useful in plants around the world. If you can use a device to put your lubrication on autopilot, allowing early failure detection and remedy, you're on the track to significant time and money savings.

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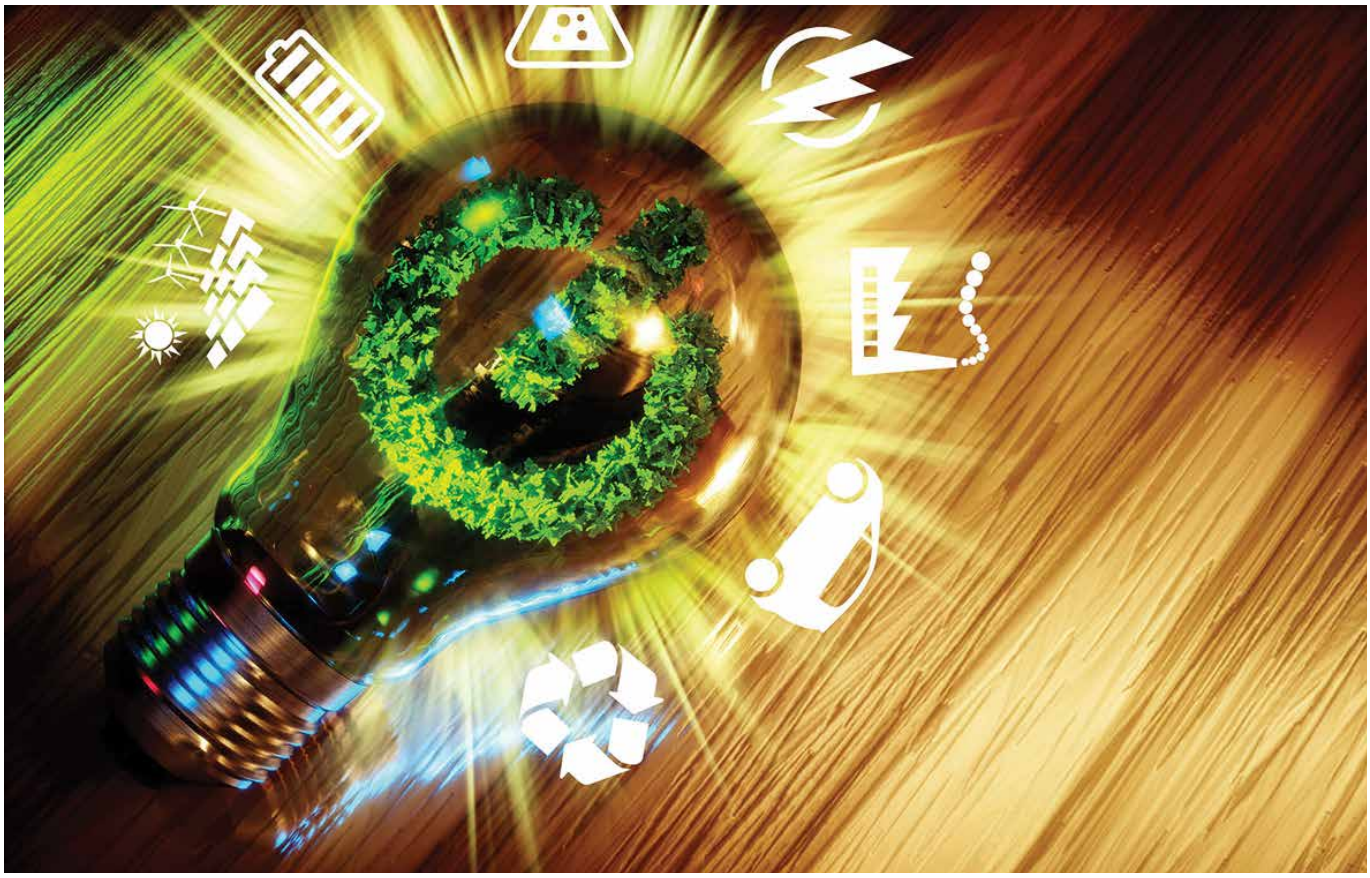
Environmental Sustainability and Measurement's Tools at the Manufacturing Industries

The concept of **sustainability** is intrinsically linked to that of environmental protection, but in recent years it has expanded to include a broader meaning that considers - in addition to the **environmental dimension** - also the **economic and social** ones. In this sense, it refers to the condition whereby the current generation can satisfy its needs without compromising the ability of future generations to satisfy their own in the three dimensions (ESG – Environmental, Social, Governance) mentioned above.



In the context, attention will be focus exclusively on the methodologies available for assessing the environmental impacts of companies, both for their normal operation and for the production of specific products, postponing the issue of sustainability in the social and governance dimension to another occasion. The meaning of environmental sustainability refers to the broader concept of **sustainable development**, that is a process model capable of maintaining the balance between respect for the environment and socio-economic progress, through long-term strategies such as:

- Recognize the intrinsic **value of the natural resources.**
- Protect the **bio-diversity of the species.**
- Protect the **health of productive ecosystems**, such as agricultural land and livestock, making them sustainable.
- Promote the **energetic transition** by using renewable energy sources.
- Designing products, goods and services through a project (**eco-design**) based on the attention of the environment for all life stages (from cradle to grave).
- Mitigate the effects of **climate changes**.

Among 17 targets identified in 2015 by **"Agenda 2030"** of United Nations for sustainable development, the commitment to combat climate change through reduction of greenhouse gas emissions - up to complete **decarbonization** of electricity production - is the one with greatest media coverage. The other targets are linked to the eco sustainability and to the resilience, but also to human dignity, regional and global political stability and economy prosperity. In January 2020 the investment plan for the **European Green Deal** 2050 was presented in Strasbourg, that is the most ambitious ecologic transition plan presented to date by a continent to reach zero emission by 2050.

Companies and individuals are also required to do their part to contribute to a **sustainable development.** In particular companies have **a moral obligation** to adopt development policies that translate into sustainable development, for example like:

- Adoption of practices based on **circular economy principles.**
- Preservation and protection of the territory and bio diversities.
- Promotion of the renewable energy sources and **efficient use of resources.**
- Recycle and optimal waste management.
- Promotion of the **sustainable mobility.**
- Development of **innovative technologies for environment.**

Including the environmental sustainability in business growth strategies today represents a **competitive advantage** that allows the company to be perceived by the market as more reliable, less risky and **therefore able to produce value in the long term.**

Measuring Environmental Sustainability

Defining objectives implies the need to measure the effectiveness of the actions taken to achieve them. It is for this purpose that a certain number of **environmental sustainability indices** (internationally recognized) have been identified, which can be grouped into the following types:

1. **Descriptive indicators,** i.e. those ones that describe the real situation with respect to environmental problems and are expressed in units (for example tons of CO_2 emissions);
2. **Performance or effectiveness indicators,** that is the ratio between the result achieved and the pre-established objective in terms of environmental policy (for example the % of waste collected separately and the waste sorting target);
3. **Efficiency indicators,** that is the ratio between the environmental result achieved and the economic resources used (for example the reduction of the atmospheric emissions per unit of cost of structural actions);
4. **Total wellness indicators,** that measure the total sustainability (for example the ecologic footprint or the contribution to the greenhouse effect).

Measuring the environmental sustainability of a company is important both to be able to assess the consequences of its business from an ecological and social point of view and because the measurability of the sustainability becomes increasingly relevant in the eyes of potential investors and partners.

This is the reason for which the most important rating agencies have developed parameters that decline the concept of sustainability of the company not only from an environmental point of view, but also under social and governance standpoints. More in general, the company's environmental sustainability is measured by verifying the following points:

a. **Compliance with the current legislation:** this is a basic element, consisting of the company's ability to respect the international and national laws and standards required for its area of expertise.
b. **Quantity of raw materials used:** this is an indicator that involves both the economic and environmental part of the company, measuring the quantity of harmful emissions and produced wastes.
c. **Supply chain:** it is necessary to consider the entire life cycle of the product, from the procurement of raw materials to the end of its life.
d. **Social impact:** it has to do with the way in which the company fits into the social contest in which operates (for example the national and international relations of the production chain, the impact to the local area in which the company operates);
e. **Environmental effects:** they concern the environmental consequences of the company's activities and, more in general, the presence of the safety procedures to reduce/cancel the damage of any negative event.

Life Cycle Assessment eCarbon Footprint

The Life Cycle Assessment is a standardized and international recognized calculation metod **(UNI EN ISO 14040:2021 e UNI EN ISO 14044:2021)** that allows to value the global environmental impact of products and processes, also considering the impacts associated with the supply chain (upstream), the phases of use (core) and at the end of life (downstream). It represents the main operational tools of the Life Cycle Thinking and provides:

- The definition of the **objectives** (for example climate change, water scarcity, resources consumption, eutrophication, etc.) and the field of application (in space and time) of the analysis.
- The filling of an **inventory of the inputs and outputs** (both in terms of mass and energy) of a defined system.
- The assessment of the potential environmental impacts related to these inputs and outputs.
- The interpretation of the results, in order to derive hard conclusions and recommendations **on which to base a communication strategy and/or an eco-design process and/or an improvements plan.**

It is a powerful tool for investigating a **company's sustainability strategy, applicable both to the entire organization** as a whole to make an *ex-ante* and *ex-post* evaluation respect to the adoption of improvement and investment initiatives, **and to a specific line of product**, even during the design phase of the same. In other words, the analysis of the life cycle allows us to take a fundamental look also at what stakeholders and partners are doing along the production chain (upstream and downstream of the production process), helping to outline a medium-long term strategy to reach the set objectives of environmental sustainability.

The life cycle analysis also represents a fundamental support for the **development of environment labeling schemes**, both in defining the environmental criteria of reference to a group of products (Ecolabel) and as main tool to obtain an **Environment Product Declaration (EPD)**.

In those cases where the primary interest of the company is to focus its analysis only on the climate changes and the consequent need to adopt measures aimed at limiting the greenhouse gas emissions (so-called GHG, Greenhouse Gases), it is possible to make **the analysis of the Carbon Footprint.** Also in this case the analysis can be carried out **at the single product level** (in accordance with the standard **UNI EN ISO 14067:2018)** or for the entire organization (in accordance with the standard **UNI EN ISO 14064:2018)**.

The benefits for the company that decides to undertake the analysis of its Carbon Footprint can be summarized as follows:

- Quantification and localization of the emissions sources.
- **Determination of one's own Carbon Intensity**, that is the quantity of CO_2 emissions per functional unit of product.
- Consistency, transparency and credibility in counting emissions.
- Identification and management of risks and responsibilities related to harmful emissions of greenhouse gases.
- **Project, development and application of initiatives and programs aimed at the reduction of pollutants.**
- Implementation of **compensation and neutralization actions** through the promotion of reforestation processes and/or protection of existing forests.
- Creation of a reference to compare own

performances with those ones of competitors.
- Achievement of an environmental label for the organization.

Our solutions

ICT srl (www.ict-advisorydivision.com) has a **professional's team** able to support the client companies to define a strong **environmental development strategy** and in fixing and implementing concrete continuous environmental improvement activities, also through the use of Lean Green methodologies and circular economy (Zero Waste Approach) applied to the entire production chain.

In particular, through the partner company Gruppo 2G S.p.A. (www.gruppo2g.com), we take care to:

- Complete the **cycle life analysis** of products and organizations (Life Cycle Assesment) according to **UNI EC ISO 14040** and **UNI EN ISO 14044.**
- Carry out a **simplified LCA** study that allows immediate verification of the life cycle and the determination of orders of magnitude of global environmental impacts, also in order to reply quickly and properly to the increasingly frequent requests for environmental transparency from clients of certain sectors (for example, the automotive sector);
- Project, document, quantify and report greenhouse gas emissions according to the standard **UNI EN ISO 14064-1:2018** and the standard **UNI EN ISO 14067:2018.**
- Provide consultancy for environmental product certification (Environmental Product Declaration, Ecolabel, Made Green in Italy) and help in the definition of and effective **environmental policy communication.**
- Support in the definition **of compensation and neutralization projects** of the organization's **equivalent GHG emissions.**
- Create an **Environmental Management System** in accordance with the standard **UNI EN ISO 14001;**
- Create an **Energy Management System** in accordance with the **standard UNI CEI EN ISO 50001:2018.**
- **To train company personnel** in sustainability issues with specific reference to those of the environmental sustainability. The courses list includes:

  - Principles, models and applications of circular economy
  - **Sustainable Supply Chain:** management and monitoring of the supply chain
  - **Life Cycle Assessment** Methodology
  - Carbon Footprint
  - Environmental product certifications
  - Environmental legislation and the environmental management system in accordance to the UNI EN ISO14001:2005.
  - Environmental legislation and the environmental management system according to the regulation EMAS.
  - The energy management system to the standard UNI CEI EN ISO 50001:2018.

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How Can Insulated Bearings Get Electrically Damaged?

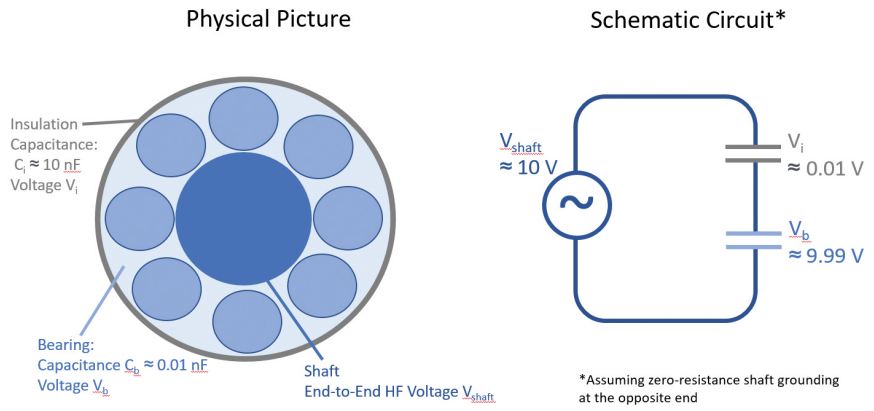
A couple of months ago, we published a Q&A post including an account of electrically damaged insulated bearings. We got a few questions about that one. "Aren't insulated bearings supposed to block bearing current? Then how did they get damaged?" Let us explain. (Make yourself comfortable.)

All electric motors on drives are subject to shaft voltage buildup. So they're all at risk of damage from shaft voltage discharging through the bearings. That's what AEGIS® Shaft Grounding Rings are for: they bleed off shaft voltage before it gets high enough to discharge. Larger motors on drives, over 100 hp/75 kW, are also subject to high frequency (HF) circulating currents. An AEGIS ring alone can't stop circulating currents, because they go through both bearings simultaneously, in opposite directions. And though it seems like an AEGIS ring at both ends of the motor should work, we've found that it can backfire.

— Insulated bearing, with white aluminum oxide coating on outer race

So for larger motors we recommend using some type of insulated bearing at the opposite end from the AEGIS ring. A ceramic bearing is perfect, but insulating sleeves and insulation-coated bearings are also fine. At least, they are most of the time.

These bearings are made of steel, with a thin layer of aluminum oxide on one race (typically the outer race). So you end up with a thin non-conductive layer between the bearing and the motor frame. Ordinarily, that insulating layer is enough to break the circuit so circulating current can't flow. In order to flow at all, it must flow at both ends: Onto the rotor at one end, and off it at the other. Insulated bearings block that flow at one end, and that's all it takes.



— Model circuit of an insulated bearing. With the ballpark figures given for capacitances and shaft voltage, 99.9% of the voltage ends up across the bearing.

But whenever you have a thin layer of insulator between two conductors, you have a capacitor. Together, the bearing's outer race, alumina, and bearing housing make a capacitor. The bearing itself also has some smaller capacitance. Now, HF circulating current is driven by a HF end-to-end voltage on the shaft. To that voltage, the bearing, insulation, and housing looke like two capacitors in series. Because the bearing's capacitance is lower than the alumina's, most of that voltage ends up across the bearing.

In the rare cases where insulated bearings fail, that voltage is enough to cause arcing through the bearing. At the other end, current would flow in the other direction through the grounding ring (if installed) or the other bearing, to complete the circuit. Again, this problem is rare. 99% of the time, an ordinary insulated bearing will not be damaged by circulating currents. At least, not fast enough to cause premature failure.

In the rare exception, you've got options. A hybrid bearing will solve the problem. No current can make it through a ceramic rolling element. Admittedly, hybrid bearings are expensive. But if you've already had an alumina-coated bearing fail, you have to ask: What's more expensive? A ceramic bearing, or the downtime from another unexpected failure?

You can also try an insulated inner race. Because it's smaller, an insulated inner race will have less capacitance than an insulated outer race. Having less capacitance in the insulation makes for less voltage across the bearing. So breakdown (arcing) is less likely.

Another thing you can try is common mode chokes, sometimes branded as "inductive absorbers." Chokes decrease HF circulating current. We don't have any hard data on this, but the combination of choke and insulated bearing may prevent HF circulating current damage. At the very least, adding chokes will slow down damage to an insulated bearing.

In any case, you would still want an AEGIS ring at the opposite end from the insulation. Neither chokes nor a single insulated bearing will protect the other bearing against shaft voltage discharge.

AEGIS Rings also come with a 2-year extended warranty against bearing fluting damage. No other form of protection against VFD-caused bearing damage offers a warranty like this.

To learn more about AEGIS shaft grounding and best practices for electrical bearing protection, sign up for a training. We offer monthly live training webinars, and – pandemic restrictions permitting – we can also visit your facility to review your exact application.

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