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# Bearing NEWS

BEARING INDUSTRY MAGAZINE

SPECIAL EDITION

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## TRENDS OF THE EUROPEAN BEARINGS MARKET

**"INNOVATIVE BEARING  
TECHNOLOGY WILL  
SHAPE THE MOBILITY  
FOR TOMORROW"**



INTERVIEW WITH

**PROF. DR. TIM HOSENFELDT**





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The new impact sleeve cap has two sides to optimize the bearing driving process.

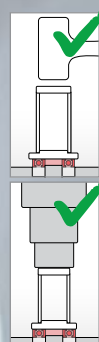


The round side is for positioning the bearing, and the straight side is for driving the bearing into place.

## Ball bearing fitting sets

**NOW - with the new KUKKO-Selecthor**

### Workshop model heavy duty

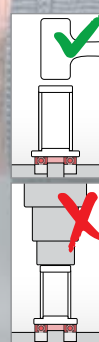


steel

71

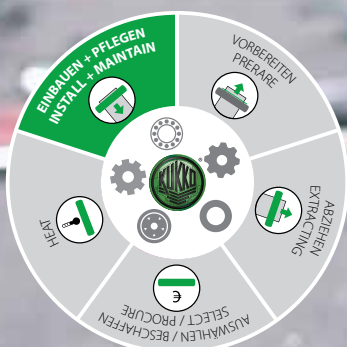


### Out of field model light duty



alloy

K-71-L-A  
K-71-L-B  
K-71-L-C



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# THE REAL 4.0

The background image shows a large exhibition booth with a bright red wall. The title 'THE REAL 4.0' is displayed in large, white, 3D block letters. In the foreground, there is a complex industrial machine with orange and yellow components, partially enclosed by clear acrylic safety barriers. Several people, including men in business suits, are gathered around the machine, looking at it. To the left, there is a white pedestal with a small display or monitor on it. The overall atmosphere is professional and high-tech.

## THIS WAS HANNOVER MESSE 2018

HANNOVER MESSE has a long history as the most important meeting place for the global industrial sector, but rarely has it been as impressive as it was in 2018.



In line with the lead theme "Integrated Industry – Connect & Collaborate", 210,000 visitors learned all about innovations presented by the exhibitors. Topics such as machine learning, artificial intelligence, industrial IT platforms, expanding the power supply system for e-mobility, using robotics and autonomous systems in production and intralogistics, and the role of humans in integrated factories were discussed in detail and presented at the exhibition stands.





# MAN, MACHINE AND FIST BUMPS

German Federal Chancellor Angela Merkel and Mexican President Peña Nieto set the tone on day one of the HANNOVER MESSE/CeMAT double-header. Asked to shake hands with a robot, they both went for the more casual fist bump – a symbol for the relaxed, natural interaction of humans with digitization, robots and machine learning.

“Technology is not about competing with us humans; it’s about assisting us. That is the core message conveyed by this trade fair, which has again underscored Hannover’s reputation as a global hotspot for the digital transformation of industry,” said Dr. Jochen Köckler, Chairman of the Managing Board at Deutsche Messe, at the close of HANNOVER MESSE and CeMAT. “The focus here has clearly been on the human element: We’re the ones making the decisions and setting the course. The interaction of humans with machines and IT adds up to a huge competitive gain across manufacturing, logistics and the energy industry.”

Under the motto of “Integrated Industry

– Connect & Collaborate”, a total of 210,000 visitors seized the opportunity to explore the innovations on display. A total of 5 800 exhibitors were present at HANNOVER MESSE & CeMAT. Topics like machine learning, artificial intelligence, industrial IT platforms, the expansion of power grids for eMobility, the use of robots and autonomous systems in production and intralogistics, and the role of workers in the integrated factory were the subject of intense debate at the stands of exhibitors at the event. As the official Partner Country, Mexico profiled itself as an innovative business partner and industrial location.

“Businesses have successfully negotiated

the first steps on the path towards digitized, connected production and are now firing up for the second stage of the journey,” reported Thilo Brodtmann, Executive Director of the German Engineering Federation (VDMA). “New platform-based business models, the use of digital twins and initial experiences with machine learning – all of this is set to play an increasingly important role in the mechanical engineering sector. Hannover Messe is a place where people present and discuss the shape of things to come, and we are once again highly satisfied with the outcome of the show,” he continued. The VDMA believed that automation, software and intralogistics would continue to define the character



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of HANNOVER MESSE, he said.

“HANNOVER MESSE has once again confirmed it is the definitive home base for the global transition to Industry 4.0. Extended value creation networks, new forms of human-machine collaboration, and the increasing integration of artificial intelligence into production operations: These remain the key features of digitization and connectivity, and were once again first unveiled here in Hannover. All of this requires even more connectivity, which is why the German

Electrical and Electronic Manufacturers' Association (ZVEI) has been calling for an industry-capable 5G network right from the start,” said ZVEI Executive Director Dr. Klaus Mittelbach. “This trade show has conveyed two other key messages. First, that we can only advance down the road to technological progress and social prosperity by teaming up and working together – not by protectionism or isolation. And second, that bringing young students into direct contact with technology – as we have done at this event – is a great way to kindle their

interest. And we have to do even more to attract their attention, for they represent tomorrow's urgently needed workforce.”

Out of a total of 210 000 visitors at the fair, more than 70,000 of them came from abroad, for an international share of 30 percent. China headed the foreign visitor statistics with a total of 6,500, followed by the Netherlands (5,300), Poland (2,700) and the United States (1,700). A total of 1,400 visitors attended from Mexico, which was this year's featured Partner Country.





Central trends highlighted at Hannover this year included the ongoing convergence between IT and mechanical engineering, industrial IT platforms and other new business models, and the imminent impact of artificial intelligence on the factory environment. The exhibitors in the automation halls profiled drive technology and fluid power as a key driver of digitized and integrated manufacturing.

The close integration of production and logistics was a key topic in the CeMAT halls – unsurprisingly, since the digital factory simply cannot work without intelligent logistics systems. Product highlights included industrial trucks, autonomous shuttles, order-picking robots and complete systems.

Further highlights consisted of assistance systems like exoskeletons,

AR goggles, and above all robots. Agile fabrication and intralogistics rely on autonomous transport systems, drones and intelligent personal assistants (IPAs). The trend towards human/machine collaboration continues unabated.

Meanwhile, displays in the energy-related halls centered on energy efficiency in direct correlation with climate protection. The focus was on decentralized, smart energy systems and infrastructure solutions for the environmentally friendly mobility of the future.

Impressive innovative performance was also demonstrated by subcontractors and development partners, who revealed approaches to connecting operations with customers for seamless efficiency. Multi-material and lightweight concept design are opening the way to a complete rethinking of structural

components, resulting not just in cost-cutting and greater efficiency, but also improved performance.

More than 160 Mexican businesses were at the fair to present their products and innovations. German Federal Chancellor Angela Merkel and Mexican President Enrique Peña Nieto agreed that progress and prosperity could only be achieved via open markets. Mexico's participation therefore fit perfectly into the context of the international free trade agreement concluded last Saturday between Mexico and the European Union, with 99% of goods between both parties to be traded in future free of tariffs.

The next HANNOVER MESSE will be staged from 1 to 5 April 2019, with Sweden as the official Partner Country. The next CeMAT will run parallel to HANNOVER MESSE from 20 to 24 April 2020.



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# BEARING WORLD *on the road to success*

- *More participants, more presentations, increased international participation*
- *New professions, predictability, digitalization and changes in mobility are among the key challenges in the rolling bearing industry*





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# BEARING WORLD

International Bearing Conference

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— Prof. Bernd Sauer TU Kaiserslautern

Bearings are the heart of any machine – this holds true both for industrial applications and automotive engineering. Rolling bearings are an essential design element in all technologies where there is movement. BEARING WORLD focuses on all aspects relating to rolling and plain bearings. This year's edition of the international scientific expert conference on bearings was organized for the second time by the Forschungsvereinigung Antriebstechnik (FVA). Hosted by Prof. Bernd Sauer, the conference under the motto “Industrial Research and Science in Dialog with Practical Application” was held at the TU Kaiserslautern from March 6 to 7, 2018. Prof. Bernd Sauer is the chair of the Institute of Machine Elements, Gears and Transmissions (MEGT) at the TU Kaiserslautern, which ranks among the world's leading research institutes in the field of rolling bearings. The next BEARING WORLD will be held in 2020.

### Considerably higher attendance from Germany and abroad

More than 250 participants (2016: 200) from 18 countries (2016: 11) accepted the invitation to the expert conference in Kaiserslautern. The considerably higher attendance from Germany and abroad reflects the great interest among industry and science representatives in high-level international exchanges on scientific topics. BEARING WORLD was initiated by the FVA in 2016 to focus on the increasing internationalization of rolling bearing markets and the resulting need for stronger international

collaboration in research and development. The conference in 2016 marked the first occasion for the FVA to address an international audience. As of 2018, all FVA conferences will focus on an international perspective, thus pushing ahead with their strategy of increased global networking.

### High-level keynotes by international experts

In addition to presentations on plain bearings, the conference succeeded in providing a comprehensive overview of latest research and development activities in the field of rolling bearings. Victoria van Camp, SKF Group, Sweden, and Prof. Tim Hosenfeldt, SCHAEFFLER AG,

shed some light on future challenges for bearing manufacturers in their keynotes. Key topics of the conference included reliability and efficiency, and other key areas such as energy efficiency, damage types, bearing calculation and dimensioning, applications in power transmission, operational stability and service life. 17 of a total of 44 presentations were held by international experts from scientific research institutes and corporate research departments.

### Networking and interdisciplinary collaboration are the keys to success

“Predictability is becoming even more important than longer service life. This means that our bearings experts also need to specialize in interpreting data from sensors and using this data in their predictions. We think that mechanical engineers need to become mechatronic engineers. At SKF, we are establishing teams that consist of data scientists and mechanical engineers because they can learn from one another”, said keynote speaker Dr.-Ing. Victoria van Camp, President, Innovation and Business Development, SKF Group, Sweden, in describing the most important challenges facing the rolling bearing industry. In addition, it will become all the more important to be able to make reliable predictions on operation and operating states and to offer solutions to tackle the issues of increasing digitalization.

*From “condition monitoring” to “reliable rotation” – how technology enables industrial revolutions, and how people turn technology into business value*  
Dr.-Ing. Victoria van Camp, SKF Group, Sweden







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—Schaeffler AG, Germany, Greetings from the host Prof. Bernd Sauer, University of Kaiserslautern

### Mega trends and electromobility require new solutions

In his keynote, Prof. Dr. Tim Hosenfeldt, Senior Vice President Technology Strategy and Innovation at Schaeffler AG explained how global mega trends such as climate change, globalization, urbanization and digitalization affect the corporate strategy and product portfolio of a mobility provider and rolling bearing manufacturer such as Schaeffler. Most importantly, their effect on the mobility of

the future makes it necessary to develop entirely new solutions and products in the rolling bearing industry, for example with regard to the dynamic development in the field of electromobility. “The evolution of mobility is in full swing, making it necessary for mobility service providers such as Schaeffler to address the changes ahead. The greatest challenge we are facing will be to adopt an ambidextrous approach, which means being capable of using both hands to equal measure at the same time. Translated to corporate

level, we need to further improve tried-and-test technologies while simultaneously exploring new mobility solutions”, said Tim Hosenfeldt.

### International networking is key to meeting the challenges of the future

Hartmut Rauen, VDMA Deputy Executive Director and Managing Director of the FVA is convinced that the research association is on the right track: “When it comes to tackling future challenges such as digitalization, electrification and sustainable management, international networking of industry and science is simply indispensable. With BEARING WORLD, the FVA offers the leading global platform for high-level scientific and technical exchange.”

*Shaping the mobility for tomorrow through innovation in bearing technology for a smarter, cleaner and safer world*  
Prof. Dr. Tim Hosenfeldt



## BEARING WORLD JOURNAL annually presents important research findings

The BEARING WORLD conference is held every two years. The FVA's BEARING WORLD JOURNAL serves to foster exchanges among international experts between the conference years by featuring peer-reviewed, high-quality scientific papers on rolling and plain bearings. As an international expert platform for publishing cutting-edge research findings, the journal is intended to contribute to technological progress in the field of bearings. Visit the websites at:  
[www.fva-net.de](http://www.fva-net.de) –  
[www.bearingworld.org](http://www.bearingworld.org)



— Hartmut Rauert © VDMA

### Participants 2018

#### Participants from industry and research, from the countries:

Austria; Belgium, Czech Republic;  
China; Denmark; France; Germany;  
Great Britain; Italy; Iran, Japan; Kuwait;  
The Netherlands; Nigeria; Spain,  
Sweden; Switzerland, Turkey, USA

#### Industry :

ACCIONA ENERGIA; AFC-Holcroft Europe;  
AICHELIN; Allianz Zentrum für Technik;  
Aßmann Ingenieurdienste; Atlas Copco  
Airpower; BestSens; Bosch Rexroth;

BP Europe; Carl Bechem; Conti Temic  
microelectronic; Daimler; Dow Silicones  
Deutschland; ebm-papst; eolotec; Evonik  
Resource Efficiency; Fersa Bearings;  
Festo; Flender; FUCHS LUBRITECH;  
FUCHS SCHMIERSTOFFE; FVA GmbH;  
Georg Martin; Georgsmarienhütte;  
GETRAG; GETRAG FORD Transmissions;  
GMN Paul Müller Industrie; GRW Gebr.  
Reinfurt; GTL-Getriebetechnik Leipzig;  
Harmonic Drive; hofer eds, Honda R&D  
Co.; IK4 TEKNIKER; ILJIN Bearing; IMO;  
Jaguar Land Rover; Jesko-Henning;  
Jiangyin Jingcheng Computer Numeric  
Control; John Deere; Klüber Lubrication  
München; Kugel- und Rollenlagerwerk  
Leipzig; Kuwait Oil Company; Leybold;  
Lubricant Consult; Liebherr Components  
Biberach; Lubrizol Deutschland; MAN  
Diesel & Turbo; MESYS; NSK Europe;  
NSK Japan; NTN-SNR Roulements; NTN  
Wälzlager (Europa); ORS Bearings;  
Phoenix Tribology; PROSINO; Punch  
Powertrain; RENK; Robert Bosch; RWG  
Germany; Sanat va Energy; SCANIA  
Engines; Schaeffler; Schüssler Technik;  
Senvion; SEW-Eurodrive; Shanghai  
Bearing Technology Research; Siemens  
Gamesa Renewable Energy; SIMPACK;  
SKF Deutschland; SKF Sweden;  
SKF The Netherlands; SMT; STLE;  
Stresstech; Sukeem Nigeria Limited;  
THIEHLENHAUS TECHNOLOGIES;  
thyssenkrupp Rothe Erde; Timken  
Europe; Timken France; TSUBAKI  
NAKASHIMA; TOTAL Deutschland;  
Vestas Nacelles Deutschland;  
Vestas Wind Systems; Voith Turbo;  
Volkswagen; ZF Friedrichshafen; Ziller

#### Institutes :

**Brno University** of Technology;  
**Chemnitz University** of Technology  
Department of Mechanical Engineering  
Institute of Design Engineering and Drive  
Technology (IKAT); **City University of  
Hong Kong** Department of Mechanical  
and Biomedical Engineering; **Clausthal  
University** of Technology Institute  
of Tribology and Energy Conversion  
Machinery; Engineering and Drive  
Technology; Competence Center for  
Tribology at **The Mannheim University**  
of Applied Sciences; Engineering Design;  
Fraunhofer Institut for Mechanics of  
Materials (IWM); Institut für Windenergie  
und Energiesystemtechnik (IWES);  
**Friedrich-Alexander-Universität**

**Erlangen-Nürnberg; Imperial College  
London; INSA Lyon** Responsable Equipe  
Tribologie et Mécanique des Interfaces  
(TMI) Laboratoire de Mécanique des  
Contacts et des Structures (LaMCoS);  
**Institut Pprime CNRS; KTH Royal  
Institute** of Technology Stockholm;  
**Leibniz University Hannover** Institute  
of Machine Design and Tribology (IMKT);  
**Leibniz-Institut** für Werkstofforientierte  
Technologien – IWT, **Nagaoka  
University** of Technology Department  
of Mechanical Engineering; **Purdue  
University** School of Mechanical  
Engineering West Lafayette (IN); **Qingdao  
University** of Technology; **Ruhr-  
University Bochum** Werkstoffprüfung;  
**RWTH Aachen University** Molecular  
Science and Engineering (MSE);  
Laboratory for Machine Tools and  
Production Engineering (WZL);  
**Shanghai University; Technische  
Universität Bergakademie Freiberg**  
Institute for machine elements; design  
and manufacturing; **University of  
Cambridge; University of Erlangen-  
Nürnberg** (KTmfk); **University of  
Kaiserslautern** Institute of Machine  
Elements; Gears and Transmissions  
(MEGT); **Université de Liège; University  
of Poitiers; University of Sheffield;  
University of Zaragoza** (Fersa-Bearings)

### Exhibition

#### Industry :

AICHELIN; Carl Bechem;  
Forschungsvereinigung Antriebstechnik  
e.V. (FVA); FVA GmbH; FUCHS  
SCHMIERSTOFFE; Gesellschaft für  
Tribologie e.V. (GfT); Georg Martin;  
Phoenix Tribology; PROSINO;  
Schaeffler; SIMPACK Center of  
Excellence; SKF; Stresstech; Ziller

#### Institutes :

Chemnitz University of Technology  
(IKAT); INSA Lyon; Leibniz-Institut  
(IWT); RWTH Aachen (MSE), Leibniz  
University Hannover (IMKT); University  
of Kaiserslautern (MEGT); University  
of Erlangen-Nürnberg (KTmfk)

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# International Conference Wind Turbine Bearings

The only exclusive platform for wind energy professionals to learn, debate and exchange critical knowledge about bearing reliability in wind turbines.

The first edition of the Wind Turbine Bearings conference was held on 29 – 31 May 2018 in Hamburg, and after the successful premier, the date is already set for the second edition in 2019!

**Bearings for Wind Turbines** conference is the only exclusive platform for wind energy professionals to learn, debate and exchange critical knowledge about **bearing reliability** in wind turbines. Together, experts explored for 3 days the complex factors that ensure **resilient, long lasting** bearing technology in all areas of the turbine. **Case studies, new research and technical advances** were interrogated in order to move towards **maintenance-free parks** and advance offshore wind as a world leader in commercially competitive renewable energy.

The conference covered beside the key note and technical presentations; also four interactive workshops where the attendees could benefit from in-depth sessions, hosted by selected industry experts. Industry experts shared their expertise with a limited group of peers. The workshop leaders provided in-depth knowledge and actively fostered open exchange and discussion to help the attendees face challenges, discover solutions, and make decisions crucial to business excellence.

The presentations during the Wind Turbine conference focussed on the

following aspects of the bearing application within wind turbine industry:

## **An introduction to certification and compliance for main bearings**

Main Bearings lifetime: standards and certification

- ISO 281 and ISO/TS 16281 Standards
- Different approaches in loads post-processing for lifetime calculation
- Contact pressure calculation and application for lifetime
- Certification acc. different guidelines: GL 2010, IEC 61400,



DNVGL-ST-0361, GL 2013

## Advanced testing and modelling for accurate lifetime prediction

The HAPT project: Endurance test of large blade bearings

- Blade bearings: A unique rolling bearing application
- Test rigs for large bearings
- The HAPT test rig
- Endurance test programs for blade bearings

New stress-based life estimation method for rolling contact fatigue of bearing:

- Conventional approach to bearing fatigue life estimation
- New approach to stress-based bearing fatigue life estimation
- Comparison case studies
- Benefits from new approach and potential research idea

## Evaluating design considerations for more robust, reliable bearings

Consideration of bearing design from wind turbine's OEM point of view:

- Overview of development process for designing and selecting different bearings in wind turbine
- Wind turbine OEM's consideration for bearing design, selection and application
- Experience learned from bearing design, selection and application
- Future consideration for bearing design and selection

Problem solving through a drastic departure from traditional materials:

- Eliminate WEC
- Provide an adjustable, repairable in place bearing
- Introduce bearing to survive life of wind turbine without replacement
- Remove hydrocarbon based lubricants with water lubricated bearings

Round Table Discussions:

- The effect of new grid codes on bearing reliability
- Interrogating bearing standards

and certification challenges

- Bearing solutions for giant turbines

Optimized design of adjusted bearing arrangement in 3MW drivetrain:

- Comparison of different main bearing arrangements
- Difficulties in the design of adjusted bearing arrangement
- Optimized design of tapered roller bearings
- Influence of temperature field and mounting accuracy on bearing preload

## Understanding bearing protection techniques for reducing the risk of failure

Asymmetrical spherical roller bearings for wind turbine main shafts:

- Problems in the field; How inadequate lubrication and rolling sliding leads to wear and potential failure
- New design concept of ASRB and function effect
- Solution with ASRB for downsizing and longer life

Rotor blade bearing lubrication, wear and failure mechanisms:

- Environmental and project specific considerations
- Manufacturing quality and purity problems, and filtration solutions
- Performance analysis
- Avoid compromising the system; contaminants and other common problems

## Preventing critical damage to drive train bearings – the latest practical knowledge about White Etching Cracks

Analysis of main influencing factors on critical loads at transmission bearings and identification of critical operation states:

- Identification of loads at the hub flange during different operation states
- Analysis of main influencing factors on loads at planetary and high speed shaft bearings
- Influence of drive torque and pitch torque on the load distribution at the planetary stage

Practical care of drivetrain bearings to avoid WEC and extend life:

- Flaking Mechanisms in Rolling bearings
- Influence of oil cleanliness
- Mechanisms of White Etching Cracks (WEC)
- Materials for extended Life and Prevention of WEC

Round Table Discussions:

- Optimal technology for the different bearing applications in a wind turbine
- The importance of grease analysis
- Compare the latest information on white etching cracks

Learning wind turbine bearing field-behaviour from IoT devices processed by monitoring algorithms residing in the cloud:

- Big data allows to process large quantities of field measurements and offers the potential for learning from turbines already in the field.
- Coupling this technology with physics-based signal processing techniques gives detailed insights in bearing condition
- Loading event analysis allows to learn about the coupling between condition and cause

## Fail to plan, or plan to fail – problem solving in the event of serious bearing failures

Case Study | Bearings in wind turbine components always fail differently than you expect:

- Status of approving bearing suppliers with OEM's in a market of lower prices
- E.ON status on blade bearings failures, monitoring, RCA and maintenance strategy
- Experience across fleets and countries on main bearings + bearings in gearboxes
- Initiatives and expectations on journal bearings

Case Study | Main bearings failure expectations based on four real cases:

- Original targets
- Hypotheses of failure modes root causes
- Analysis of each real case
- Concluding assumptions

# Speakers 2018

More information about the coming event can be found on  
<https://windturbine-bearings.iqpc.com>



**Niels Emsholm**  
Technical Fleet Manager  
E.ON, Sweden



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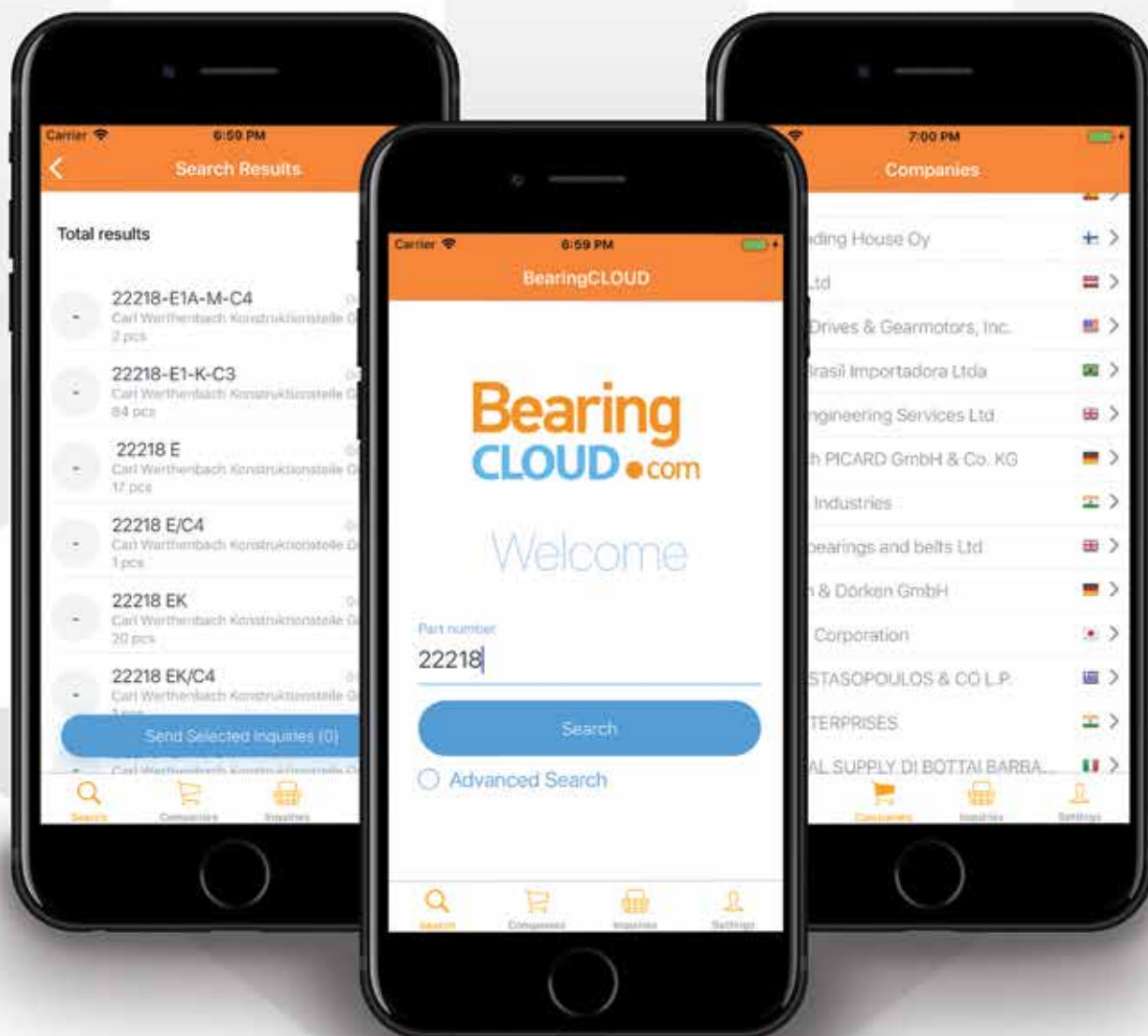


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Prof. Dr. Tim Hosenfeldt

# INNOVATIVE BEARING TECHNOLOGY WILL SHAPE THE MOBILITY FOR TOMORROW

One of the keynote speakers for this year's edition of the international scientific expert conference on bearings was Prof. Dr. Tim Hosenfeldt, Senior Vice President Technology Strategy and Innovation at Schaeffler.

In his keynote, Prof. Dr. Tim Hosenfeldt, explained how global mega trends such as climate change, globalization, urbanization and digitalization affect the corporate strategy and product portfolio of a mobility provider and rolling bearing manufacturer such as Schaeffler.

Most importantly, their effect on the mobility of the future makes it necessary to develop entirely new solutions and products in the rolling bearing industry.

We tried to reveal the essence of his keynote presentation and further the dynamic development in the field of electromobility during an interview.

## **What is your role in the organization?**

I'm responsible for technology strategy and innovation for Schaeffler Group. This means first being responsible for the worldwide advanced research. We have several collaborations, like our Schaeffler Hubs for advanced research in different universities worldwide, where Schaeffler and people work together in shared offices.

Then we have our innovation strategy and roadmap within a perspective of 20 years; with innovation management, new business fields and public private partnership: with one objective in mind: "What need the customer from Schaeffler in the future and how we could be the preferred technology partner?"

Finally, we have a third field where we bring science to business, that's what we

call "Innovation Projects". We go from our knowledge and advanced research to build up for Schaeffler complete new demonstrators, like new wheel hub drive systems that enable new automated mobility concepts, like the "Schaeffler Mover". The department accounts around 90 people at Schaeffler worldwide, distributed between Germany, North America, Greater China, Singapore, and Japan (not including "virtual organizations" coming from universities worldwide). Besides technology strategy and innovation, I'm also responsible for the surface technology field. I'm myself Professor of Surface Technology and Tribology at the university of Erlangen.

## **Can you tell us more about your key note presentation at the Bearing World conference?**

We talked mainly about the mobility of tomorrow: our focus is the need of innovative bearing technologies to make

the world smarter, cleaner and safer. We have disruptive changes coming ahead of us. We actually don't have to decide or discuss; those changes are just coming. The only question is: "How disruptive are those changes?" For that reason, we are well prepared as an integrated automotive and industrial supplier developing to a "supplier of mobility". This is of course a challenging transformation of collaboration and skills. Are we prepared to meet the expectations? Not only what the OEM is ordering from us, but also how look the future of mobility.

## **Which are the current Global trends on mobility?**

We are working on 94 trends at the moment, and 4 "megatrends" can be distinguished among them. The first is the environment, more specifically the climate change. According to the Paris agreement we must limit the temperature increase only of 2°C and to reduce the CO<sub>2</sub>

*"The fourth mega-trend is technology and digitalization"*





**Prof. Dr. Tim Hosenfeldt,**  
*Senior Vice President Technology Strategy  
and Innovation at Schaeffler AG*

## *“The IoT and Industry 4.0 are both aspects of the increasing digitalization and may drive us into more communicative and interactive projects.”*

emissions. This is not locally, but globally. Then, we have the society change: more and more people are living in mega-cities (in Europe: Paris and London) and driving or moving every day longer distances in very congested places. Moving to the third change is the globalization: more and more people have increased wealth and have higher standards, including for mobility. This increases the need of efficient mobility in the mega-cities, but also between them. If we discuss more locally for mega-cities, another objective is also to aim for emission-free solutions. Current diesel engines are relatively successful at reducing emissions but there's still work to do regarding particles.

The fourth mega-trend is technology and digitalization. It influences nearly everything, as a threat but also as a big opportunity. The key message for Schaeffler as technology leader is: anything that could be electrified, connected and automated, will be in the future. This brings the topic of e-mobility, especially for mega-cities, and energy efficiency: lightweight, low-friction, low-noise bearing solutions. And finally, the Internet of Things will connect machines with people. This means that the bearings should get new functionalities, like collecting data related to mobility. From that point of view the bearing is the ideal machine

element since you have motion, forces, torque present in the same component.

### **How do you see the correlation between IoT and Industry 4.0?**

This is an important topic. For me, the IoT and Industry 4.0 are both aspects of the increasing digitalization and may drive us into more communicative and interactive projects. The key for Schaeffler is to make smarter products to collect data, allowing simultaneously stronger consumer-supplier impact off automated real-time processes. Of course, we will have to build knowledge from that data. Therefore we have a digital agenda running based on 5 key elements: product & services, machines, processes, analyses & simulations, and finally user experience. For this last part, the goal is to generate value for our customers but also for the people of the factories. To summarize, IoT and Industry 4.0 are great support to handle the growing complexity.

### **Can you share with us Schaeffler's “Mobility for Tomorrow” strategy focus areas?**

This is where our corporate innovation management find its best role: looking how is the world changing and focusing on the four megatrends (as previously evoked). Practically, we've created four focus areas that we are currently

working on at Schaeffler: eco-friendly drives (optimized combustion engines, electric drives, industrial drives), urban mobility (two wheelers, inner-city railway, micro mobiles), interurban mobility (rail vehicles, aircraft, off-highway) and energy chain (wind power, solar power and conventional power generation). The strategy is to deliver the right components and systems to address those focus areas. Moreover, we have now new business unit completely focusing on e-mobility and Industry 4.0.

### **How is Schaeffler as a global automotive and industrial supplier pushing ahead with its transformation process in readiness for the future?**

It is doing this by means of “Agenda 4 plus One”, our program for the future. The program is structured into four plus one categories: “Customer focus”, “Operational excellence”, “Financial flexibility”, “Leadership and talent management”, and – as the “plus One” – “Securing long-term competitiveness and value creation”.

It is broad-based and encompasses 20 initiatives, including E-Mobility, Industry 4.0 and our Digital Agenda. ‘Agenda 4 plus One’ is the driving force behind our transformation.

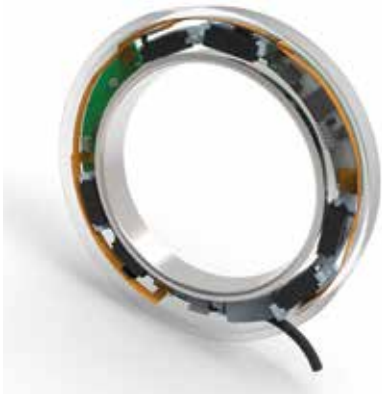
### **What is the role of bearings for Industry 4.0 and eMobility?**

A big challenge for Schaeffler is the ambidexterity in the field. On one hand, we have to produce better and better bearings in term of lifetime, endurance, tribology and energy efficiency. On the other hand, bearings are fitted everywhere in the mechanical processes and they are



—Flanged housing units with for electric motors





— Schaeffler integrates sensor technology into its spindle bearings

therefore predestined for data collection in terms of process-control and machine monitoring, would it be a machine for production or just a driving application. For example, in our e-wheel drive there's a complete digitized drive-train in the rear. In that sense, Schaeffler develops sensorized components and mechatronic products. These are, according to me, formidable enablers for Industry 4.0

### What can you say about the quote “The bearing of the future will be an integrated sensor”?

The bearing is the sensor, or the sensor is an integrated bearing : collecting the data where “the data occur”. The pre-processing is made by Schaeffler and transmitted to the Schaeffler-Cloud allowing further analysis to support our customers with not only data, but also knowledge.

### Can you give us some examples of Schaeffler's sensorized components and mechatronic

*“The bearing is the sensor, or the sensor is an integrated bearing : collecting the data where the data occur.”*

### products which play an important role for Industry 4.0?

I'd like to start first with our vision and base eco-system. We are today able to offer standard hardware solutions and IT infrastructure as well, from simple components to complete digital services. It encompasses all stages of the digital added value. In parallel, we've put efforts to build an open, flexible, extendable and application-oriented architecture to allow users to benefit from all the strategic services of Schaeffler. On top of it, via Cloud, we help the customers to control processes, maximize availability and optimize product quality.

Coming to the products, Schaeffler developed the “VarioSense” sensor-bearing: this is a standard bearing combined to an integrated modular sensing system to measure speed, shaft displacement, vibration or temperature, depending on what the customer actually need to measure. It can be used in various applications like for example gearboxes, pumps but also e-motors.

The second solution we offer is build based on a holistic approach for linear guidance systems in machine-tool and handling systems. We call it “DuraSense” : it combines monitoring of the lubrication condition and automatic

re-lubrication of the guidance. The customers can, that way, avoid unplanned downtime and reach longer lifetime.

A newer sensorized product we offer is called “TorqueSense”: it's a plug-and-play sensor unit for Off-Road powertrain applications. We enable direct measuring of the torque and the torque distribution using contactless and very robust physical principles.

Besides those specific, we have general solutions for condition monitoring, like our SmartCheck solution. The customer can directly mount it on most of applications like gearboxes, pumps or e-motors, to measure vibration, speed and temperature. Benefits for customers are clear: avoid unplanned breakdowns and support predictive maintenance operations. Schaeffler is able to equip existing solutions, new integrated solutions, as well as retrofitted applications.

### How important will “coatings” be in eMobility?

In every tribological system, you have what you could call two “surface-partners” and -most of the time- a lubricant. So in terms of energy efficiency, it's obviously very important



— Urban vehicle concept for the future: “technologies for the mobility of tomorrow” powered by innovative wheel modules

# Smart hybrid transmissions

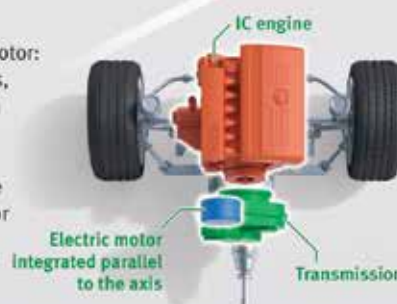
SCHAEFFLER

Schaeffler has developed a space-optimized transmission for plug-in hybrid vehicles. The **dedicated hybrid transmission** combines the benefits of an automated manual transmission with those of the electrified powertrain. At the same time, driving dynamics and ride comfort are enhanced while consumption and emissions are reduced.



## Functional principle: DH-ST 6+2

One total transmission system for the IC engine and the electric motor: Its special feature is a division of the transmission into two units, each with two gear ratios. Located between them is a replication transmission, also with two gear ratios. The IC engine uses both transmission units including the one of the electrical path. As a result, six gears in total are available to the IC engine. Due to the dual use of one gear level, five gear wheel levels are sufficient for this purpose. Two gears are available to the electric motor.



## Benefits of the transmission architecture



High power output



Small space



Cost-efficient



Reduced consumption

During shifting events the integrated electric motor compensates for the absent torque of the IC engine. The compact design of the mechanically sophisticated transmission saves valuable space. Six gear ratios in ICE mode and two in electric mode ensure particularly low consumption. The dedicated hybrid transmission is ideally suited for vehicle concepts with high overall system output.

Graphic: [www.josekdesign.de](http://www.josekdesign.de)

— Schaeffler is accelerating electric mobility

to reduce first the friction losses.

Therefore we developed a comprehensive “coating-toolbox” focusing on the most important criteria’s: friction reduction for higher energy efficiency increased lifetime by wear and corrosion protection. Smart surfaces by sensorical coatings. Another important field is the electrical insulation (which is a growing field in the e-mobility): to avoid electrical current between the metallic parts and damages to the oil. Surface Technology addresses those matters to propose more efficient products. A better control of friction losses allows you to drive longer distances with or the same battery capacity.

## Do you also develop new technologies for energy efficiency?

Like mentioned previously, everything where you have sliding contacts and/or friction is an important topic. On the other hand, we also tackle this challenge with “Lightweight” designs. The goal is to use

new composite materials or multi-material concepts: using the right material at the right place. And finally, at the stage of exploration, we work on bearings where there’s only air between the two surface-partner, avoiding thus any contact.

## How will all these new developments affect the TCO for customers?

Total cost of ownership is a very important aspect, especially if you look into the B2C market. The customer doesn’t necessarily pay for the product, but also for the use. Traditionally, we sell a bearing and the business is done. But more and more, the customer orders availability or productivity. For example in the railway segment, we are responsible to deliver availability or miles, and we support it with whole predictive maintenance solutions to keep the applications running.

This is what the customer pays for. If

we come back on mobility, it will be more and more connected, automated, emission-free but also more and more shared. TCO-wise, people will want more and more to buy mobility instead of owning their mobility device. We can also imagine in the near future apps telling you automatically what devices to use to get from a point A to B. So yes, TCO will be more and more important in the future.

## What is the purpose of “Multi-Material Concepts” and “bionic design”?

The Multi-Material Concept is how we enable optimal utilization of the material properties, and adapt the material selection locally to the product requirements. One technology that perfectly allows us the local use of different materials is additive manufacturing. Indeed, the additive manufacturing enables the next step of coating: this is the coating “in three dimensions”. That way, we can have



a quite intelligent material design and obtain the properties we exactly need. Therefore, developing traditional manufacturing with the new techniques is very important. Schaeffler is very strong regarding that aspect. We are not only experts in materials and surface technology research, but also in producing the best quality and delivering high quantities at the same time. In Aerospace for example, we have already developed solutions with special cooling features and integrated sensors. This is a great field for additive manufacturing development, but not the main market.

About the bionic designs, nature was a great inspiration. If you observe nature, for example how a tree is growing, material is used in an ideal manner only where it is needed. This inspiration can be used in technology, and this what I've showed in my presentation during the conference: bearings can be designed and manufactured from steel, multi-material plastics and plastic-metal hybrid design to reduce the mass by more than 20% and have the same lifetime or

endurance. Better friction properties can also be obtained by putting a composite material in place of pure steel-to-steel counterparts, and only where it's needed. Finally, a significant cost reduction can be reached by building this optimized design in comparison with a whole component.

### As conclusion; what are still the main challenges for a successful "Mobility for Tomorrow"?

The challenge lies in the ever-increasing complexity, more fractured mobility, the different demands, additional competences and also the different perceptions depending on the regions of the world. An important key to success is the capability for system based thinking and ambidexterity, the rare ability to use both hands at the time with equal skill. This means continuously perfecting proven products and at the same time developing new sectors and applications. This entails major changes in the variety of necessary competences and requires an overarching and agile collaboration within the company and across company

boundaries across different industries. If you talk about "urban and micro mobility" solutions in Germany or Europe, it may not necessarily mean the same thing in Singapore, Greater China or Japan. Besides, we face more and more diverse drive-trains, more diverse and more complex vehicle components and even more diverse energy sources. Of course, today if you buy a car, you can do everything with it : driving in the city or inter-urban. But at the end of the day, we observe that still, people tend to use more and more diverse and specific mobility solutions.

The shared mobility model is also getting more important and we can imagine soon complete automated systems running 24/7, with a higher demand on component's lifetime. Of a course, to achieve this, a robust digital macro-infrastructure is needed an a very intuitive and self-explanatory interface as well. I have to notice that we still don't have at the moment in Germany. We need a broad, safe, complete internet access to achieve all the ambitions of the Internet of Things.

## One platform – many possibilities

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The Schaeffler Mover with **wheel-hub drive** provides a flexible and zero-emissions platform for diverse vehicle concepts. All drive and suspension modules are installed in a single unit, the "**Schaeffler Intelligent Corner Module**." The module is easily scalable in terms of vehicle length and width as well as for maximum space for new cabin concepts.

### Maximum maneuverability

The Schaeffler design permits a steering angle of up to 90°. This results in enormous agility of the vehicle and also makes parking maneuvers possible with minimal space requirements.



Steering motor with transmission

Yoke

Spring and dampers

Wheel-hub drive

Intelligent Corner Module

### Variable vehicle concepts

The vehicle's platform, the "Rolling Chassis," houses the entire drive technology. Various body versions for passenger and cargo transportation can be installed on top of this platform without any modifications of the drive system and suspension.



various body versions

"Rolling-Chassis"



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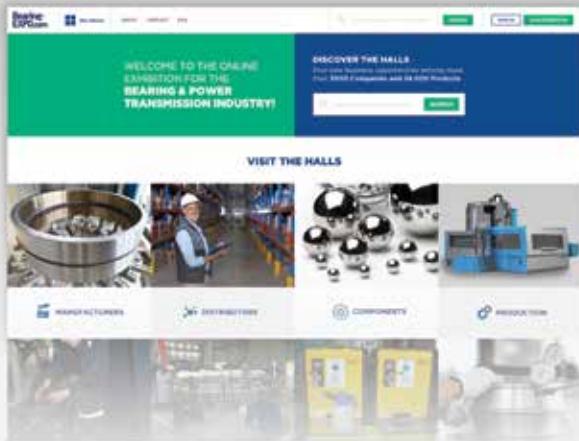
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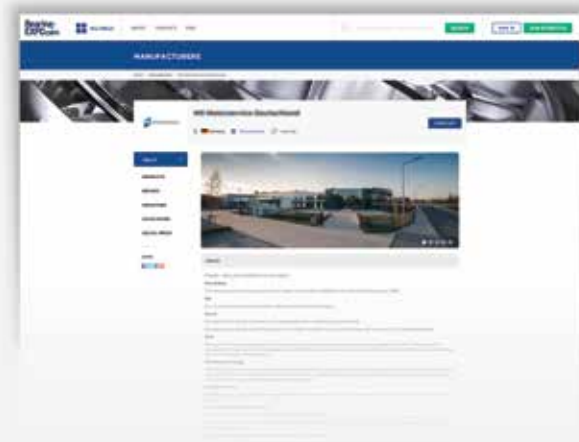


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We also produce power transmissions products such as vee & wedge belts and pulleys, timing belts and pulleys and both flexible and rigid couplings.



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Dunlop has a production site in Consett, Co. Durham, north east UK and a warehouse and distribution centre in Ashford, Kent, south east UK that serves the markets of both the UK and Europe, Dunlop premium roller chain is proud to be manufactured in the EU.

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## Environment

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In pursuit of continued quality, every Dunlop chain is made of a special steel alloy developed by our Engineering Department which when combined with advanced heat treatment processes ensures that our customers can always rely on a constant quality level of all Dunlop premium roller chains. Dunlop premium chains are easily recognisable by their high quality black boxed packaging and hologram label design, look out for the Dunlop flying D on the outer plates for further reassurance that you are receiving a genuine Dunlop premium product.

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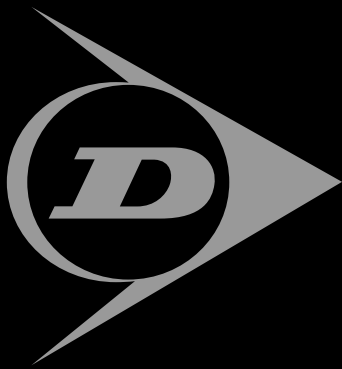


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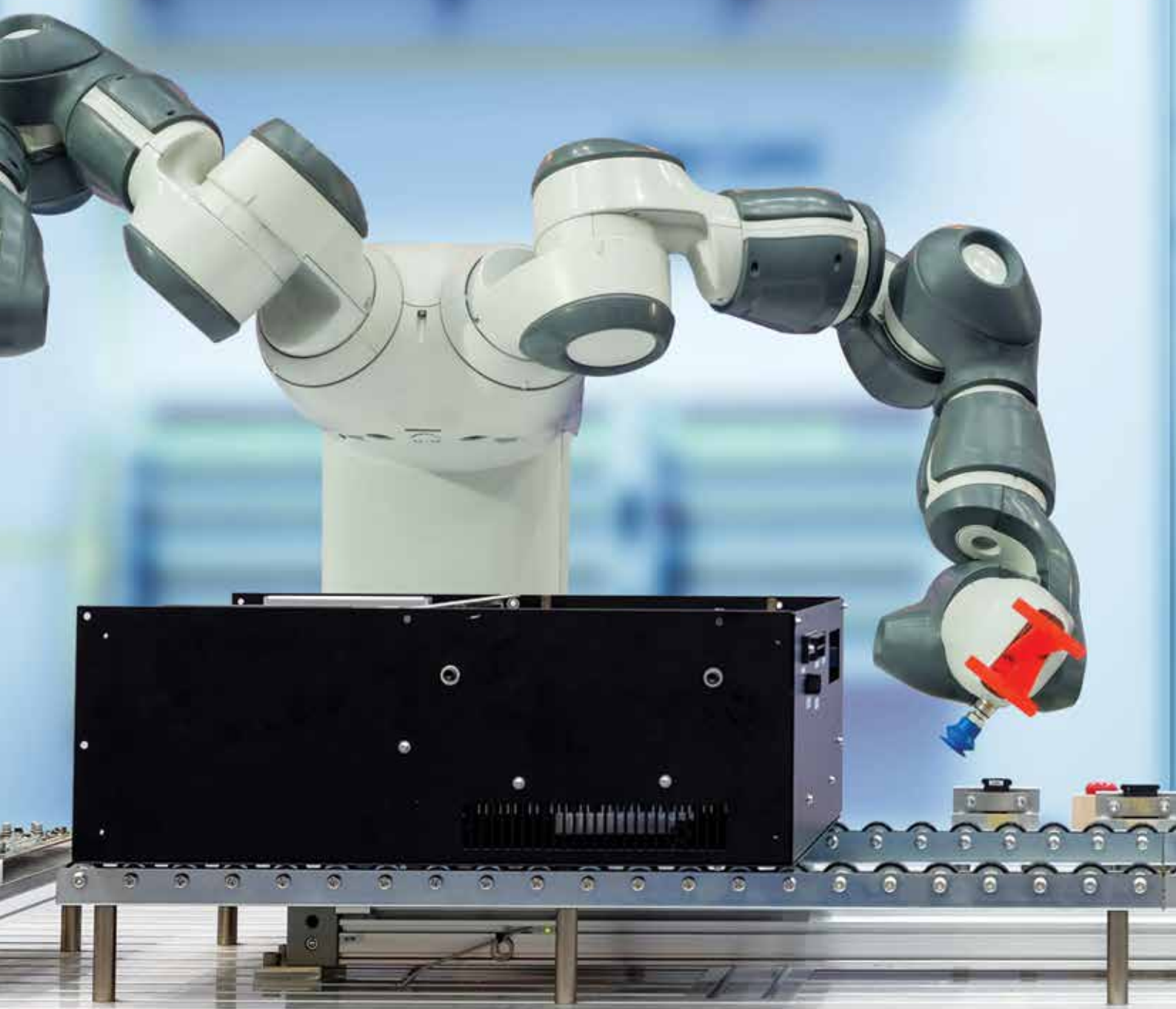
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# *The Trends of the* **EUROPEAN** **BEARINGS MARKET**







Across all end-user segments in Europe, there has been an increasing demand for bearings with longer service life, higher efficiency and lower maintenance requirements. In addition to this, different applications in different end-user segments are demanding specialized bearing solutions that meet their requirements and challenges.

The various special type of bearings used across different end-user segments include the following.

- Standard ball- and roller bearings
- Machine tools require super-precision bearings.
- Relubrication-free/ self-lubricating bearings are preferred in food and beverage processing machines.
- Insulated bearings (coated with INSOCOAT) are preferred in electric motors and generators.
- Hybrid bearings, corrosion resistant bearings and self-aligning bearings are used across different end-user segments.

Bearing designs are constantly improved by manufacturers in order to increase the energy efficiency and performance of bearings. These include redesigned raceway profiles, usage of special material for cages, raceways and rolling elements.

#### **Which segments are highly impacted?**

A major disadvantage of using fully stainless steel bearings in electric motors and generators is that of electric arcing – the accidental passage of electric current across the rolling elements of the bearings. Electrical arcing can result in damage to bearing surface and premature aging of the lubricant. This adversely affects the performance and life of the bearing. However, by

the usage of hybrid bearings with ceramic rolling elements, which have natural insulating properties, these disadvantages of stainless steel bearings can be eliminated, thereby increasing the operating life of bearings and reducing the bearings maintenance cost. Silicon Nitride ( $\text{Si}_3\text{N}_4$ ), which is a black ceramic material, and Zirconium Dioxide ( $\text{ZrO}_2$ ), which is a white ceramic material, are the preferred choices of material for making ceramic rolling elements.

The adoption of hybrid bearings in wind turbine is expected to increase during the forecast period, as end-users are looking at ways to minimize maintenance cost. The growing investments into renewable energy segment that uses electric generators is expected to

drive the growth of hybrid bearings in electric generator application.

The other major advantage of hybrid bearings with ceramic rolling elements that helps ceramic bearings find application in the aerospace segment is their lighter density (weight) compared to stainless steel. By using hybrid bearings, premium brand manufacturers have achieved bearing weight reduction of up to 60%. Added benefits of ceramic rolling elements include lifespan improvement, increased resistance to wear and contamination, and lower power loss through heat generation.

Pressure on profit margins is forcing airlines to maximize fuel efficiency of the aircraft. As a result of this, the adoption







of ceramic bearings with lower-weight and longer service life is expected to increase throughout the forecast period.

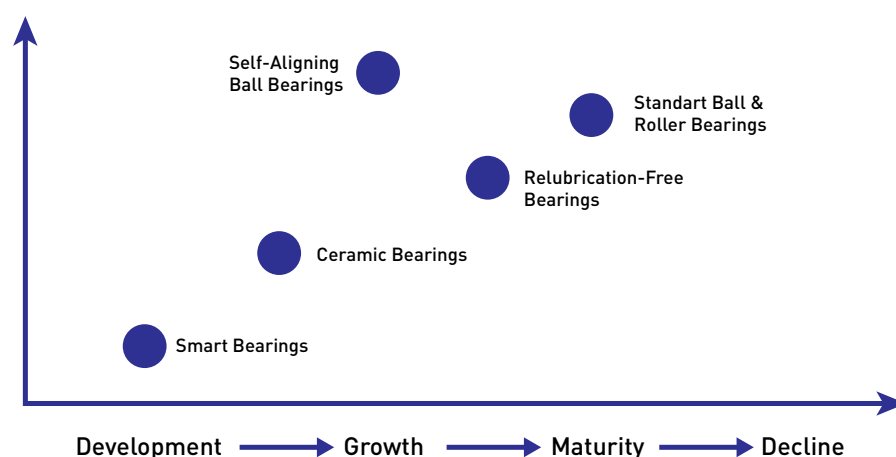
The demand for relubrication-free sealed ball bearings that can be used with wash-grade stainless steel motors and gearboxes is expected to increase throughout the forecast period (2021). Sales of these bearings and wash-grade motors are likely to be driven by hygiene standards set by European Food Safety Authority (EFSA) in Europe and Food and Drug Administration (FDA) in the United States (in case of exported machines). In addition to this, the expected increase in the global demand for processed food is likely to increase the demand for food processing machinery, and thereby provide more opportunities to sell relubrication-free sealed ball bearings.

Similarly, self-aligning ball bearings find extensive adoption in applications such as machine tools, paper processing machines and textile processing machines. Shaft misalignments can be caused by varying

loads exerted on roller shafts due to variations in dimensions of the different machined objects (in case of machine tools) or paper dimensions (in case of paper processing) or fabric widths (in case of textile processing). However, self-aligning ball bearings can accommodate such radial loads on the shaft without causing misalignment of the shaft. This also reduces the friction on the rolling element and thus reduces damage to the bearing. Therefore, end-users are

able to achieve longer bearing life and longer lubrication intervals, significantly reducing their operating costs. These advantages are likely to increase end-user preference for self-aligning ball bearings and hence increase their sales.

The below graph represents the market adoption stages in Europe, of the various bearing technologies.





### The Generation of Smart Bearings

With the advent of the industrial internet of things (IIoT), several machinery and equipment are beginning to get connected and their conditions are starting to be continuously monitored. This trend has impacted the bearings market too. Two of the leading bearing suppliers have started supplying smart bearings, whose condition can be continuously monitored to predict faults before they occur. The smart bearings market is still in the nascent stage of adoption. Many of the other leading bearing manufacturers are expected to add smart bearings in their portfolios during the forecast period. As faults in smart bearings can be predicted before they occur, they add significant value to end-users by minimizing the cost of unexpected downtime. This factor is likely to increase the adoption of smart bearings.

This ability to predict faults and failures in bearings will add advantage to bearing manufacturers, as they will be able to better forecast the demand for spare parts, leading to more efficient inventory management and tighter control over the after-market segment, which has been strongly influenced by distributors. At the same time, the growing adoption of

IIoT-based smart bearings is expected to decrease the replacement rate of installed bearings. This is because, smart bearings, when installed, will be replaced based on the actual condition of the bearing rather than on a predetermined replacement schedule. In the latter case, bearings are replaced after a pre-defined lifetime, even if they are in perfect working condition.

### How do bearing manufacturers take advantage?

Bearing manufacturers need to continuously work with their customers to understand their challenges and shortcomings. Simultaneously, bearing suppliers need to encourage an innovative culture among their technical teams so that they are able to provide innovative and sophisticated solutions to meet the demands and challenges faced by the customers.

In order to develop smart bearings, manufacturers must work towards establishing partnerships with IIoT platform providers and analytics solution providers to integrate these capabilities to develop smart bearings. With such partnerships in place, bearing manufacturers will be able to widen their solution portfolios to include bearings

service (such as predictive maintenance) and thereby, increase their revenue. This will be important for bearing manufacturers in Europe to differentiate themselves from low-priced bearing imports and sustain their revenues.

### Conclusion

The European bearings market is a continuously evolving market with constant improvements in bearing designs and the integration of new technologies with bearings. In order to stay ahead of the curve, it is important that bearing manufacturers invest significant time, effort and money in building partnerships with companies offering complementary technologies and in the research and development of new and innovative bearing designs and also in the development of robust testing mechanisms to validate the performances of these new designs.

*For further information on Frost & Sullivan's latest report on the European Bearings Market, contact the analyst and author Krishna Raman, Industry Analyst, Industrial Automation & Process Control Business Unit, E-mail: [KrishnaR@frost.com](mailto:KrishnaR@frost.com)*



# THREE LETTERS. TOTAL QUALITY.

NSK sets many things in motion – for example in the agricultural industry. As a leading global manufacturer of rolling bearings, NSK combines 100 years of success and a total quality approach.



MOTION & CONTROL™

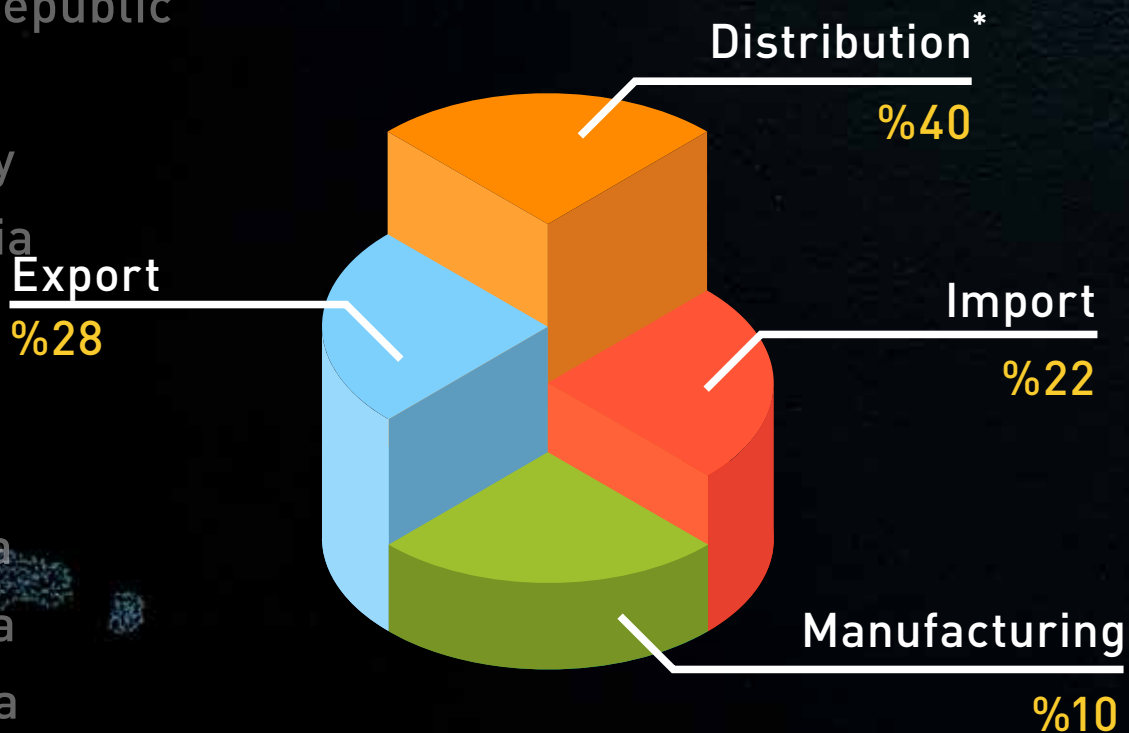
**NSK**

[www.nskeurope.com](http://www.nskeurope.com)



# European Bearing Market Research Distribution & Manufacturing Statistics

Read in our next issue the bearing distribution market research and individual Import, Export, Manufacturing statistics for **28 EU member countries**



\* This graphic is just for illustration purpose, more accurate stats graphics will be shared in our next issue.







# BEARING & GEARBOX SEMINARS

USA (INDIANA) SEPTEMBER 2018

## SEMINAR PROGRAM

### BEARINGS

#### 3th of September 2018

Development of bearing suppliers and quality control during purchasing

#### 4th of September 2018

Basics of bearing technology

#### 5th of September 2018

Bearing failures: Investigation and analysis of practical examples

### GEARBOXES

#### 5th of September 2018

Bearing failures: Investigation and analysis of practical examples

#### 6th of September 2018

Preventive maintenance and condition monitoring of industrial gearboxes

#### 7th of September 2018

Supplier development for large industrial gearboxes and quality control

## BEARING SEMINARS

### Development of bearing suppliers and quality control during purchasing

*3th of September 2018, 10:00 a.m. – 05:00 p.m.*

Global sourcing of bearings opens plenty of opportunities for optimization of supply chains. However, any new supplier approval goes along with a certain quality risk. Therefore, this seminar is focused on the following subjects:

1. Definition of quality requirements, technical specifications
2. Approach during supplier visits and audits
3. Requirements related to documentation of production
4. Methods for incoming inspection
5. Concepts for quality control



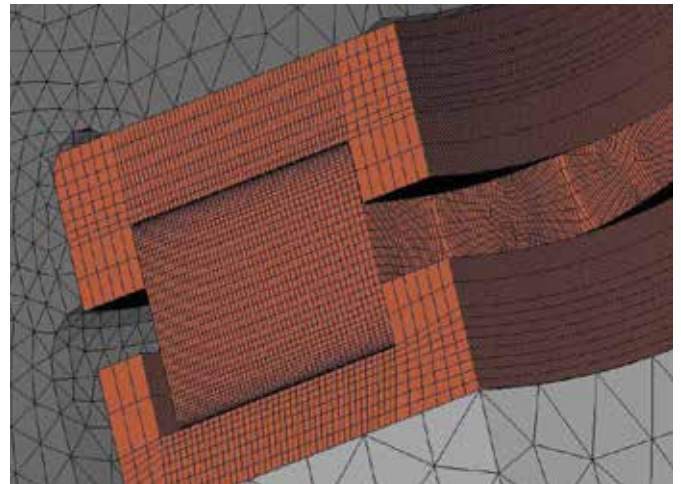


## Basics of bearing technology

*4th of September 2018, 10:00 a.m. – 05:00 p.m.*

This one day seminar provides basic knowledge especially for design of bearing arrangements and for quality assurance during purchasing. Lectures shall focus especially on:

1. Types, Properties, Concepts
2. Basics of Tribology
3. Raceway crowning
4. Material properties
5. Sample assesement



## Bearing Failures: Investigation and analysis of practical examples

*5th of September 2018, 10:00 a.m. – 05:00 p.m.*

Identification and understanding of failure root causes is necessary in order to initiate the required counter measures. Therefore, this seminar shall show based on practical examples how damage characteristics can be identified and to which conclusion they lead. Main topics are especially:

1. Methods for damage investigation
2. Damage mechanisms
3. Quality characteristics of bearings
4. Examples from numerous applications



# GEARBOX SEMINARS

## Preventive maintenance and condition monitoring of industrial gearboxes

*6th of September 2018, 10:00 a.m. – 05:00 p.m.*

In many technical systems, breakdowns of particular components lead to enormous subsequent costs as production will be affected significantly. Detection of damages at early stages can lead to minimization of downtime and helps to avoid secondary damages by which overall breakdown costs can be highly reduced. Therefore, this seminar refers to the following topics:

1. Investigation of lubricants
2. Regular inspection and endoscopy
3. Vibration measurement and analysis of obtained results
4. Automation of shutdown in case of detected defect



## Supplier development for large industrial gearboxes and quality control during purchasing

7th of September 2018, 10:00 a.m. – 05:00 p.m.

Large industrial gearboxes are typically produced in small series while frequently, individual solutions are requested which require close collaboration between supplier and customer. Here, especially clear communication of requirements, verification of technical concepts and of course the general assessment of production processes are essential. Accordingly, the topics of this seminar are:

1. Structure and content of technical specifications
2. Verification of technical documents such as drawings, stress and lifetime calculations of shafts, gearings, bearings and housings
3. Approach during supplier visits and audits
4. Requirements related to documentation of production
5. Methods for incoming and production related inspection



## "Special Deals"

### BEARING PACKAGE

- ✓ Development of bearing suppliers and quality control during purchasing
- ✓ Basics of bearing technology
- ✓ Bearing failures: Investigation and analysis of practical examples

### GEARBOX PACKAGE

- ✓ Bearing failures: Investigation and analysis of practical examples
- ✓ Preventive maintenance and condition monitoring of industrial gearboxes
- ✓ Supplier development for large industrial gearboxes and quality control



You can download the registration form and all the seminar details on the Elgeti Engineering website at [www.elgeti-engineering.de](http://www.elgeti-engineering.de) in order to subscribe for one or more of the training seminars or contact Ms. Alexandra Becker on [ab@elgeti-engineering.de](mailto:ab@elgeti-engineering.de) or call +1 2195105499

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Grease reduces friction in bearings. Less friction means longer life. LUBExpert alerts you when friction levels increase, guides you during re-lubrication, and prevents over and under lubrication.

## Grease Bearings Right



**Right** Lubricant



**Right** Location



**Right** Interval



**Right** Quantity



**Right** Indicators



Ultrasound Solutions

[sdtultrasound.com/lubexpert](http://sdtultrasound.com/lubexpert)

**110**  
**years**  
**and**  
**Still Rolling**

1908 was a historical year. The first Ford Model T rolled out of the Detroit factory, “The Kiss” (Lovers) was made by the Austrian Symbolist painter Gustav Klimt, Pu-Yi became the last emperor of the Qing-dynasty and the Chicago Cubs won the World Series. The Rollway® history started that same year when trolley car 764 rolled down the tracks of the Syracuse Rapid Trans-it Line, it carried with it a new product that would eventually set the stage for a century of innovation. That drive through the streets of Syracuse marked the first time that bearings from the Railway Roller Bearing Company had been installed and tested.

#### **A legacy to be proud of**

Throughout the early part of the 20th century, the fledgling company flourished and started producing general-purpose roller bearings for heavy-duty equipment used in steel, pulp and paper mills. The company also began manufacturing a new line of straight cylindrical roller bearings. It was during this time that the Railway Roller Bearing Company

was approached by Henry Ford to produce rear wheel bearings for the Fordson tractor. This eventually led to manufacturing transmission bearings for Franklin, Pierce-Arrow, Lincoln, Peerless, and Packard automobiles. In 1923, the firm changed its name to Rollway Roller Bearing Company, and expanded its offerings even further, with the introduction of a line of automotive roller bearings. That product-line

expansion continued through the second half of the previous century and into the 21st century, new Rollway products were developed and delivered to meet the demands of markets as diverse as oil and gas, material handling, steel mills, agriculture, construction and mining.

#### **From Great Recession to World War 2**

By 1930, two thirds of all automobiles



had Rollway® bearings as standard equipment. However, diversified products and the variety of industries served didn't spare the company, along with the rest of the industry from the consequences of the great recession after the Wall street crash of 1929. Fortunately, despite a nearly 70% drop in sales at its worst point and the loss of half of its workforce, the company managed to stay afloat and from 1941 to 1945 contributed to the war effort.



Rollway® bearings were used in tanks, catapults, gun turrets, and ammunition hoists during World War II. Roller bearings and other products, including friction clutches, were also shipped to Europe to help the Allies under the Lend-Lease Act of 1941. In fact, this included almost 17 million bearings. Great Britain was one of the largest buyers of Rollway bearings during the war, with Vickers, Handley Page, Bristol and Hawker among the companies supplied. As Rollway Roller Bearing Company became increasingly known and respected throughout the bearing industry for its

superior quality and custom-design capabilities, the company's reputation for solving even the most demanding industrial-application challenges grew as well. That's why, in 1974, the Romanian government sought out Rollway Roller Bearing Company's insight and expertise to manufacture a new line of large bearings. By 1976, Rollway Roller Bearing Company had won a \$35 million contract to build a new manufacturing facility in Ploiesti, providing both the know-how and the equipment for the factory. The venture marked the beginning of Rollway Bearing NV in Belgium, recently renamed, Regal Beloit Belgium NV, based in Antwerp. The International sales, marketing, engineering, customer service and distribution center is still located in Belgium. Its central location in Europe, close to the seaports of Antwerp and Rotterdam and the national airport of Brussels minimizes transit time for sea as well as air shipments.

### Part of international groups

In 1996, Rollway Bearing NV became part of Emerson Power Transmission, a business unit within Emerson Industrial Automation, a world leader in the production of mechanical power transmission drives, bearings and components.

In 2015, the Rollway® brand and the seven other Power Transmission brands (McGill®, Sealmaster®, Browning®, Jaure®, KopFlex®, Morse® and System Plast®) were acquired by Regal Beloit Corporation.

### Successful product range

Today, the Rollway® brand that first



launched its product line on a single trolley car provides businesses and industries around the world with more than 7,000 different types of roller and ball bearings. The Rollway® bearings product line, originally produced only in Syracuse, New York, is now manufactured in multiple facilities around the globe. The Regal connection, along with Rollway brand's own century long tradition of innovation, will help move Rollway bearings to the forefront of the bearing industry. As the brand has entered its second century, it remains synonymous with precision and quality craftsmanship and stands ready to keep business and industry moving ahead for the next 100 years. The Rollway brand has now become a brand with global presence and is one of the bearing brands in the Regal group. A product overview can be found on [www.RollwaySmartGuide.com](http://www.RollwaySmartGuide.com). Other bearing brands within the group are "McGill", "Sealmaster", "Browning", "System Plast" and HubCity™.

### About Regal Beloit Corporation

Regal Beloit Corporation (NYSE: RBC) is a leading manufacturer of electric motors, electrical motion controls, power generation and power transmission products serving markets throughout the world. The company is comprised of three business segments: Commercial and Industrial Systems, Climate Solutions and Power Transmission Solutions. Regal is headquartered in Beloit, Wisconsin, and has manufacturing, sales and service facilities throughout the United States, Canada, Latin America, Europe and Asia. For more information, visit [RegalBeloit.com](http://RegalBeloit.com)



***JUNE-DECEMBER***

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**2018**  
***EVENTS***  
***EXHIBITIONS***  
***CONFERENCES***

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**GGB**  
BEARING TECHNOLOGY

an EnPro Industries company

## MARINE

**BALTEXPO**

25 Jun - 27 Jun 2018  
Gdansk / Poland

Technologies and solutions available  
for the maritime industry.

[www.baltexpo.ztw.pl](http://www.baltexpo.ztw.pl)

## ENERGY

**PCIM ASIA**

26 Jun - 28 Jun 2018  
Shanghai / China

Power Electronics, Intelligent Motion,  
Renewable Energy, Energy Management

[www.pcimasia-expo.com.cn](http://www.pcimasia-expo.com.cn)

## GENERAL INDUSTRY

**IAMD SHENZHEN**

27 Jun - 29 Jun 2018  
Shenzhen / China

The largest and most influential  
automation, motion and drive  
show in South China

[www.ia-shenzhen.com](http://www.ia-shenzhen.com)



## MACHINE TOOLS

**MTA VIETNAM**

04 Jul - 06 Jul 2018  
Ho Chi Minh / Vietnam

Precision engineering, machine  
tools and metalworking

[www.mtavietnam.com](http://www.mtavietnam.com)

## ROBOTICS

**CIROS**

04 Jul - 07 Jul 2018  
Shanghai / China

China international robotics show

[www.en.ciros.com.cn](http://www.en.ciros.com.cn)

## MINING

**IME XINJIANG**

18 Jul - 20 Jul 2018  
Xinjiang / China

China Xinjiang International Mining Expo

[www.imechina.cn](http://www.imechina.cn)

## MATERIALS HANDLING

**CEMAT AUSTRALIA**

24 Jul - 26 Jul 2018  
Melbourne / Australia

International Trade Fair for Materials Handling, Automation  
Technology, Transport Systems and Logistics

[www.messe.de](http://www.messe.de)



## MARINE

**INAMARINE**

25 Jul - 27 Jul 2018  
Jakarta / Indonesia

Shipbuilding, offshore, marine  
equipment and machinery expo

[www.inamarine-exhibition.net](http://www.inamarine-exhibition.net)

## AUTOMOTIVE

**AUTOMECHANIKA**

08 Aug - 10 Aug 2018  
Atlanta / USA

International automotive parts exhibition

[www.automechanikachicago.com](http://www.automechanikachicago.com)

## MARINE

**MARINTEC SOUTH AMERICA**

14 Aug - 16 Aug 2018  
Rio de Janeiro / Brazil

Maritime maintenance and shipbuilding

[www.marintecsa.com.br](http://www.marintecsa.com.br)

## CEMENT

**BBTEE**

18 Aug - 20 Aug 2018  
Guangzhou Shi / China

China International Concrete Block  
and Brick Industrial Exhibition

[www.bbtee.com](http://www.bbtee.com)



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## 2018 AGENDA

## EVENTS, EXHIBITIONS & CONFERENCES

### AGRICULTURE

#### AGRITECHNICA ASIA

22 Aug - 24 Aug 2018  
Bangkok / Thailand

Asia's largest trade fair for agricultural machinery and equipment

[www.agritechnica-asia.com](http://www.agritechnica-asia.com)

### AUTOMOTIVE

#### AUTOMECHANIKA MIMS MOSCOW

27 Aug - 30 Aug 2018  
Moscow / Russia

22nd International Exhibition of Automotive Parts, Components, Car Maintenance Equipment and Products

[www.mims.ru](http://www.mims.ru)

### MARINE

#### OFFSHORE EUROPE

27 Aug - 30 Aug 2018  
Stavanger / Norway

Biggest offshore event of Europe

[www.offshore-europe.co.uk](http://www.offshore-europe.co.uk)

### MARINE

#### SMM

04 Sep - 07 Sep 2018  
Hamburg / Germany

The leading international maritime trade fair

[www.smm-hamburg.com](http://www.smm-hamburg.com)

### PAPER

#### ICE SOUTH EAST ASIA

05 Sep - 07 Sep 2018  
Bitec / Bangkok

International paper converting fair

[www.ice-southeastasia.com](http://www.ice-southeastasia.com)

### MINING

#### ELECTRA MINING AFRICA

10 Sep - 14 Sep 2018  
Johannesburg / South Africa

International Mining, Industrial, Machine Tools and Electrical Trade Show

[www.electramining.co.za](http://www.electramining.co.za)

### GENERAL INDUSTRY

#### IAMD USA

10 Sep - 15 Sep 2018  
Chicago / USA

America's Leading Trade Show for Integrated Automation, Industrial IT, Power Transmission and Control

[www.ia-shenzhen.com](http://www.ia-shenzhen.com)

MEDIA PARTNER  
**Bearing NEWS**

### AUTOMOTIVE

#### AUTOMECHANIKA

11 Sep - 15 Sep 2018  
Frankfurt / Germany

The World's Leading Trade Fair for the Automotive Service Industry

[www.automechanikasa.co.za](http://www.automechanikasa.co.za)

### MARINE

#### SMM

04 Sep - 07 Sep 2018  
Hamburg / Germany

The leading international maritime trade fair

[www.smm-hamburg.com](http://www.smm-hamburg.com)

### MATERIALS HANDLING

#### CEMAT RUSSIA

19 Sep - 21 Sep 2018  
Moscow / Russia

International Exhibition for materials handling, warehousing equipment and logistics

[www.cemat-russia.ru](http://www.cemat-russia.ru)

MEDIA PARTNER  
**Bearing NEWS**





# Bearing2018

## Shanghai

on 19 – 22 September 2018

Shanghai World Expo Exhibition & Convention Center

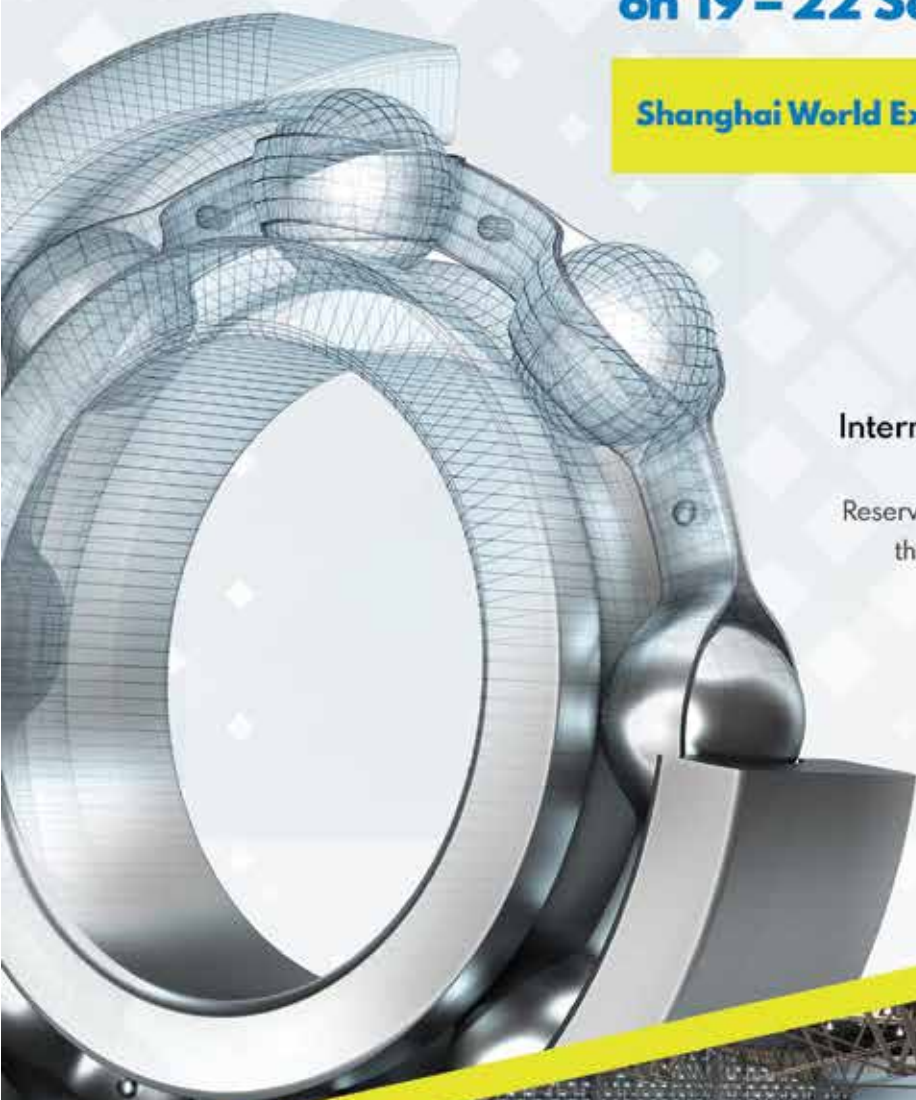
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- Network with peers who-do-what-you-do
- Meet over 50 world-class solution providers

# MAINTENANCE 4.0 CONFERENCE & EXHIBITION

## Conference Topics Include:

- ✓ Smart Tools, Drones and Robotics for Maintenance
- ✓ Managing Risks Associated with Operating Assets
- ✓ IIoT & the Internet of Condition Monitoring
- ✓ Predictive, Prescriptive and Prognostic Maintenance
- ✓ Asset Condition Monitoring and Management
- ✓ Reliability Engineering and Reliability Techniques
- ✓ Reliability Leadership and Reliability Culture
- ✓ Technician Efficiency and Effectiveness
- ✓ Asset Performance Management
- ✓ Health and Safety Aspects and Impacts
- ✓ ISO55000, 55001, 55002, 55003 & 55004
- ✓ Smart EAM Tools and Solutions
- ✓ Work Execution Management
- ✓ Asset Portfolio Management
- ✓ Asset Data Management



## 2018 AGENDA

## EVENTS, EXHIBITIONS &amp; CONFERENCES

## BEARING

**BEARINGS 2018**

19 Sep - 22 Sep 2018  
Shanghai / China

China International Bearing Industrial Exhibition

[www.bearingfair.com](http://www.bearingfair.com)

MEDIA PARTNER  
**Bearing  
NEWS**

## WINDPOWER

**GLOBAL WIND SUMMIT**

25 Sep - 28 Sep 2018  
Hamburg / Germany

Windeurope Conference &  
Windenergy Hamburg

[www.windeurope.org](http://www.windeurope.org)

## MAINTENANCE

**EUROMAINTENANCE**

25 Sep - 29 Sep 2018  
Antwerp / Belgium

Since 1972 the most important European  
congress in the field of Maintenance.

[www.efnms.eu](http://www.efnms.eu)

MEDIA PARTNER  
**Bearing  
NEWS**

## POWER TRANSMISSION

**EPTDA CONVENTION**

25 Sep - 28 Sep 2018  
London / UK

Annual event of the EMEA Power  
Transmission Distributors Association

[www.eptda.org](http://www.eptda.org)

MEDIA PARTNER  
**Bearing  
NEWS**

## GENERAL INDUSTRY

**MSV**

01 Oct - 05 Oct 2018  
Brno / Czech Republic

International engineering fair

[www.bvv.cz](http://www.bvv.cz)

## AUTOMATION

**MOTEK**

08 Oct - 11 Oct 2018  
Stuttgart / Germany

International trade fair for automation  
in production and assembly

[www.motek-messe.de](http://www.motek-messe.de)

## FOOD &amp; BEVERAGE

**AGROPRODASH**

08 Oct - 12 Oct 2018  
Moscow / Russia

Machine & equipment for food  
and beverage industry

[www.agroprodash-expo.ru](http://www.agroprodash-expo.ru)

## MINING

**MINING MYANMAR**

11 Oct - 13 Oct 2018  
Yangon / Myanmar

Minreal mining machinery & equipment

[www.miningmyanmar.com](http://www.miningmyanmar.com)

## STEEL

**METALEX**

11 Oct - 13 Oct 2018  
Ho Chi Minh / Vietnam

Metalworking, components  
and subcontracting

[www.metalexvietnam.com](http://www.metalexvietnam.com)

## POWER TRANSMISSION

**PTDA INDUSTRY SUMMIT**

17 Oct - 20 Oct 2018  
Hollywood / USA

Annual event of the Power Transmission  
Distributors Association

[www.ptda.org](http://www.ptda.org)

## 2018 AGENDA

## EVENTS, EXHIBITIONS &amp; CONFERENCES

## MACHINERY

**LES DREVMASH**

22 Oct - 25 Oct 2018

Moscow / Russia

17th International Exhibition Machinery, Equipment and Technology for Logging, Woodworking and Furniture Industries

[www.lesdrevmash-expo.ru](http://www.lesdrevmash-expo.ru)

## PUMPS &amp; VALVES

**PCV EXPO**

23 Oct - 25 Oct 2018

Moscow / Russia

International exhibition for pumps, compressors, valves and actuators

[www.pcvexpo.ru](http://www.pcvexpo.ru)

## STEEL

**EUROBLECH**

23 Oct - 26 Oct 2018

Hannover / Germany

International exhibition for sheet metal working technology

[www.messe.de](http://www.messe.de)

## STEEL

**ANKIROS**

25 Oct - 27 Oct 2018

Istanbul / Turkey

International Iron-Steel, Foundry and Non-Ferrous Metals Technology, Machinery and Products Trade Fair

[www.messe.de](http://www.messe.de)

## MATERIALS HANDLING

**EURASIA PACKAGING**

31 Oct - 03 Nov 2018

Istanbul / Turkey

International packaging machinery fair

[www.packagingfair.com](http://www.packagingfair.com)

## FOOD &amp; BEVERAGE

**ISTANBUL FOOD-TECH**

31 Oct - 03 Nov 2018

Istanbul / Turkey

Exhibition for food and beverage production chain

[www.foodtecheurasia.com](http://www.foodtecheurasia.com)

## MANUFACTURING

**HYBRID / COMPOSITES EUROPE**

06 Nov - 08 Nov 2018

Stuttgart / Germany

Production of hybrid components and applications

[www.hybrid-expo.com](http://www.hybrid-expo.com)

## GENERAL INDUSTRY

**PTC ASIA**

06 Nov - 09 Nov 2018

Shanghai / China

Power transmission and control exhibition

[www.ptc-asia.com](http://www.ptc-asia.com)



## MATERIALS HANDLING

**CEMAT ASIA**

06 Nov - 09 Nov 2018

Shanghai / China

Material handling, automation, transport/logistics fair

[www.cemat-asia.com](http://www.cemat-asia.com)



## STEEL

**MWCS**

06 Nov - 10 Nov 2018

Shanghai / China

Metalworking and CNC Machine Tool Show

[www.metalworkingchina.com](http://www.metalworkingchina.com)

## MECHANICAL ENGINEERING

**FMB**

07 Nov - 09 Nov 2018

Bad Salzungen / Germany

The supplier show for mechanical engineering

[www.fmb-messe.de](http://www.fmb-messe.de)





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# L O N D O N

a n n u a l c o n v e n t i o n

# 2018

26-28 September

  
20<sup>th</sup>  
anniversary

ONLINE REGISTRATION STARTING IN MARCH 2018

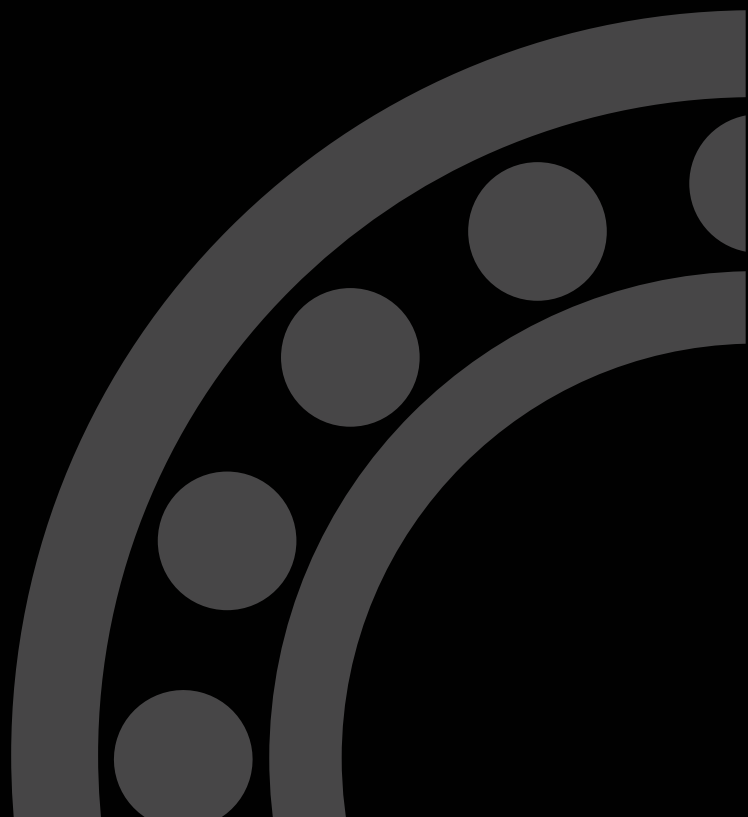
[www.eptdaconvention.org](http://www.eptdaconvention.org)



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Over 3 million bearing designations available in our database, with a complete and detailed explanation of bearing prefixes and suffixes. Roughly 100 bearing manufacturers and more than 600 bearing types listed. Purchase your license and gain instant access to Bearing Data's Interchange System.

[www.bearingdata.com](http://www.bearingdata.com)





## 2018 AGENDA

## EVENTS, EXHIBITIONS &amp; CONFERENCES

## PAPER

**PAPEREX SOUTH INDIA**

11 Nov - 13 Nov 2018  
Chennai / India

Paper Industry Trade Fair

[www.southindia.paperex.in](http://www.southindia.paperex.in)

## AUTOMOTIVE

**CICEME**

21 Nov - 23 Nov 2018  
Beijing / China

International Coal Equipment and Mining  
Technical Equipment Exhibition

[www.ciceme.com](http://www.ciceme.com)

## ENERGY

**SUBCON**

05 Jun - 07 Jun 2018  
Birmingham / UK

Manufacturing supply chain  
and manufacturing

[www.subconshow.co.uk](http://www.subconshow.co.uk)

## AUTOMATION

**SPS IPC DRIVES**

27 Nov - 29 Nov 2018  
Nuremberg / Germany

Electric automation - systems  
and components

[www.mesago.de](http://www.mesago.de)

## PUMPS &amp; VALVES

**VALVE WORLD EXPO**

27 Nov - 29 Nov 2018  
Dusseldorf / Germany

International Valve Trade  
Fair and Conference

[www.valveworldexpo.com](http://www.valveworldexpo.com)

## MINING &amp; CONSTRUCTION

**BAUMA CHINA**

27 Nov - 30 Nov 2018  
Shanghai / China

The leading platform for construction  
machinery, building material  
machines, mining machines and  
construction vehicles in Asia

[www.bauma-china.com](http://www.bauma-china.com)

## MACHINE TOOLS

**MANUFACTURING INDONESIA**

06 Dec - 09 Dec 2018  
Jakarta / Indonesia

8th International Mining, Tunneling,  
Machinery Equipments and  
Heavy Duty Vehicles Fair

[www.machinetoolindonesia.com](http://www.machinetoolindonesia.com)

## MINING

**MINING TURKEY**

13 Dec - 16 Dec 2018  
İstanbul / Turkey

Mining, Mining Machinery, Equipment  
and Construction Vehicles Fair

[www.madenturkiyefuari.com](http://www.madenturkiyefuari.com)

PTC  
MDA  
ASIA

# BEARING ROOT CAUSE FAILURE ANALYSIS WORKSHOP

PTC ASIA EXHIBITION IN SHANGHAI  
ON 06 - 09 NOVEMBER 2018

Presented by  
**PER ARNOLD ELQVIST**

SEE PAGE >

66



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# Z LOCK<sup>®</sup> SLEEVE



## TAPER LOCKING REINVENTED



# FYH has reinvented the adaptor sleeve.



This is the ball bearing version of our patented revolutionary locking system, Z LOCK. The new series is called ZK and utilizes a tapered bore UK insert with our original Z LOCK sleeve instead of a traditional adaptor sleeve. The units are pre-assembled at the factory and are ready to use straight out of the box unlike traditional units that have separate inserts and adaptor sleeves. The installation of ZK units is extraordinary. ZK uses one key to tighten just two set screws by hand. ZK requires no torque charts and does not affect the inner clearance of the bearing at all.



Tighten the set screws by hand. Tightening the set screws creates extreme holding power over traditional adaptor sleeves without any change to the bearing clearance.



A traditional UK unit requires many tools to be assembled. You must tighten the lock nut using a torque wrench and following a torque tightening chart. Over tightening of the adaptor creates smaller clearance which can affect bearing life.

# FYH

FYH INC.





Deutsche Messe



# BEARING ROOT CAUSE FAILURE ANALYSIS WORKSHOP

PTC ASIA EXHIBITION IN SHANGHAI  
ON 06 - 09 NOVEMBER 2018

Presented by **PER ARNOLD ELGQVIST**

- ◆ To emphasize the importance of Bearing failure root cause analysis as a tool to improve the efficiency of Maintenance: Identifying the root causes for the failures and determining the exact required corrective actions, in order to avoid further failures for the same cause will help maintenance to perform a precise repair and avoid waste of time and unnecessary use of spare parts.
- ◆ To terminate the workshop blindness of accepting bearing failures as “normal” and the simple replacement of bearings as consumables without implementing any corrective actions as “let’s hope that this bearing will last longer”.
- ◆ To describe the most common causes for bearing failures, in order to easier determine and understand the required corrective actions.
- ◆ To emphasize the importance of understanding the different bearing failure modes according to the ISO 15243 will also be pointed out as these, in many cases, will clearly and directly indicate the failure causes.
- ◆ This workshop will also cover a simple and practical procedure on how to perform a bearing root cause failure analysis and some relevant success stories will be solved in an interactive way.



# Content of the Workshop

- ◆ First determination to be made: Natural or premature failure?
- ◆ Why should we do Bearing Root Cause Failure Analysis?  
First of all, in order to avoid further repetitive failures and unplanned downtime.  
Second, to perform no more nor less than the required repair, which means increased efficiency.  
Reduction of both unplanned and planned downtime.
- ◆ Benefits:  
Reducing unnecessary downtime, both planned and unplanned (OEE+).  
Extended bearing life increasing the availability of the process (OEE+).  
Reduced total cost by reducing the failure cost and avoiding further repetitive failures.
- ◆ Example: Success story at a cement mill  
Failure cost: 40,000 USD  
Lost production value: 28'000,000 USD

## Failure of a large bearing in a cement mill:



Service life:  
¡105 hours!



It may be very simple when you have the knowledge. By knowing the most common causes for bearing failures and the different bearing modes it will, in many cases, be very easy to identify the failure root cause and logically to immediately indicate the required corrective action.



Example of a simple analysis:

Vertical pump

Bearings: 6215 + 51115  
Lubricant: Grease ISO VG460 Moly.  
Speed: 1500 RPM  
You got 10 seconds!



## ISO 15243 established Bearing Failure Modes.

The following failure modes will be described:

### Fatigue:

- » Subsurface initiated fatigue
- » Surface initiated fatigue

### Wear:

- » Abrasive wear
- » Adhesive wear

### Corrosion:

- » Moisture corrosion
- » Fretting corrosion
- » False Brinelling

### Electrical erosion:

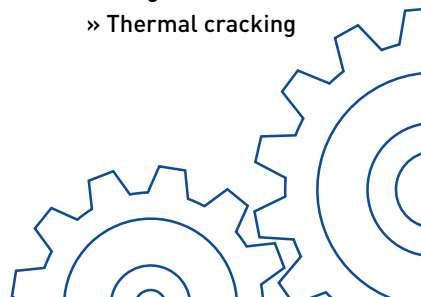
- » Excessive voltage
- » Current leakage

### Plastic deformation:

- » Overload
- » Indentation from debris
- » Indentation by handling

### Fracture and cracking:

- » Forced fracture
- » Fatigue fracture
- » Thermal cracking





## The Procedure of Bearing Root Cause Failure Analysis. A complete Failure Analysis Process should include:



1. Determination of the most complete information on the operating conditions.
2. Relevant photos during the process.
3. Samples of the lubricant from the application and sample of unused lubricant for comparison.
4. Marking of the bearings and their position in the equipment.
5. Careful dismantling of the bearing avoiding unnecessary additional damages.
6. Inspection of the other machine components to determine collateral damages.
7. Verify bearing seating on shafts and in housings.
8. Verify the condition and distribution of the lubricant inside the bearings. If possible, take additional samples.
9. Clean the bearings and the components and take note if possible of the markings, brand and complete designations.
10. Realize the analysis of the bearing and corresponding components. Take additional photos.
11. Determine the causes of the failure comparing the failure patterns with available standard photos from ISO 15243 and/or bearing manufacturers.
12. Determine the necessary corrective actions required in order to avoid the recurrence of the same failure.
13. Protect and keep the failed bearing for future use as comparison.
14. Example: Some examples of the above will be shown.
15. Interactive exercises: During the workshop, several interactive examples of bearing failure analysis will be performed.
16. Conclusions and recommendations.

Register today as **there are only 50 seats available.**



Kenan Özcan

**WORKSHOP REGISTRATION**

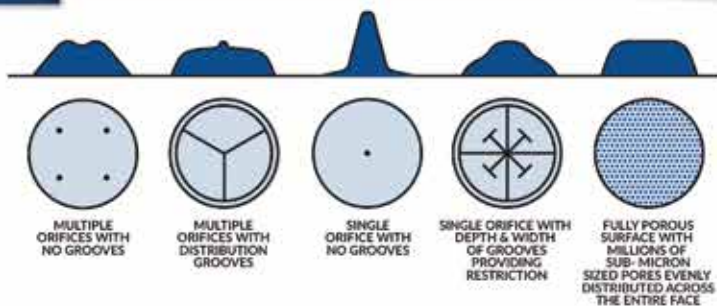
P: +32 3 612 56 44  
E: [info@bearing-news.com](mailto:info@bearing-news.com)  
W: [www.bearing-news.com](http://www.bearing-news.com)



## WHAT POROUS MEDIA AIR BEARINGS CAN DO FOR YOU

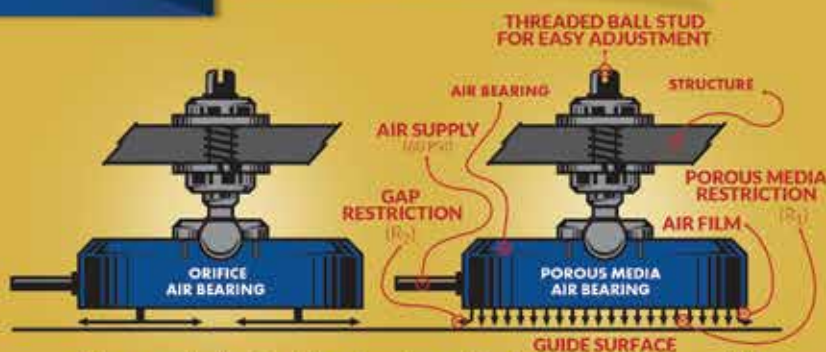
Deliver High-Performance Solutions When You Apply the Benefits of Frictionless Motion \*

### A COMPARISON: Porous Media vs. Orifice Distribution



Orifice air bearings suffer from uneven pressure gradients, and complex distribution schemes struggle to compensate for the inherent inefficiencies. Porous media bearings distribute air evenly and maintain a near-uniform pressure profile across the entire bearing face.

### COMPARING TECHNOLOGIES: Lift Force in the Air Gap



When grounded, orifice air bearings have minimal pressurized area to establish initial lift. Complicated fixtures and set up procedures are required to reset the machine, and the ability to effectively preload the bearing is limited. Porous air bearings pressurize the face uniformly even when grounded, inviting novel preload schemes and allowing machines to be restarted with ease.

### AIR BEARING APPLICATIONS



LINEAR MOTION



ROTARY MOTION



NON-CONTACT HANDLING



SEALING & BALANCING

## THE BENEFITS OF POROUS MEDIA AIR BEARINGS

### ZERO FRICTION

Unlike conventional rolling element bearings, porous media air bearings are non-contact, stiction-free, and provide almost infinite resolution and repeatability.

### ZERO WEAR

Rolling element bearings wear over time from mechanical contact, resulting in inconsistent machine performance. With porous media air bearings there is no contact, so no wear, just consistent performance.

### STRAIGHTER MOTION

Mechanical point-contacts within rolling element bearings trace any surface and dimensional imperfections into the path of motion. Porous media air bearings float over these imperfections, averaging the surface and eliminating the need to compensate for erratic tracking.

### SMOOTH AND SILENT OPERATION

The motion of the balls within a conventional rolling element bearing is noisy and causes velocity ripples. This compromises stability and impacts performance. Without contact or competing forces, porous media air bearings provide smooth, silent motion.

### HIGHER DAMPING

Porous media air bearing's squeeze film damping effect delivers high dynamic stiffness and better controllability.

### NO LUBRICATION

Porous media air bearings ride on a cushion of air, so unlike conventional rolling element bearings there is no need for lubricants and no accompanying maintenance hassle or lubricant migration issues.





# Thin Section Bearings Operating on Mars

— Nachi presented its comprehensive range of high-quality roller bearings at Hanover Industrial Fair April 23 to 27, 2018

During Hannover Messe, IAMD show 2018 which took place from April 23 to April 27, Nachi Europe GmbH, located in Krefeld, showed its large range of high-grade roller bearings for applications in all industrial branches. The company focuses on top performance. The innovative roller bearings technology of the Japanese mechanical engineering trust, which is well known all over the world, has decisively influenced the success of the latest NASA's Mars mission. The drive system of the Mars robot Curiosity is equipped with very lightweight but stable and strong thin section bearings designed and manufactured by the Japanese specialists.

Due to the sophisticated material characteristics, the raceway design and the space-proven tribology, these roller bearings exceed by far the expected lifetime of the Mars rover Curiosity which was formerly planned to be 2 years. This proves the high competence and the outstanding know-how of the Japanese manufacturer. Nachi's roller bearings operate reliably in the adverse space conditions which include e. g. temperatures between -120 °C and 0 °C.

As well all other operators profit from these excellent qualities, especially the high reliability. This relates to all the roller bearings of Nachi's comprehensive product range. The range includes deep groove ball bearings for universal use on shafts with 10 to 320 mm in dia., axial ball bearings in various types for one or double sided load with 10 to 360 mm inner dia., angular contact ball bearings with 10 to 200 mm inner dia., single and double row cylindrical roller bearings for shafts from 17 to 500 mm dia. respective 25 to 320 mm dia., spherical roller bearings and spherical thrust roller bearings with 20 to 1060 mm inner dia. respective 60 to 530 mm inner dia. as well as tapered roller bearings for shafts 15 to 320 mm in dia.

These roller bearings operate absolutely reliable during an extreme long service time. Thanks to their matured design and the high surface quality of the raceways they guide shafts extremely smooth, calm and friction-reduced at highest concentricity. Due to various lubrication methods and design types with or without shields respective sealings Nachi's roller bearings can be used in a great range of

conditions in various applications, such as machine tool, construction and special machinery, mining equipment, cranes, compressors, ships, road and rail vehicles.

Optimized types are available, e.g. extraordinarily vibration-proof spherical roller bearings, for exotic applications in extreme conditions.

As an option, in addition to the standard types high-precision roller bearings with minimized clearance are available as well as matched pair bearings with no axial clearance and bearing units with housings.

Nachi's specialists master the complete production line from raw steel to manufacturing and heat treatment to assembly. Thus they can guarantee highest quality.

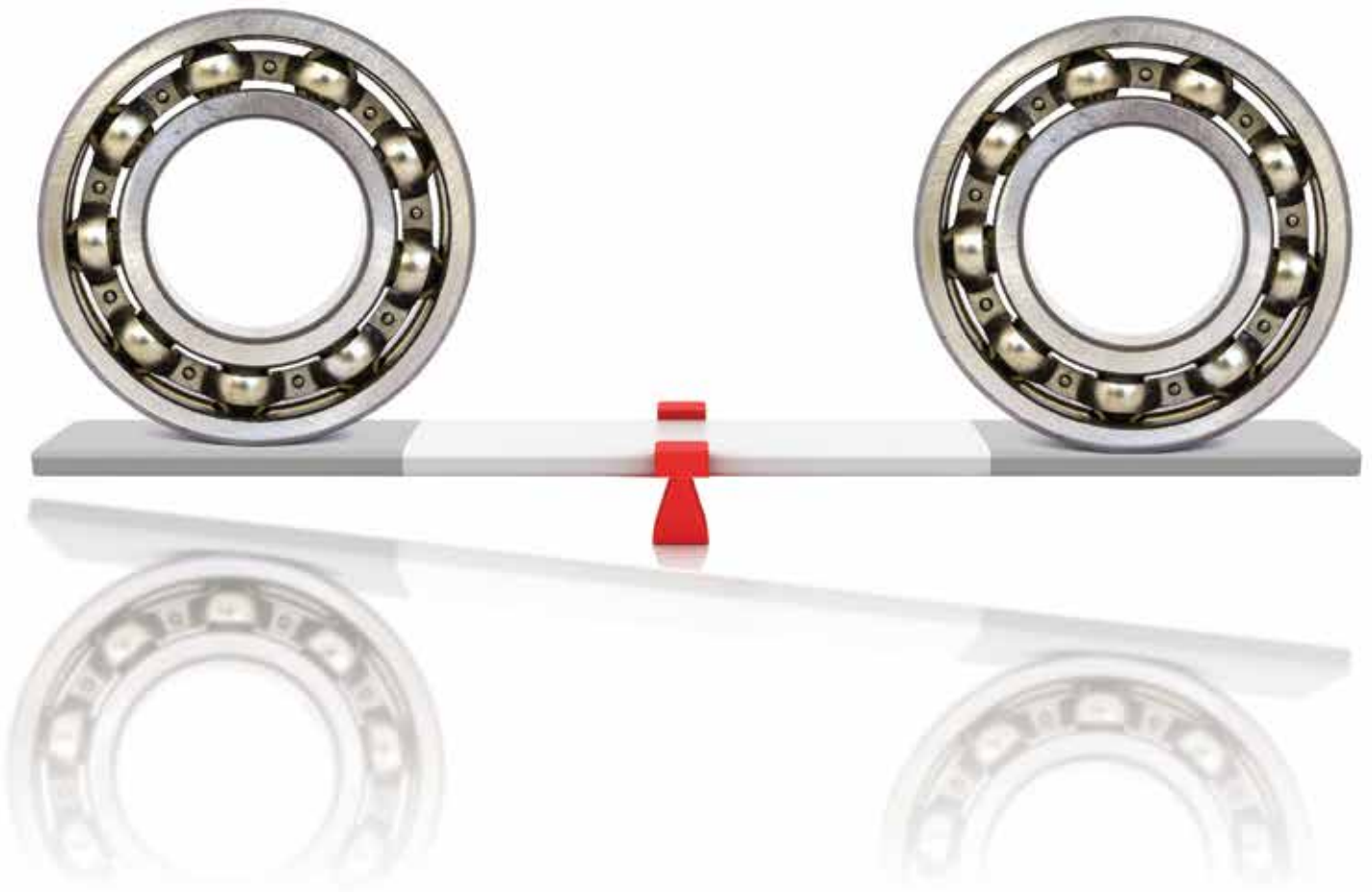
## Further information on Mars Rover Curiosity:

[www.jpl.nasa.gov/news/  
press\\_kits/MSLLanding.pdf](http://www.jpl.nasa.gov/news/press_kits/MSLLanding.pdf)



# IS THERE REALLY A **DIFFERENCE?**

## ARE YOU WILLING TO **RISK THE UNKNOWN?**



Bearing quality varies widely within the global supply chain and variations you don't identify can result in catastrophic failures within your application. Bearing qualification provides technical information about a manufacturer's design, capability, and quality so you can successfully partner with a quality bearing supplier. Understanding the importance of bearing qualification within the global bearing supply chain will help save you time and money. Napoleon Engineering Services, as the largest independent bearing testing and inspection facility in the U.S., has the experience, capability, and knowledge to help you create and carry out a plan, unique to your needs, for successfully qualifying bearing suppliers.



# Bearing NEWS

BEARING INDUSTRY MAGAZINE

Increase your visibility

in **2018**  
and  
beyond!

- + **320.000** UNIQUE VISITORS/YEAR  
FROM 177 COUNTRIES
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& SPECIAL ISSUES / YEAR
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